INDUSTRIAL MINERALS UNDERGROUND FOREMAN STUDY GUIDE

PRESENTED BY THE BUREAU OF MINE SAFETY

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Preface

This program is for instructional purposes only and does not constitute an endorsement by Pennsylvania Department of Environmental Protection, Bureau of Mine Safety of any specific product. Attendance of this program ***does not*** constitute certification under state or federal laws or regulations.

Disclaimer

The information and recommendations contained in this program have been compiled from sources believed to be reliable and to represent the best current opinion on the subject. No warranty, guarantee, or representation is made by the Pennsylvania Department of Environmental Protection, Bureau of Mine Safety, as to the absolute correctness or sufficiency of any representation contained in this course and publication, and assumes no responsibility in connection therewith; nor can it be assumed that all acceptable safety measures are contained in this, or that other or additional measures not be observed under particular or exceptional conditions or circumstances.

Section I: Accident Reporting Requirements

Department of Environmental Protection
Bureau of Mine Safety

REPORTABLE ACCIDENTS

DOCUMENT ID: 580-0100-001

EFFECTIVE DATE: March 20, 2020

PAGE LENGTH: 2 pages

The operator shall notify the Department no later than 15 minutes of discovery of an accident.

Accident – An unanticipated event, including any of the following:

1. A death of an individual at a mine.
2. An injury to an individual that has a reasonable potential to cause death and/or serious injuries resulting in the injured being admitted to a hospital.
3. An entrapment of an individual at a mine for more than 30 minutes or which has a reasonable potential to cause death or serious injury.
4. An unplanned inundation by a liquid or gas.
5. An unplanned ignition or explosion of gas or dust.
6. An unplanned mine fire not extinguished within 10 minutes of discovery.
7. An unplanned ignition or explosion of a blasting agent or an explosive.
8. An unplanned roof fall at or above the anchorage zone in active workings where roof bolts are in use.
9. An unplanned roof or rib fall in active workings that impairs ventilation or impedes passage.
10. A coal or rock outburst that causes withdrawal of miners or which disrupts regular mining activity for more than one hour.
11. An unstable condition at an impoundment or refuse pile that requires emergency action in order to prevent failure or causes individuals to evacuate the area.
12. Failure of an impoundment or refuse pile.
13. Damage to hoisting equipment in a shaft or slope that endangers an individual or which interferes with use of the equipment for more than 30 minutes.
14. An event at a mine which causes death or bodily injury to an individual not at the mine at the time the event occurs.
15. An interruption to the mine ventilation system that results in withdrawal of personnel from the mine (fan stoppage) or an interruption that has the potential to create a hazardous condition (e.g. air reversal, short-circuit or blockage of the air current).
16. An unplanned connection into an adjacent mine, abandoned workings, or borehole.
17. All other incidents that could cause similar results as the items listed above.

If an accident/incident occurs and it is questionable as to whether it should be reported to the Department, please contact the Department to make a determination.

If the mine inspector, inspector supervisor, or managers cannot be reached, then the emergency telephone number (**1-800-541-2050**) for the Department of Environmental Protection will be used to notify the Bureau of Mine Safety.

The Bureau of Mine Safety will immediately, after becoming aware of an accident/unanticipated event, notify the operator whether the accident/unanticipated event is a reportable accident and if an investigation will be conducted.

The "Reportable Accidents" list and accident notification contact information sheet will be provided and shall be posted at all mines in appropriate locations and act as a guide when an unanticipated event occurs.

WRITTEN REPORTS TO THE DEPARTMENT

Each mine operator shall report to the Department each accident and lost time injury within 10 days of occurrence. Providing a copy of the MSHA 7000-1 Mine Accident, Injury, and Illness Report form is acceptable. Each accident and lost time injury shall be reported on a separate form.

Each mine operator shall also conduct its own investigation of the accident and develop a written report of the investigation. The report shall include all of the following:

1. The date and time of the accident and the Department representative notified.
2. The date the investigation began.
3. The names of the individuals participating in the investigation.
4. A description of the accident site and any alterations made to the site.
5. An explanation of the accident or injury, including a description of any equipment involved and relevant events before and after the accident.
6. An explanation of the cause of the accident.
7. An explanation of the cause of any injury sustained due to the accident.
8. The name, occupation and experience of any miner involved in the accident.
9. A sketch depicting the accident, including dimensions where pertinent.
10. A description of steps taken to prevent a similar accident in the future.

This report shall be provided to the Department upon completion of the investigation.

When an accident is reported, the Department will issue a verbal order (followed up in writing) to prevent the destruction of evidence or alteration of the site. The order will remain in effect until completion of all investigations pertaining to the accident. Only work necessary to rescue any individual and prevent destruction of mine equipment is allowed. Any plans to recover individuals or to return the affected areas of the mine to normal operations will require Department approval.

Section II: Laws

PA Department of Labor and Industry

GENERAL SAFETY LAW

Act No. 174, May 18, 1937, P.L. 654,
as amended June 28, 1951 and July 13, 1953

AN ACT

To provide for the safety and to protect the health and morals of persons while employed; prescribing certain regulations and restrictions concerning places where persons are employed, and the equipment, apparatus, materials, devices and machinery used therein; prescribing certain powers and duties of the Department of Labor and Industry relative to the enforcement of this act; and fixing penalties. (Title amended July 13, 1953, P.L. 438, No. 97)

Compiler's Note: Section 3 of Reorganization Plan No. 2 of 1975 provided that Act 174 is suspended insofar as it conflicts with Reorganization Plan No. 2.

Compiler's Note: Section 16(a)(1) of Act 147 of 1971 provided that Act 174 is repealed insofar as it is inconsistent with Act 147.

Be it enacted, &c., That,

Section 1. Definitions – The term "**establishment**" shall mean any room, building or place within this Commonwealth where persons are employed or permitted to work for compensation of any kind to whomever payable, except farms or private dwellings, and shall include those owned or under the control of the Commonwealth, and any political subdivision thereof, as well as school districts.

The term "**department**" shall mean the Department of Labor and Industry.

Section 2. General Safety and Health Requirements –

(a) All establishments shall be so constructed, equipped, arranged, operated, and conducted as to provide reasonable and adequate protection for the life, limb, health, safety, and morals of all persons employed therein.

(b) All belts, pulleys, gears, chains, sprockets, shafting, and other mechanical power transmission apparatus, stationary engines, electrical equipment, and apparatus shall be properly guarded to protect workers from injury.

(c) All cranes, hoists, steam or electric shovels, plant railroads, and other apparatus or devices used for moving, lifting, lowering, and transporting material shall be designed, constructed, equipped, and operated as to eliminate dangerous conditions.

(d) The point of operation on all saws, planers, jointers or other power driven woodworking machines and all power presses, planers, shapers, and other power driven machine tools, and dangerous parts of any other machines or devices shall be provided with guards of a type approved by the department. Laundry machines, extractors, washers, ironers, and other machines or apparatus shall be provided with guards where, because of accident hazard, they are required by the department.

(e) All toxic and noxious dusts, fumes, vapors, gases, fibers, fogs, mists or other atmospheric impurities, created in connection with any manufacturing process, emitted into or disseminated throughout areas where persons are employed in such quantities as, in the opinion of the department, would injure the health of employees or create other dangerous conditions, shall be removed at the point of origin, or, where this is impractical, personal protective devices shall be provided and worn by persons subjected to such hazards.

(f) All pits, quarries, mines other than coal mines, trenches, excavations, and similar operations shall be properly shored, braced, and otherwise guarded, operated, and conducted as to provide reasonable and adequate protection to workers employed therein. (Functions transferred, June 3, 1975, Reorg. Pl. No.2, P.L.628)

(g) All building construction, demolition, and cleaning, including window cleaning, shall be conducted in a manner as to avoid accident hazards to workers or the public. Scaffolds, ladders, material hoists, window cleaning devices, safety belts, and other equipment used in such operations, shall be designed, manufactured, constructed, and erected as to be safe for the purpose intended. All stairs, open-sided floors, platforms, and runways shall be provided with proper railings and toe-boards.

(h) When employees, due to the nature of employment, are subject to injury from flying particles, falling objects, sharp or rough surfaces or materials, hot, corrosive or poisonous substances, acids or caustics and injurious light rays or harmful radioactive materials, they shall be provided with and shall wear goggles, other head and eye protectors, gloves, leggings, and other personal protective devices. ((h) amended July 13, 1953, P.L. 438, No. 97)

(i) All plant, scenic or other railroad operations other than those common carrier railroads presently subject to the jurisdiction of the Public Utility Commission shall be maintained and operated in such a manner as to prevent unreasonable or unnecessary hazards to workers or the public. Motive power, rolling stock, and roadbeds shall be designed, manufactured, and maintained so as to be safe for its intended purpose and provide maximum safety to the public and the employees involved. ((i) added Oct. 7, 1976, P.L. 1107, No. 225)

Section 3. Lighting, Heating, Ventilation, and Sanitary Facilities - All establishments shall be adequately lighted, heated, and ventilated. Proper sanitary facilities shall be provided in sufficient number for the persons employed, and shall include toilet facilities, washing facilities, dressing rooms, and wholesome drinking water of approved quality.

(Section 3 repealed in part Oct. 4, 1978, P.L. 909, No. 173)

Section 4. Fireworks and Explosives Plants - Establishments where fireworks or explosives are manufactured or stored shall be located at a safe distance from other buildings, highways, or railroads for the protection of the public. Such establishments shall be located, erected, operated, and conducted as to provide adequate and reasonable protection to persons employed therein.

Section 5. Floor Space - The floor space of workrooms in any establishment shall not be so crowded with machinery as to thereby cause risk to the life or limb of any employee. Proper clear aisle space shall be maintained where necessary for employees to walk between machines, equipment, or material. Machinery shall not be placed in any establishment in excess of the sustaining power of the floors and walls thereof.

Section 6. Removal of Guards - No person shall remove or make ineffective any safeguard, safety appliance or device attached to machinery except for the purpose of immediately making repairs or adjustments, and any person or persons who remove or make ineffective any such safeguard, safety appliance or device for repairs or adjustments shall replace the same immediately upon the completion of such repairs or adjustments.

Section 7. Prohibited Use of Dangerous Machinery - If any machinery, or any part thereof, is in a dangerous condition or is not properly guarded, the use thereof may be prohibited by the Secretary of Labor and Industry or his authorized representative, and a notice to that effect shall be attached thereto. Such notice shall be removed only by an authorized representative of the department after the machinery is made safe and the required safeguards are provided, and in the meantime such unsafe or dangerous machinery shall not be used.

Section 8. Air Space for Workroom - The owner, agent, lessee or other person having charge or managerial control of any establishment, shall provide or cause to be provided not less than two hundred and fifty cubic feet of air space for each and every person in every workroom in said establishment where persons are employed.

Section 9. Canneries and Labor Camps - All canneries for the canning or preserving of fruits, vegetables and meats shall be kept in a clean and sanitary condition, and all labor camps operated in connection with such canneries and all other labor camps shall be located, constructed, maintained and operated in all respects as to provide for the health, safety, and comfort of occupants of such camps.

(Functions transferred and suspended in part Nov. 30, 1972, Reorg. Pl. No. 1, P.L. 1750)

Section 10. Safe Practices - The department may prepare and publish for the use of industry recommendations for safe practices as a guide in the elimination of accidents.

Section 11. Industrial Homework - Industrial homework shall be conducted in such manner as to ensure the safety and health of all persons so employed.

Section 12. Rules and Regulations - The Department of Labor and Industry shall have the power and its duty shall be to make, alter, amend, and repeal rules and regulations for carrying into effect all the provisions of this act, and applying such provisions to specific conditions.

Section 13. Enforcement; Right of Entry - The provisions of this act shall be enforced by the Department of Labor and Industry. For the purpose of enforcing the provisions of this act, the Secretary of Labor and Industry, or his duly authorized representative, shall have the power to enter any room, building, or place where labor is employed, and to issue the necessary instructions to the superintendent, manager, or responsible agent of the employer, to correct violations of this act or regulations based on this act.

Section 14. Procedure in Prosecution - Prosecution for violation of the provisions of this act or the rules and regulations of the department authorized by this act may be instituted by any authorized agent of the department.

Section 15. Penalties – Any person who shall violate any of the provisions of this act or the rules and regulations of the department as herein provided for, or who shall hinder or delay or interfere with any person charged with the enforcement of this act in the performance of his duty, shall, upon conviction in a summary proceeding, be sentenced for a first offense to pay a fine of not less than twenty-five dollars and not more than one hundred dollars, and in default of the payment of such fine and costs, shall be imprisoned for a term of not more than thirty days, and, upon conviction for a second offense, shall be sentenced to pay a fine of not less than fifty or more than two hundred dollars, and in default of the payment of such fine and costs, shall be imprisoned for a term not exceeding sixty days. Any person guilty of a third offense, under the provisions of this act, shall be guilty of a misdemeanor, and, upon conviction, shall be sentenced to pay a fine of not more than five hundred dollars, or to undergo imprisonment not exceeding six months, or both, at the discretion of the court. Each violation shall be deemed to constitute a separate offense.

All fines collected under this act shall be forwarded to the Department of Labor and Industry who shall transmit the same to the State Treasury, through the Department of Revenue.

Section 16. Repealer –

(a) The following acts are hereby repealed:

The act approved the second day of May, one thousand nine hundred and five, entitled "An act to regulate the employment, in all kinds of industrial establishments, of women and children employed at wages or salary, by regulating the age at which minors can be employed and the mode of certifying the same, and by fixing the hours of labor for women and minors; to provide for the safety of all employees in all industrial establishments, and of men, women and children in schoolhouses, academies, seminaries, colleges, hotels, hospitals, storehouses, office buildings, public halls and places of amusement, in which proper fire-escapes, exits and extinguishers are required; to provide for the health of all employees, and of men, women and children in all such establishments, storehouses and buildings, by proper sanitary appliances; and to provide for the appointment of inspectors, office clerks and others, who, with the chief factory inspector, shall constitute the Department of Factory Inspection; to enforce the same; and providing penalties for violations of the provisions thereof; fixing the term and salaries of the chief factory inspector and his appointees," and all amendments thereto.

(b) All acts and parts of acts inconsistent with this act are hereby repealed.

Department of Environmental Protection
Bureau of Deep Mine Safety

GUIDELINES FOR USE OF INTERNAL COMBUSTION MOTORS IN UNDERGROUND MINES OTHER THAN COAL

DOCUMENT ID: 580-2200-008

TITLE: Guidelines for Use of Internal Combustion Motors in Underground Mines Other than Coal

EFFECTIVE DATE: August 11, 1997

AUTHORITY: Section 25-2(f) of the General Safety Law, 43 P.S. § 25-2(f); 34 Pa. Code § § 33.117(c) (relating to mine railways and motor haulage); 33.121 (relating to ventilation, general requirement), and 33.122 (relating to ventilating current).

POLICY: This document establishes procedures and criteria for the approval and use of internal combustion motors in underground mines other than coal mines.

PURPOSE: Section 25-2(f) of the General Safety Law requires that all mines other than coal mines be operated in a manner that provides reasonable and adequate protection to workers employed therein. In furtherance of this requirement, the use of internal combustion motors in an underground mine other than a coal mine is prohibited unless otherwise approved by the Department. The following are the standards the Department intends to apply in governing the approval and appropriate use of an internal combustion motor in an underground mine other than a coal mine.

APPLICABILITY: This guidance applies to all Bureau personnel who inspect mines other than coal mines as well as all personnel who approve the use of equipment in these mines. This guidance also applies to all non-coal mine operators in the Commonwealth.

DISCLAIMER: The policy and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in this policy and procedures shall affect regulatory requirements.

The policy and procedures herein are not an adjudication or regulation. There is no intent on the part of the Department to give this policy the weight or deference that would be accorded an adjudication or regulation. The policy and procedure merely announces the policy that DEP intends to apply in the future for the rules governing the use of internal combustion motors in mines other than coal.

PAGE LENGTH: 3 pages

LOCATION: Volume 9, Tab 13

PROCEDURES:

A. "General Statement of Policy"

In general, the Department will approve the use of internal combustion motors in an underground mine if the operator has demonstrated that:

Adequate air quality, as defined by § § 33.121 and 33.122 will be maintained in all areas of the mine affected by the request.

The equipment powered by internal combustion motors, and the motor itself, will be operated in a safe manner.

"The operator shall be responsible for ensuring that all internal combustion motors (these include company owned, leased, rented, and contractor used equipment) taken in an underground mine, other than a coal mine, will be used in accordance with these guidelines:"

B. "Requested Information"

The Department requests the operator to submit two (2) copies of the following information either annually on or before April 1 of the calendar year or prior to opening or reopening a mine. The information should be sent to the Pottsville Office of Deep Mine Safety, 5 West Laurel Boulevard, Pottsville, PA 17901. This office will be responsible for the distribution of the information packets.

The requested information is as follows:

1. An updated ventilation plan that shows the following:

    a. Mine name.
    b. A mine map of the following scales: not greater than 1″ = 500′ for the overall mine map and not greater than 1″ = 200′ for typical faces (number of 1:200 maps depends on the number of different ventilating systems employed at the face). The maps should show the following:

        i. Direction and quantity of principal airflows.
        ii. Locations of seals used to isolate abandoned workings.
        iii. Locations of areas withdrawn from the ventilating system.
        iv. Locations of all main, booster, and auxiliary fans not shown in paragraph (d) of this section.
        v. Locations of air regulators and stoppings and ventilation doors not shown in paragraph (d) of this section.
        vi. Locations of overcasts, undercasts, and other airway crossover devices not shown in paragraph (d) of this section.
        vii. Locations of known oil or gas wells within 1 year of mining advancement.
        viii. Locations of known underground mine openings adjacent to the mine.

ix. Locations of permanent underground shops, diesel fuel storage depots, oil fuel storage depots, hoist rooms, compressors, battery charging stations, and explosive storage facilities or magazines. Permanent facilities are those intended to exist for one year or more.

x. Significant changes in the ventilation system projected for one year.

c. Mine fan data for all active main and booster fans including manufacturer's name, type, size, fan speed, blade setting, approximate pressure at present operating point, motor brake horsepower rating, operating characteristics chart, and quantity of air being produced.

d. Diagrams, descriptions, or sketches showing how ventilation is accomplished in each typical type of working place including the approximate quantity of air provided and typical size and type of auxiliary fans used.

e. The number and type of internal combustion units used underground, including make and model of unit, type of motor, make and model of motor, brake horsepower rating of motor and MSHA approval number if it exists.

The Department requests the operator to maintain a list of rental, short term use (less than 30 days) or contractor units at the mine site used underground. This should include the same information as requested in Part B, Section 1e. This information does not need to be submitted annually. It must be maintained at the mine site for the inspectors' review upon request.

C. "Safety Guidelines"

1. "The Department requests that gasoline motors are refueled outside the mine. If a gasoline motor is to be refueled underground, the motor must be shut off. Gasoline may be brought into the mine for purposes of refueling motors provided that the gasoline is transported in an approved and labeled safety can of no more than 5-gallon capacity."

2, "A fire extinguisher or automatic suppression system should be installed on any mobile internal combustion motored equipment. A fire extinguisher should be located within 100 feet of a stationary piece of equipment that is powered by an internal combustion motor."

3. "All safety components should be maintained as prescribed and developed by the manufacturer."

4. "Mine atmosphere will be maintained with an adequate supply of pure air. Pure air shall mean air containing not less than 19.5% oxygen; not more than 0.5% carbon dioxide; and no harmful quantities of other noxious or poisonous gases (e.g. ceiling limit of 5 ppm nitrogen dioxide, ceiling limit of 200 ppm carbon monoxide or 50 ppm time weighted average).

Gas test by mine officials while persons are in the working section shall be done with approved gas detection instruments. Should concentrations of dangerous gasses be detected, the operator shall take the necessary precautions to ensure that the harmful noxious or poisonous gasses are removed from the work area."

At this time, there is no standard or limit on diesel particulate matter (DPM). If a standard is developed for exposure to DPM, that shall be incorporated into this policy.

5. The Department expects that gasoline powered motors will be shut off when the vehicle is not in motion.

Non-mobile gasoline powered motors should be left to run as minimally as possible.

Gasoline should not be stored underground. Storage for the purposes of this policy means a quantity in excess of the amount that will be used in twenty-four hours. Storage includes the gasoline fuel tanks of mobile and stationary equipment.

Exception to storage rules: When the mine is idle (i.e. during weekends and holidays), the 24-hour requirement will be waived until activity/production is resumed.

D. "Application Review"

1. After receipt of an application, the Department will review the application to determine whether the information submitted to the Department is adequate enough to enable the Department to make a determination to approve or deny the application. This review will be completed within fifteen days of the receipt of the application.

2. If the application does not contain adequate information, the Department will provide a written statement of the specific information that will enable the Department to make a determination to - approve or deny the application.

3. Upon review of an adequate application, a determination will be made whether to grant tentative approval pending a site visit.

4. The Department will notify the applicant, in writing, whether the application has been tentatively approved and the time and date of site visit.

5 The Department will notify the operator, in writing, of approval or denial of the application upon completion of the site visit.

E. "Enforcement Options"

There are a number of enforcement options available to enable the Department to address the improper use of an internal combustion motor in an underground mine other than a coal mine. The options range from a warning letter to an order ceasing operations at the mine. What is appropriate depends on the nature of the violation.

Department of Environmental Protection
Bureau of Deep Mine Safety

UNDERGROUND STORAGE OF EXPLOSIVES

DOCUMENT NUMBER: 580-2200-010

TITLE: Underground Storage of Explosives

EFFECTIVE DATE: June 19, 2004

AUTHORITY: Sections 617, 618, and 1402 of the Anthracite Coal Mine Act, 52 P.S. § § 70-617,618 and 70-1402; Sections 256 and 702 of the Bituminous Coal Mine Act, 52 P.S. § 701-256, and 701-702; and Section 1915-A of the Administrative Code of 1927, 71 P.S.S. § 510-15.

POLICY: It is the Department of Environmental Protection's ("**DEP**") policy that explosives shall be stored at underground mines in a manner that protects workers, the public, and property.

PURPOSE: This guidance specifies how explosives may be stored in underground coal mines for extended periods of time.

APPLICABILITY: This guidance is applicable to all anthracite and bituminous underground coal mine inspectors, engineers, and operators of anthracite and bituminous underground coal mines.

DISCLAIMER: The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the Department to give these rules that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 2 pages

LOCATION: Volume 9, Tab 24

BACKGROUND: High explosives are used in both anthracite and bituminous underground coal mines. At anthracite coal mines, the explosives are to be stored on the surface in magazines, and only enough for one day's work is to be taken underground (see Sections 605 and 617 of the Anthracite Act). In the mine, the explosives are to be stored in wooden magazine boxes. Until the early 1970s the practice in the large mines had been to use a special rail magazine car to bring large quantities of explosives and detonators underground. Wooden day boxes would then be used to distribute the explosives and detonators to the working sections. At the end of the day the explosives car would be withdrawn from the mine and refilled in the morning from the surface magazine. The smaller mines would receive just enough explosives and detonators for a couple of days. These explosives either went immediately underground for that day's use or were stored in wooden magazine boxes on the surface. By the mid-1970s there were no longer mines using large amounts of explosives on a daily basis. Operators are reluctant to store larger quantities of explosives on the surface due to the risk of theft, vandalism, and accidental explosion due to vandalism.

In bituminous underground mines, explosives and detonators can be stored for up to 48 hours in a magazine. Again, wooden day boxes are used to take the explosives and detonators to the working sections. There has been a significant reduction in the amount of explosives and detonators used in bituminous coal mines due to the implementation of continuous mining machines and longwall mining systems.

Today, the explosives used in underground coal mines are significantly more stable and harder to accidentally detonate. The percentage of nitroglycerin in dynamite has been significantly reduced. In the past decade, operators have been using an emulsion, which is even more stable than the dynamite.

Section 702 of the Bituminous Act allows an operator to use a new technology or method different from one required under the Bituminous Act if that method or technology affords protections to workers and property that is at least substantially equivalent to the protections afforded by the Act. Identical language is found in Section 1402 of the Anthracite Act. These Acts were adopted in 1961 and 1965, respectively. Provided the following guidance is followed, storing explosives in an underground mine for extended periods will afford workers and property the same or greater protection than what was intended under the Acts.

Guidance: In general, explosives can be stored in an underground mine if:

1. Until needed for use, the explosives and detonators are stored in a magazine of substantial construction with no metal exposed on the inside. Detonators and explosives may be stored in the same magazine if they are separated by a 4-inch wooden partition or its equivalent. Otherwise, detonators and explosives are to be stored in separate magazines at least 5 feet apart.

2. The magazine is located at least 25 feet from roadways and power wires in a well rockdusted location protected from roof falls. This location shall be at least 300 feet from the faces, and out of the direct line of blasting, outby the last permanent stopping and on intake air.

3. The Department shall approve the design, construction, and placement of a magazine before that magazine is used for storing any explosives or detonators. The Department's approval shall specify the maximum amount of explosives and detonators to be stored in a magazine, as well as, the maximum amount of time the explosives and detonators can be stored.

4. The operator has an approved program for maintaining the magazine.

5. At the end of each shift the unused explosives and detonators are returned to the magazine.

6. The operator shall maintain a record of explosives taken from and placed in the magazine. Any other alternative procedures for storing explosives and detonators in an underground mine are to be submitted to the Department in accordance with TGD No. 580-2200-004, Procedures for Processing Requests to adopt new items or methods under Section 702 and 1402 of the Pennsylvania Mining Laws.

Department of Environmental Protection
Bureau of Mine Safety

SINKING OF SHAFTS AND SLOPES FOR UNDERGROUND MINES

DOCUMENT NUMBER: 580-2200-011

TITLE: Sinking of Shafts and Slopes for Underground Mines

EFFECTIVE DATE: December 24, 2005

AUTHORITY: The Pennsylvania Anthracite and Bituminous Coal Mine Acts ("**Acts**") (52 P.S. § § 70-101 *et. seq*. and § § 701-101 *et. seq*.); Section 2(f) of the General Safety Law (43 P.S. 25-2(f); The Coal and Non-Coal Surface Mining Conservation and Reclamation Acts ("**SMCRA**") (52 P.S. § § 1396.1 *et. seq*. and § § 3301 *et. seq*.); Sections 1915-A and 1917-A of the Administrative Code of 1977 (§ § 510-15 and 17); and 25 Pa. Code Chapters 87, 88, 89, 207, and 210.

POLICY: It is the policy of the Department to administer and enforce the mine safety laws in a manner that ensures the safety of persons working in or about the mine.

PURPOSE: The purpose of this technical guidance is to identify the safety requirements applicable to the development of shaft and slope entries to underground mines and to provide the operator the ability to implement the U.S. Department of Labor, Mine Safety and Health Administration's ("**MSHA**") requirements for shaft and slope construction in lieu of those set forth in the Acts.

APPLICABILITY: This Technical Guidance is applicable to all employees of the Department's Bureau of Mine Safety responsible for inspecting underground mines and all underground mining operations.

DISCLAIMER: The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the Department ("**DEP**") to give these rules that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

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LOCATION: Volume 9 Tab 25

GUIDANCE:

1. Underground Coal Mines

The sinking of shafts and the driving of slope entries for underground coal mines, either in operation or under development, is subject to the requirements of the Pennsylvania Anthracite or Bituminous Coal Mine Acts ("**Acts**"). The safety standards for persons involved in the construction of anthracite mine shafts and slopes are contained in § § 70-725–70-731. The safety standards for persons involved in the construction of bituminous mine shafts are contained in § 701-290(l). The other provisions of the Acts are applicable to address issues not addressed by these sections, *e.g*. use of permissible explosives.

The Mine Safety and Health Administration's ("**MSHA**") regulations concerning the construction of entries from the surface to the coal seam are found in 30 CFR Part 77 Subpart T (Underground Coal Mines-Health and Safety Standards-Slope and Shaft Sinking). In the Department's opinion, these standards afford protections to workers that are substantially equivalent to or greater than those afforded by the requirements of the Acts. Therefore, pursuant to Section 1402 of the Anthracite Act and Section 702 of the Bituminous Act and to promote consistency, an operator may implement the MSHA standards in lieu of the requirements in the Acts. The operator must request, in writing, the Department's authorization to use the MSHA subpart T standards in lieu of the Act's requirements. This authorization will be granted if the operator agrees to submit to the Department all requests or plans that must be submitted and approved by MSHA under Subpart T.

2. Underground Industrial Mineral Mines

The Department's safety standards for the development and operation of underground industrial mineral mines is established by Section 2(f) of the General Safety Law and its implementing regulations, found at 25 Pa. Code Chapter 207. These regulations, *inter alia*, incorporate by reference the MSHA regulations found at 30 CFR Part 57 (relating to health and safety standards for underground metal and nonmetal mines). Therefore, the Department's regulations already require operators of underground industrial mineral mines to follow the MSHA regulations for the construction of entries to underground metal and nonmetal mines.

3. Qualifications

Shaft and Slope Construction Supervisor – The person immediately responsible for supervising persons engaged in the sinking of a shaft or slope entry is responsible for ensuring compliance with applicable safety requirements and the safety of persons engaged in this activity. At a minimum, the Department expects this supervisor to be the person who: ensures the adequacy of the entry's ventilation, performs all required checks for methane and oxygen, checks the walls of the entry for loose rock after a blast, and ensures the adequacy of the entry's ground control. In general the Department will consider a person competent, by issuing a certificate of competency, to supervise persons engaged in the sinking of shafts or slopes if that person:

(a) Is at least 21 years of age.

(b) Has at least 2 years of practical experience in the sinking of slopes and shafts or has 1 year of practical experience in the sinking of slopes and shafts and either possess:

(i) A Bachelor of Science Degree in mining engineering.

(ii) A certificate of qualification to be a coal mine foreman or assistant coal mine foreman issued pursuant to the Acts.

(iii) A certificate of qualification to be an industrial mineral underground mine foreman.

(iv) An acceptable certificate of qualification issued by another state.

(c) Has been trained in the detection of oxygen and explosive gases, as well as, the use and mechanics of all gas detection devices.

(d) Has demonstrated the ability to ensure the safety of persons engaged in the sinking of slopes and shafts by successfully answering at least 80 percent of the questions in an examination administered by the Department.

Blaster – The Department will continue to require persons performing blasting activity in connection with the construction of an entry from the surface to the coal seam or mineral deposit to be mined to possess a license issued pursuant to Chapter 210. For Industrial Mineral Mines the authority for this requirement comes from § 207.217 (relating to blasting activity) and 210.12 (relating to scope). For coal mines the authority for this requirement flows from the fact that the development of an entry from the surface to the seam to be mined is also surface mining activity subject to the requirements of the SMCRA and its implementing regulations found at § § 87.124(d) (relating to use of explosives: general requirements) and 88.134(c) (relating to blasting: general requirements).

Note: The construction of a mine opening from the surface to the coal seam or mineral strata to be mined is also surface mining activity subject to the SMCRA or the NCSMCRA and their implementing regulations. The regulations concerning the use of explosives are found at § 77.453 and § 77.561-565 (relating to use of explosives) for noncoal mines; § 87.64 (relating to blasting plan), and § § 87.124–129 (relating to the use of explosives) for bituminous mines, and § 88.45(relating to blasting) and § § 88.134-137 (relating to blasting) for anthracite coalmines. These regulations are for the protection of persons and property outside the permit area as well as persons at the mine site. They address issues such as peak particle velocity, air blasts, pre-blast surveys, scheduling of blasts, and measures to be taken to protect traffic on nearby highways. The Department is developing a proposed rulemaking package which will, among other things, clarify that these regulations apply to the use of explosives in connection with the development of a mine opening, as well as, increased flexibility in the scheduling of the blasts so that the construction of a mine opening can occur round the clock.

Section III: PA Code Chapter 207

CHAPTER 207. NONCOAL UNDERGROUND MINES

Subchap. **Sec.**

Authority

The provisions of this Chapter 207 issued under sections 2(f) and 12 of the act of May 18, 1937 (P. L. 654, No. 174)(43 P. S. § § 25-2(f) and 25-12); and sections 1917-A and 1920-A of the Administrative Code of 1929 (71 P. S. § § 510-17, and 510-20), unless otherwise noted.

Source

The provisions of this Chapter 207 adopted December 1, 1972, 2 Pa.B. 2262, unless otherwise noted.

Subchapter A. GENERAL

Sec.

§ 207.1. [Reserved]

Source

The provisions of this § 207.1 adopted December 1, 1972, 2 Pa.B. 2262; reserved April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041. Immediately preceding text appears at serial page (234646).

§ 207.2. [Reserved]

Source

The provisions of this § 207.2 adopted December 1, 1972, 2 Pa.B. 2262; amended December 1, 1972, 2 Pa.B. 2262; reserved April 9, 2004, April 10, 2004, 34 Pa.B. 2041. Immediately preceding text appears at serial page (234646).

§§ 207.11—207.22. [Reserved]

Source

The provisions of these § § 207.11—207.22 adopted December 1, 1972, 2 Pa.B. 2262; reserved April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041. Immediately preceding text appears at serial pages (234647) to (234650).

§§ 207.31—207.46. [Reserved]

Source

The provisions of these § § 207.31—207.46 adopted December 1, 1972, 2 Pa.B. 2262; reserved April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041. Immediately preceding text appears at serial pages (234650) to (234655).

§ 207.101. Scope

This chapter applies to underground noncoal mines and mined-out underground noncoal mines used to house other businesses in this Commonwealth. The purpose of this chapter is for the protection of life, the promotion of health and safety, and the prevention of accidents.

Source

The provisions of this § 207.101 adopted April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041.

§ 207.102. Definitions

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise:

Developed facility—The portion of a mined-out underground noncoal mine developed or being developed for storage, manufacturing or other activities requiring a person to enter the mined-out area. The term includes all roads and means of entering and leaving the mined-out area of the underground noncoal mine.

Mined-out—A portion of the noncoal underground mine where no further mining is planned.

Noncoal underground mine—

(i) Lands, excavations, underground passageways, shafts, slopes, tunnels and workings, structures, facilities, equipment, machines, tools or other property including impoundments, retention dams and tailings ponds, on the surface or underground, used in, or to be used in, or resulting from, the work of extracting metals or minerals other than coal from their natural deposits in nonliquid form, or if in liquid form, with workers underground, or used in, or to be used in, the milling of the metals or minerals, or the work of preparing metals or minerals other than coal, and includes custom preparation facilities.

(ii) Private ways and roads appurtenant to the areas set forth in subparagraph (i).

Person—A natural person, partnership, association or corporation or any agency, instrumentality, or entity of Federal or State government. When used in any clause prescribing and imposing a penalty, or imposing a fine or imprisonment, or both, the term "person" does not exclude the members of an association and the directors, officers, or agents of a corporation.

Source

The provisions of this § 207.102 adopted April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041.

§ 207.103. Responsible party

The person who is the owner or operator of a noncoal underground mine or developed facility shall ensure that the noncoal underground mine or developed facility is constructed and operated in accordance with this chapter. A subcontractor who conducts all or part of the operation shall be jointly and severally responsible with the owner or operator.

Source

The provisions of this § 207.103 adopted April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041.

§ 207.104. Enforcement

(a) The Department has the authority to issue orders necessary to ensure compliance with section 2(f) of the act of May 18, 1937 (P. L. 654, No. 174) (43 P. S. § 25-2(f)), known as the General Safety Law, and this chapter. This authority includes orders:

(1) Revoking or suspending a certificate of qualification to be a foreman.

(2) Ceasing or suspending the operation of a noncoal underground mine or developed facility.

(3) Requiring the abatement of an unsafe condition or practice.

(b) Except for orders abating a condition that is an imminent hazard or ceasing, in whole or in part, the operation of a noncoal underground mine or developed facility due to the existence of an imminent hazard, the Department will not issue an order abating a condition or correcting a violation of this chapter until the owner or operator has had an opportunity to meet with the Department to discuss the matter and the owner or operator has had a reasonable opportunity to abate the condition or correct the violation.

Source

The provisions of this § 207.104 adopted April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041.

Subchapter B. NONCOAL UNDERGROUND MINES

GENERAL

Sec.

PERFORMANCE STANDARDS

Source

The provisions of this Subchapter B adopted April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041, unless otherwise noted.

GENERAL

§ 207.201. Applicability

This subchapter applies to the development, construction, and operation of noncoal underground mines in this Commonwealth.

§ 207.202. Definitions

The following words and terms, when used in this subchapter, have the following meanings, unless the context clearly indicates otherwise:

MSHA—The United States Department of Labor, Mine Safety and Health Administration, its employees, and its officers.

Magazine—A structure used for the storage of explosives.

PERFORMANCE STANDARDS

§ 207.211. Safety requirements

(a) The provisions of 30 CFR Part 57 (relating to safety and health standards—underground metal and nonmetal mines) are incorporated herein by reference.

(b) Alternative safety and health standards for underground metal and nonmetal mines, established by MSHA under section 101(c) of the Federal Mine Safety and Health Act of 1977 (30 U.S.C.A. § 811(c)) and 30 CFR Part 44 (relating to rules of practice for petitions for modification of mandatory safety standards), are incorporated herein by reference.

(c) The provisions of 30 CFR Part 57 requiring the submission of a map, plan, notification, report, program description or other materials to MSHA are amended to require the same submission to the Department. A copy of the documents required by 30 CFR Part 57 to be submitted to MSHA and any other material requested by MSHA under 30 CFR Part 57 shall also be submitted to the Department's Anthracite and Industrial Mineral Mine Safety Division at 5 West Laurel Blvd., Pottsville, Pennsylvania 17901.

(d) An owner or operator of a noncoal underground mine maintaining a magazine located on the surface shall comply with the magazine licensing requirements of Chapter 211 (relating to storage, handling and use of explosives).

§ 207.212. Employment of foreman

The owner or operator of an underground noncoal mine shall employ a foreman who possesses the Department's certificate of qualification to be a foreman.

§ 207.213. Duties of foreman

The foreman shall have full charge of the inside portions of the noncoal underground mine and the persons employed therein. The foreman's duty shall be to ensure compliance with the Commonwealth's mine safety laws and the regulations promulgated thereunder, as well as to secure and promote the health and safety of persons employed in the noncoal underground mine.

§ 207.214. Certificate of qualification application requirements

To be eligible to apply for a certificate of qualification, the individual shall:

(1) Be at least 21 years of age.

(2) Have at least 2 years of practical experience as a noncoal underground miner or have 1 year of practical experience as a noncoal underground miner and either possess a Bachelor of Science Degree in mining engineering, possess a certificate of qualification under section 205 of the Pennsylvania Anthracite Coal Mine Act (52 P. S. § 70-205) or section 206 of the Pennsylvania Bituminous Coal Mine Act (52 P. S. § 701-206) or possess an acceptable certificate of qualification issued by another state.

§ 207.215. Standards for issuing certificates of qualification

(a) The Department will only issue certificates of qualification to be a foreman to applicants who have demonstrated the ability to ensure the safety of persons and the inside portions of a noncoal underground mine under their supervision. Applicants make this demonstration by correctly answering at least 80% of the Department's written examination covering applicable mine safety laws and regulations of the Commonwealth.

(b) The Department may refuse to issue to an applicant a certificate of qualification when the applicant has demonstrated an inability or unwillingness to comply with the mine safety laws and regulations of the Commonwealth or the mine safety laws or regulations administered by MSHA.

§ 207.216. Examining committee

(a) The Department will appoint a committee consisting of a noncoal underground mine foreman and a representative of the Department to prepare the initial draft of the examination to be given to applicants for the mine foreman's certificate of qualification. A bank of questions shall be developed by the committee. The Department will assemble the examination from this bank of questions.

(b) This committee shall review and score the results of the examinations given to applicants for the foreman's certificate of qualification. These results shall be transmitted to the Department for issuance of the certificate.

§ 207.217. Blasting activity

The storage, handling, and use of explosives at a noncoal underground mine shall be under the supervision and control of a person licensed as a blaster under Chapter 210 (relating to blasters' licenses).

Subchapter C. MINED-OUT AREAS

GENERAL PROVISIONS

Sec.

SPECIFICATIONS

Source

The provisions of this Subchapter C adopted April 9, 2004, effective April 10, 2004, 34 Pa.B. 2041, unless otherwise noted.

GENERAL PROVISIONS

§ 207.301. Applicability

This subchapter applies to the use of mined-out underground noncoal mines in this Commonwealth. The activities covered by this subchapter include storage, manufacturing, or other activities requiring a person to enter the mined-out area.

§ 207.302. Definitions

The following words and terms, when used in this subchapter, have the following meanings, unless the context clearly indicates otherwise:

Outside air—Air moving through the mined-out passageways after entering them through the main or accessory portals by mechanical or natural forces.

Pure air—Air containing not less than 19.5% oxygen, not more than 0.5% carbon dioxide, and no harmful quantities of other noxious or poisonous gases, dust, soot, or particulates.

Safety container—A container not over 5 gallons capacity, having a spring closing lid and spout cover.

§ 207.303. Approvals

(a) A person may not operate a business in a mined-out area unless that mined-out area is part of a developed facility, which has been approved by the Department in writing and is constructed and operated in accordance with this subchapter.

(b) The owner or operator of the developed facility shall submit to the Department a written request which:

(1) Identifies the owner of the developed facility.

(2) Identifies the location of the developed facility.

(3) Describes the purpose of the developed facility.

(4) Identifies a responsible person at the developed facility.

(5) Contains a map or drawings depicting the developed facility, including the following:

(i) The information required by § 207.314(b) (relating to ventilation) if the developed facility will be using mechanical ventilation.

(ii) The information required by § 207.318(b) (relating to storage of flammable liquids) if more than 5 gallons of flammable liquid are to be stored in the developed facility.

(c) One or more inspections of the developed facility may be part of the Department's review of the operator's request.

(d) The Department's approval may include conditions necessary to ensure compliance with section 2(f) of the act of May 18, 1937 (P. L. 654, No. 174) (43 P. S. § 25-2(f)), known as the General Safety Law, the requirements of this subchapter, and protect the public health, safety, and welfare.

SPECIFICATIONS

§ 207.311. Roof areas

The owner or operator of a developed facility shall ensure that the developed facility's roof shall be scaled, bolted, or otherwise supported.

§ 207.312. Lighting

(a) *Permanent*. The owner or operator of a developed facility shall ensure that a permanent lighting system is installed in the developed facility to provide adequate lighting for the activities to be conducted in the developed facility. An adequate permanent lighting system is one constructed in accordance with a Nationally recognized safety code such as the *National Electric Code* established by the United States of America Standards Institute.

(b) *Emergency*. The owner or operator of a developed facility shall ensure that a person is not allowed to work in a developed facility unless either an emergency lighting system meeting the requirements of the Department has been installed in that area or each worker is provided with an approved personal lamp.

(1) The emergency lighting system shall be powered by an emergency generator. The emergency lighting system shall also be constructed in accordance with a Nationally recognized safety code such as the *National Electric Code* established by the United States of America Standards Institute.

(2) Cap lamps constructed and maintained in accordance with 30 CFR 19.5 (relating to general requirements for approval) are approved as personal lamps. The Department may approve the use of other types of personal lamps provided the other lamps are as safe as a personal cap lamp constructed and operated in accordance with 30 CFR 19.5.

§ 207.313. Entrances and exits

The owner or operator of a developed facility shall ensure that two separate passages, connecting each area of the developed facility to the surface, shall be provided for personnel use and shall be maintained in a safe, passable condition at all times.

§ 207.314. Ventilation

(a) *General requirement*. The owner or operator of a developed facility shall ensure that an adequate supply of pure air is provided and maintained in the developed facility as provided in subsection (c). If the Department or the operator determines it is necessary to install mechanical means of ventilation, these mechanical means for providing pure air shall be approved by the Department in writing before the mechanical ventilation system is operated.

(b) *Ventilation system requirements*. The owner or operator of the developed facility shall submit to the Department drawings depicting the proposed ventilation system. One or more inspections of the developed facility may be part of the Department's review of the proposed mechanical ventilation system. Any Department approval may include conditions necessary to ensure the ventilation system is providing pure air to all portions of the developed facility.

(c) *Quantity of air*. A minimum of 20 cubic feet of outside air shall be supplied to every occupied or enclosed space in a developed area, per minute, per person present in that area.

Cross References

This section cited in 25 Pa. Code § 207.303 (relating to approvals).

§ 207.315. Closing underground sections

If it becomes necessary to permanently close or enclose a section or portion of the developed facility, the owner or operator of the developed facility shall ensure that noncombustible material is used to permanently close or enclose that section or portion of the developed facility.

§ 207.316. Inspections

The owner or operator of a developed facility shall ensure that inspections are made at the following times, and defective conditions that are discovered shall be corrected:

(1) *Monthly*. The ceiling, pier, and walls shall be inspected monthly for new cracks. The entrances, shafts, slopes, drifts, and roadways leading to them, and the doors or gates shall be inspected monthly to ensure they are in safe, usable condition.

(2) *Biweekly*. Emergency lighting systems and approved personal lamps shall be tested biweekly to assure they are in operating condition. Charge, fluid, terminals, and visual conditions of batteries shall be checked.

(3) *Weekly*. The ventilating system shall be inspected weekly to ensure that motors and controls are in operating condition.

§ 207.317. Record of inspection

The owner or operator of the developed facility shall ensure that daily logs containing the findings of inspections and the repairs and corrective action taken are maintained and kept on file at the developed facility's office. These logs shall be available for inspection by the Department at any time during working hours. Each day's log shall be dated and signed by a person designated by the owner or operator to be responsible for the day-to-day operation of the developed facility. Corrections or orders

required by the Department representative shall be in writing and shall become a part of the log.

§ 207.318. Storage of flammable liquids

(a) The owner or operator of the developed facility shall ensure that flammable liquids are stored in a safety container unless otherwise approved in writing by the Department. To request the Department's approval, the owner or operator shall submit to the Department a photograph, drawing, or sketch of the container and an explanation as to why this alternative container is safe for storing flammable liquids. Department approvals may include conditions necessary to ensure that the container will safely store flammable liquids.

(b) The owner or operator of a developed facility shall ensure that flammable liquids in excess of 5 gallons are not stored in the developed facility unless otherwise approved in writing by the Department.

(c) The request for storing more than 5 gallons of flammable liquid shall include a drawing depicting the location, size, and nature of storage. The request shall also state the reason it is necessary to store more than 5 gallons of flammable liquids and describe the materials which will be used to construct the container, as well as measures to be taken to detect, prevent, or respond to a fire or a spill.

Cross References

This section cited in 25 Pa. Code § 207.303 (relating to approvals).

§ 207.319. Check in/check-out system

The owner or operator of the developed facility shall ensure that there is a check-in/check-out system, which will inform personnel on the surface of the mine as to who is currently in the developed facility.

Section IV: PA Code Chapter 210

CHAPTER 210. BLASTERS' LICENSES

Sec.

Authority

The provisions of this Chapter 210 issued under sections 3 and 7 of the act of July 1, 1937 (P. L. 2681, No. 537) (73 P. S. § § 157 and 161); section 3 of the act of July 10, 1957 (P. L. 685, No. 362) (73 P. S. § 166); Reorganization Plan No. 8 of 1981 (71 P. S. § 751-35); section 2(f) of the act of May 18, 1937 (43 P. S. § 25-2(f)); Reorganization Plan No. 2 of 1975 (71 P. S. § 751-22); section 4(b) of the Surface Mining Conservation and Reclamation Act (52 P. S. § 1396.4(b)); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P. S. § 3311(e)); and sections 1917-A and 1920-A(b) of The Administrative Code of 1929 (71 P. S. § § 510-17 and 510-20(b)), unless otherwise noted.

Source

The provisions of this Chapter 210 adopted January 26, 1973, effective January 27, 1973, 3 Pa. 183, unless otherwise noted.

Cross References

This chapter cited in 25 Pa. Code § 77.561 (relating to general requirements); 25 Pa. Code § 87.64 (relating to blasting plan); 25 Pa. Code § 87.124 (relating to use of explosives: general requirements); 25 Pa. Code § 88.134 (relating to blasting: general requirements); 25 Pa. Code § 207.17 (relating to blasting activity); and 25 Pa. Code § 211.101 (relating to definitions).

§ § 210.1—210.3. [Reserved]

Source

The provisions of these § § 210.1—210.3 adopted January 26, 1973, effective January 27, 1973, 3 Pa.B. 183; amended November 7, 1980, effective November 8, 1980, 10 Pa.B. 4294; reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243459) to (243462).

§ § 210.4—210.6. [Reserved]

Source

The provisions of these § § 210.4—210.6 adopted January 26, 1973, effective January 27, 1973, 3 Pa.B. 183; reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243462) to (243463).

§ 210.11. Definitions

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise:

ATF—The United States Department of Justice, Bureau of Alcohol, Tobacco, Firearms and Explosives.

Blaster—A person who is licensed by the Department under this chapter to detonate explosives and supervise blasting activities.

Blaster learner—An individual who is learning to be a blaster and who participates in blasting activities under the direct supervision of a blaster.

Blaster's license—A license to detonate explosives and supervise blasting activities issued by the Department under this chapter.

Demolition and **demolition blasting**—The act of wrecking or demolishing a structure with explosives.

Explosives—Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. The term includes dynamite and other high explosives, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord and igniters. The term includes all items in the "List of Explosive Materials" provided for in 27 CFR 555.23 (relating to list of explosive materials).

Limited—A classification of blaster's license applicable to persons who supervise the loading or detonate explosives in operations in which the use of explosives is not related to excavation or demolition.

Mine opening blasting—Blasting conducted for the purpose of constructing a shaft, slope, drift or tunnel mine opening for an underground mine, either operating or under development from the surface down to the point where the mine opening connects with the mineral strata to be or being extracted.

Person—A natural person.

Authority

The provisions of this § 210.11 amended under section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11 of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311); sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 210.11 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended August 8, 2008, effective August 9, 2008, 38 Pa.B. 4355; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (335908).

§ 210.12. Scope

This chapter applies to persons engaging in the detonation of explosives within this Commonwealth. Except for persons engaging in mine opening blasting, this chapter does not apply to persons authorized to detonate explosives or to supervise blasting activities under:

(1) The Pennsylvania Anthracite Coal Mine Act (52 P. S. § § 70.101—70.1405).

(2) The Pennsylvania Bituminous Coal Mine Act (52 P. S. § § 701-101—701-706).

Authority

The provisions of this § 210.12 amended under section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P. S. § 1396.4b); section 11 of the Noncoal Surface Mining Conservation and Reclamation Act (52 P. S. § 3311); and sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P. S. § § 510-17 and 510-20).

Source

The provisions of this § 210.12 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended August 8, 2008, effective August 9, 2008, 38 Pa.B. 4355. Immediately preceding text appears at serial page (303212).

§ 210.13. General

(a) A person may not detonate explosives or supervise blasting activities unless the person has obtained a blaster's license.

(b) A blaster's license will only be issued or renewed after it is verified that the applicant is in compliance with 18 U.S.C.A. Chapter 40 and 27 CFR Part 555 (relating to commerce in explosives).

(c) The Department may exempt certain individuals from needing a blaster's license if the person is detonating extremely small amounts of explosives for industrial or research purposes. The Department will consider a written request for an exemption from the person seeking the exemption.

(d) Upon request, a blaster shall exhibit a blaster's license to the following:

(1) An authorized representative of the Department.

(2) The blaster's employer or an authorized representative of the employer.

(3) A police officer acting in the line of duty.

(e) A blaster's license is not transferable.

Authority

The provisions of this § 210.13 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 210.13 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (335909).

§ 210.14. Eligibility requirements

(a) To be eligible for a blaster's license, a person shall:

(1) Be 21 years of age or older.

(2) Have at least 1 year of experience as a blaster learner in preparing blasts in the classification for which a license is being sought.

(3) Have taken the Department's class on explosives. It is not necessary for a blaster to retake the class when adding an additional classification to a license.

(4) Have successfully passed the Department's examination for a blaster's license.

(b) The Department will not issue or renew a license if the applicant, as indicated by past or continuing violations, has demonstrated a lack of ability or intention to comply with the Department's regulations concerning blasting activities.

Source

The provisions of this § 210.14 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751.

Cross References

This section cited in 25 Pa. Code § 210.17 (relating to issuance and renewal of licenses).

§ 210.15. License application

(a) The license application shall be on forms provided by the Department and be accompanied by a check for $50 payable to the Commonwealth of Pennsylvania. The complete application shall be submitted to the Department at least 2 weeks prior to the examination.

(b) The license application shall include a signed notarized statement from a person who has direct knowledge of the applicant's expertise, such as the blaster who supervised the applicant, or the applicant's employer. The statement shall:

(1) Describe the applicant's experience in blasting. In particular, the statement shall describe in detail how the applicant assisted in the preparation of the blasts and for how long.

(2) State whether the applicant is competent to prepare and detonate blasts in the classification for which the license is being sought.

Source

The provisions of this § 210.15 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751.

Cross References

This section cited in 25 Pa. Code § 210.17 (relating to issuance and renewal of licenses).

§ 210.16. Examinations

(a) The Department will conduct examinations for specific types of blasting, as specified in § 210.17(a) (relating to issuance and renewal of licenses).

(b) The Department will schedule and conduct examinations as needed.

(c) An applicant failing to appear for a scheduled examination forfeits the application fee unless the applicant provides written notice to the Department 2 weeks prior to the examination date or submits a valid medical excuse in writing.

(d) Refund of the fee or admittance to a subsequent examination without a reapplication fee will be at the discretion of the Department.

Authority

The provisions of this § 210.16 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537 (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 210.16 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (335910).

Cross References

This section cited in 25 Pa. Code § 210.17 (relating to issuance and renewal of licenses).

§ 210.17. Issuance and renewal of licenses

(a) A blaster's license is issued for a specific classification of blasting activities. The classifications will be determined by the Department and may include general blasting (which includes all classifications except demolition, mine opening blasting, and underground noncoal mining), trenching and construction, law enforcement, surface mining, underground noncoal mining, mine opening blasting, industrial, limited and demolition.

(b) A person may apply to amend the blaster's license for other classifications by meeting the requirements of § 210.14 (relating to eligibility requirements) and by submitting a complete application.

(c) A blaster's license will be issued for 3 years.

(d) A blaster's license is renewable if the blaster can demonstrate that he has had a minimum of 8 hours of continuing education in Department-approved courses related to blasting and safety within the 3-year period.

(e) The blaster's license may be renewed for a 3-year term by submitting a renewal application to the Department and a check for $30, payable to the "Commonwealth of Pennsylvania."

(f) A person who intends to be a blaster and whose blaster's license was not renewed within 1 year of its expiration date shall apply for a new license under § § 210.14—210.16 (relating to eligibility requirements; license application; and examinations).

(g) A person who conducted demolition blasting under a general blaster's license may conduct demolition blasting after July 14, 2001, by applying for and receiving a demolition blaster's license. The Department may waive the examination required under § 210.14 and the application fee if the blaster demonstrates at least 3 years of experience in demolition blasting. The demonstration shall be in the form of a notarized statement from the blaster's employer that describes the blaster's experience.

Authority

The provisions of this § 210.17 amended under section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P. S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P. S. § 3311(e)); sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P. S. § § 510-17 and 510-20); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 210.17 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended August 8, 2008, effective August 9, 2008, 38 Pa.B. 4355; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (335910) to (335911).

Cross References

This section cited in 25 Pa. Code § 210.14 (relating to eligibility requirements).

§ 210.18. Recognition of out-of-State blaster's license

(a) The Department may license a person who holds a blaster's license or its equivalent in another state. The Department may issue the license if, in the opinion of the Department, that state's licensing program provides training on the storage, handling and use of explosives and an examination that is equivalent to the requirements of this chapter.

(b) A request for a license under this section shall be made in writing. Copies of the other state's explosives training and examination material and proof that the applicant holds a license in the other state shall be provided to the Department in order to make a proper evaluation.

Source

The provisions of this § 210.18 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751.

§ 210.19. Suspension, modification, and revocation

The Department may issue orders suspending, modifying, or revoking a blaster's license. Before an order is issued, the Department will give the blaster an opportunity for an informal meeting to discuss the facts and issues that form the basis of the Department's determination to suspend, modify, or revoke the license. The Department may suspend, modify, or revoke a blaster's license for violations of this chapter and Chapters 77, 87, 88, and 211.

Authority

The provisions of this § 210.19 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act

of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 210.19 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (335912).

Section V: PA Code Chapter 211

CHAPTER 211. STORAGE, HANDLING, AND USE OF EXPLOSIVES

Subchap. Sec.

Authority

The provisions of this Chapter 211 issued under sections 1901-A and 1920-A of The Administrative Code of 1929 (71 P. S. § § 510-1 and 510-20); amended under sections 3 and 7 of the act of July 1, 1937 (P. L. 2681, No. 537) (73 P. S. § § 157 and 161); section 3 of the act of July 10, 1957 (P. L. 685, No. 362) (73 P. S. § 166); Reorganization Plan No. 8 of 1981 (71 P. S. § 751-35); section 2(f) of the act of May 18, 1937 (43 P. S. § 25-2(f)); Reorganization Plan No. 2 of 1975 (71 P. S. § 751-22); section 4(b) of the Surface Mining Conservation and Reclamation Act (52 P. S. § 1396.4(b)); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P. S. § 3311(e)); and sections 1917-A and 1920-A(b) of The Administrative Code of 1929 (71 P. S. § § 510-17 and 510-20(b)), unless otherwise noted.

Source

The provisions of this Chapter 211 adopted June 14, 1972, effective June 15, 1972, 2 Pa.B. 1067, unless otherwise noted.

Cross References

This chapter cited in 25 Pa. Code § 77.561 (relating to general requirements); 25 Pa. Code § 87.124 (relating to use of explosives: general requirements); 25 Pa. Code § 88.134 (relating to blasting: general requirements); 25 Pa. Code § 207.211 (relating to safety requirements); and 25 Pa. Code § 210.19 (relating to suspension, modification, and revocation).

Subchapter A. GENERAL PROVISIONS

Sec.

Cross References

This subchapter cited in 25 Pa. Code § 211.191 (relating to scope).

§ § 211.1 and 211.2. [Reserved]

Source

The provisions of these § § 211.1 and 211.2 reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243466) to (243469).

§ 211.31. [Reserved]

Source

The provisions of this § 211.31 amended November 7, 1980, effective November 8, 1980, 10 Pa.B. 4294; reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial page (243469).

§ § 211.32—211.44. [Reserved]

Source

The provisions of these § § 211.32—211.44 reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243469) to (243482).

§ § 211.51—211.56. [Reserved]

Source

The provisions of these § § 211.51—211.56 reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243481) to (243490).

§ § 211.61 and 211.62. [Reserved]

Source

The provisions of these § § 211.61 and 211.62 reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243490) to (243495).

§ 211.71. [Reserved]

Source

The provisions of this § 211.71 reserved October 15, 1982, effective October 16, 1982, 12 Pa.B. 3736. Immediately preceding text appears at serial page (11436).

§ 211.72. [Reserved]

Source

The provisions of this § 211.72 amended October 15, 1982, effective October 16, 1982, 12 Pa.B. 3736; reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243495) to (243496).

§ § 211.73—211.76. [Reserved]

Source

The provisions of these § § 211.73—211.76 reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243496) to (243497).

§ § 211.81—211.87. [Reserved]

Source

The provisions of these § § 211.81—211.87 reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial text pages (243497) to (243499).

§ 211.88. [Reserved]

Source

The provisions of this § 211.88 amended July 28, 1972, 2 Pa.B. 1439; reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial page (243499).

§ 211.101. Definitions

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise:

ATF—The United States Department of Justice, Bureau of Alcohol, Tobacco, Firearms and Explosives.

Access point—A point in the outer perimeter security and a point in the inner perimeter security that allows entry to or exit from the magazine or the magazine site.

Acts—Sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161), section 3 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § 166) and Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35).

Airblast—An airborne shock wave resulting from an explosion, also known as air overpressure, which may or may not be audible.

At-the-hole communication—Communication between the driller who drilled the blast holes to be loaded in a blast and the blaster-in-charge of that blast in which the driller describes the conditions of the boreholes that the driller drilled. At-the-hole communication may consist of cones placed in the boreholes with messages describing borehole conditions or verbal communication in which the driller describes the condition of the boreholes.

Blast area—The area around the blast site that must be cleared and secured to prevent injury to persons and damage to property.

Blast site—The specific location where the explosives charges are loaded into the blast holes.

Blaster—An individual who is licensed by the Department under Chapter 210 (relating to blasters' licenses) to detonate explosives and supervise blasting activities.

Blaster-in-charge—The blaster designated to have supervision and control over all blasting activities related to a blast.

Blasting activity—The actions associated with the use of explosives from the time of delivery of explosives to a worksite until all postblast measures are taken,

including priming, loading, stemming, wiring or connecting, detonating, and all necessary safety, notification, and monitoring measures.

Building—A structure that is designed for human habitation, employment, or assembly.

Charge weight—The weight in pounds of an explosive charge.

Concertina razor wire—Razor wire that is extended in a spiral for use as a barrier, such as along or on a fence and having a minimum of 101 coils of wire to 50 linear feet.

Cube root scaled distance ($Ds^{1/3}$)—A value calculated by using the formula $Ds^{1/3}$ = D/(cube root) W, where actual distance (D) in feet measured in a horizontal line from the blast site to the nearest building or structure not owned or leased by the blasting activity applicant, the permittee, or their customers, is divided by the cube root of the maximum weight of explosives (W) in pounds detonated per delay period of less than 8 milliseconds. Cube root scaled distance is used to estimate airblast levels.

Delay interval—The designed time interval, usually in milliseconds, between successive detonations.

Detonator—

(i) A device containing an initiating or primary explosive that is used for initiating detonation of explosives.

(ii) The term includes electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord, delay connectors, and nonelectric instantaneous and delay blasting caps.

Explosives—Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. The term includes dynamite and other high explosives, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters. The term includes all items in the "List of Explosive Materials" provided for in 27 CFR 555.23 (relating to list of explosive materials).

FMCSA inspection—The inspection required by the Federal Motor Carrier Safety Administration in 40 CFR 396.3 (relating to inspection, repair, and maintenance).

Flyrock—Overburden, stone, clay, or other material cast from the blast site through the air or along the ground, by the force of a blast, and which travels to one of the following areas:

(i) Beyond the blast area.

(ii) Beyond permit boundaries on blasting operations on mining permits issued under the Surface Mining Conservation and Reclamation Act (52 P.S. § § 1396.1—1396.19b) or the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § § 3301—3326).

Indoor magazine—A magazine located entirely within a secure intrusion-resistant and theft-resistant building which is primarily used for commercial or industrial purposes.

Inner perimeter security—Measures taken to increase the intrusion resistance and theft resistance of a magazine that encircles an individual or a group of magazines. These measures lie within the outer perimeter security measures.

MSHA—The United States Department of Labor, Mine Safety and Health Administration.

Magazine—A structure used for the storage of explosives.

Misfire—Incomplete detonation of explosives.

OSHA—The United States Department of Labor, Occupational Safety and Health Administration.

Outdoor magazine site—The contiguous area of land upon which the following are located: a magazine or group of magazines; the outer perimeter security, and the inner perimeter security, if any.

Outer perimeter security—Measures taken to increase the intrusion resistance of magazines that encircle the area where the magazines are situated.

Particle velocity—A measure of the intensity of ground vibration, specifically the time rate of change of the amplitude of ground vibration.

Peak particle velocity—The maximum intensity of particle velocity.

Person—A natural person, partnership, association or corporation, or an agency, instrumentality, or entity of state government or a municipality.

Primer—A cartridge or package of high explosives into which a detonator has been inserted or attached.

Square root scaled distance (Ds)— A value calculated by using the formula Ds = D/(square root) W, where actual distance (D) in feet, measured in a horizontal line from the blast site to the nearest building or structure, neither owned nor leased by the blasting activity permittee or its customer, divided by the square root of the maximum weight of explosives (W) in pounds, that is detonated per delay period of less than 8 milliseconds. Square root scaled distance is used to estimate ground vibration.

Stemming—Inert material placed in a blast hole after an explosive charge for the purpose of confining the explosion gases to the blast hole, and inert material used to separate explosive charges in decked holes.

Structure—

(i) A combination of materials or pieces of work built or composed of parts joined together in some definite manner for occupancy, use, or ornamentation.

(ii) The term includes everything that is built or constructed, including bridges, offices, water towers, silos, and dwellings.

Utility line—An electric cable, fiber optic line, pipeline, or other type of conduit used to transport or transmit electricity, gases, liquids, and other media including information.

Wheeled vehicle—A vehicle that moves about on three or more wheels and has a gross vehicle weight of less than 11,000 pounds.

Authority

The provisions of this § 211.101 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.101 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended June 17, 2005, effective June 18, 2005, 35 Pa.B. 3406; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (311861) to (311863).

§ 211.102. Scope

(a) This chapter applies to persons using or storing explosives and engaging in blasting activities in this Commonwealth. Persons storing explosives underground at permitted underground mines are exempt from this chapter. Persons conducting blasting underground at underground mines shall comply with § 211.151 (relating to prevention of damage or injury). The storage of explosives in magazines on the surface at an underground mine is subject to the applicable requirements of this chapter. The provisions of this chapter that are more stringent than the blasting provisions in

Chapters 77, 87, and 88 (relating to noncoal mining; surface mining of coal; and anthracite coal) apply to blasting activities at coal or noncoal surface mines.

(b) Compliance with this chapter does not relieve a person who is engaged in blasting activities from compliance with other applicable laws or regulations of the Commonwealth.

Authority

The provisions of this § 211.102 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.102 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (311863) to (311864).

§ 211.103. Enforcement

(a) The Department may issue orders necessary to implement this chapter including an order to suspend, modify, or revoke a license or permit authorized by this chapter, or to require corrective action for a violation identified in subsection (c).

(b) Before issuing an order modifying peak particle velocity or airblast limits in a blasting activity permit, the Department will first provide the permittee with an opportunity to meet and discuss modifications.

(c) It is a violation of this chapter to:

(1) Fail to comply with this chapter or Chapter 77, 87, or 88 (relating to noncoal mining; surface mining of coal; and anthracite coal), regarding storage and use of explosives.

(2) Fail to comply with any order or permit or license of the Department issued under this chapter or Chapter 77, 87, or 88.

(3) Hinder, obstruct, or interfere with the Department or its personnel in the performance of any duty hereunder.

(4) Violate 18 Pa.C.S. § 4903 or § 4904 (relating to false swearing; and unsworn falsification to authorities).

(d) The Department will not issue a permit or license to any person who has done any of the following:

(1) Failed or continues to fail to comply with this chapter, a condition of a permit issued under this chapter or an order issued to enforce the requirements of this chapter.

(2) Demonstrated an inability or lack of intention to comply with this chapter as indicated by a past or continuing violation.

(3) Not complied with the 18 U.S.C.A. Chapter 40 and 27 CFR Part 555 (relating to commerce in explosives) and does not have an ATF license or permit, when required.

Authority

The provisions of this § 211.103 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.103 adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (311864).

Subchapter B. STORAGE AND CLASSIFICATION OF EXPLOSIVES

Sec.

Source

The provisions of this Subchapter B adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751, unless otherwise noted.

Cross References

This subchapter cited in 25 Pa. Code § 211.141 (relating to requirements); and 25 Pa. Code § 211.191 (relating to scope).

§ 211.111. Scope

(a) This subchapter applies to the classification and storage of explosives. It establishes the requirements, procedures, and standards for licensing, constructing, and siting and maintaining magazines.

(b) Persons storing explosives underground in permitted underground mines are exempt from this subchapter.

Source

The provisions of this § 211.111 amended June 17, 2005, effective June 18, 2005, 35 Pa.B. 3409. Immediately preceding text appears at serial page (281302).

§ 211.112. Magazine license and fees

(a) A person storing explosives shall do so in a magazine licensed by the Department. A person may not construct, install, or modify a magazine until the Department has issued or amended the license in writing. The licensee shall store explosives in accordance with the approved application, the license, and this chapter.

(b) A magazine license will only be issued or renewed after it is verified that the applicant has complied with 18 U.S.C.A. Chapter 40 and 27 CFR Part 555 (relating to commerce in explosives) and is authorized as either a licensee or a permittee by the ATF.

Verification can be provided by the applicant entering the ATF license or permit number on the license application.

(c) The license specifies the types and quantities of explosives to be stored in the magazine and any other condition necessary to ensure that the proposed activity complies with applicable statutes and this chapter.

(d) Licenses will be issued for a period of time set by the Department and the expiration date will appear on the license. If the Department receives a complete renewal application by the expiration date, the licensee may continue to operate under the current license until the Department acts on the renewal application.

(e) License fees are as follows:

(1) License:

(i) Application—$50

(ii) Site inspection—$50

(2) License modifications—$50

(3) License renewals—$50

(4) License transfers—no fee

Authority

The provisions of this § 211.112 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.112 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (311865).

§ 211.113. Application contents

(a) An application to obtain, renew, modify, or transfer a magazine license shall be on forms approved by the Department. Before the Department issues, renews,

transfers, or modifies a license, the application must demonstrate that the applicant has complied with the applicable requirements of this chapter.

(b) A completed license application must include all of the following:

(1) The applicant's name, address, telephone number, and ATF license or permit number.

(2) A contact person, including name, title, and telephone number.

(3) The types and quantities of explosives to be stored within the magazine.

(4) A map, plan, or a sketch of the site location showing the nearest buildings, nearest railways, nearest highways, existing barricades, if any, and proposed barricades.

(5) A plan showing the design and specifications of the magazine to be licensed.

(6) A plan showing the design, specifications, dimensions, and locations of all security measures to be installed under § 211.115(d) (relating to standards for classifying and storing explosives and constructing, maintaining, and siting magazines).

(7) The latitude and longitude of outdoor magazines except for Type 3 magazines as defined in 27 CFR 555.203(c) (relating to types of magazines).

(8) The latitude and longitude of indoor magazines containing high explosives.

(c) A license renewal application must include all of the following:

(1) The applicant's name, address, and telephone number.

(2) A contact person, including name, title, and telephone number.

(3) The maximum amount and type of explosives for which the magazine is currently licensed.

Authority

The provisions of this § 211.113 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166

and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.113 amended June 17, 2005, effective June 18, 2005, 35 Pa.B. 3409; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (311865) to (311866).

Cross References

This section cited in 25 Pa. Code § 211.115 (relating to standards for classifying and storing explosives and constructing, maintaining, and siting magazines).

§ 211.114. Displaying the license

The magazine license, or a legible copy of the license, shall be conspicuously displayed. If possible, the license shall be displayed inside the magazine. In all other cases, the license shall be displayed at the site and adjacent to the magazine to which it applies.

§ 211.115. Standards for classifying and storing explosives and constructing, maintaining, and siting magazines

(a) The provisions of 27 CFR Part 555, Subpart K (relating to storage), are incorporated herein by reference. If any provision of 27 CFR Part 555, Subpart K addresses an issue addressed in this section, the more stringent provision applies. These provisions shall be used to:

(1) Classify explosives.

(2) Determine which class of explosives may be stored in each type of magazine.

(3) Determine the quantity of explosives that may be stored.

(4) Determine the applicable construction standards for each type of magazine.

(5) Site the magazine.

(6) Specify maintenance and housekeeping standards for a magazine.

(7) Grant variances.

(b) For purposes of incorporation by reference of 27 CFR Part 555, Subpart K, the term "Department" is substituted for the term "director" and the term "representatives of the Department" is substituted for the term "ATF Official."

(c) Indoor magazines shall be located in buildings which are in compliance with all applicable building codes and other applicable regulations.

(d) Persons storing only display fireworks in Type 4 magazines as defined in 27 CFR 555.203(d) (relating to types of magazines) are exempt from this subsection except for paragraphs (8) and (9). Type 3 magazines as defined in 27 CFR 555.203(c), are exempt from this subsection. The following security measures apply to outdoor magazines and to indoor magazines located in buildings that are not intrusion-resistant and theft-resistant:

(1) Each magazine site shall be inspected by the licensee or his agent at least daily at approximately 24-hour intervals. If all magazines and outer perimeter security gates at the site are equipped with electronic intrusion detection devices conforming with paragraphs (3)(ii) or (iii), and (4)(ii) or (iii), or otherwise approved, in writing, by the Department, the inspection shall be conducted at least every 7 days. Individual magazines or entire magazine sites which do not contain explosives are not required to be inspected provided the inspection records reflect the date the last explosives were removed from the magazine. Each inspection shall include the magazine itself, the access points, and perimeter security. The inspection can be performed by a person or electronically by remote cameras. A record of the inspections shall be kept and made available to the Department. Records shall be maintained for at least 3 years. The record of each inspection shall include:

(i) The names of the persons who inspected the site.

(ii) The date and time each inspection began and ended.

(iii) Any information related to the integrity of the magazine site.

(iv) Actions taken on problems discovered.

(v) The dates on which no inspections were conducted because no explosives were contained in the magazine.

(2) There may be no more than one access point to each magazine site. The Department may approve, in writing, more than one access point to a magazine site if the Department determines that the security of the site will be maintained.

(3) Each magazine must have outer perimeter security that obstructs, to the greatest extent possible, unauthorized access to the magazine by wheeled vehicles. The outer perimeter security must surround the entire magazine site and be located at least 25 feet away from the exterior of any magazine within the site or at least 25 feet away from the inner perimeter security measures, whichever is applicable. The Department may approve, in writing, a lesser distance upon request when the Department determines a lesser distance is appropriate and will

not compromise the security of the magazine site. The outer perimeter security requirements can be met by measures approved by the Department as provided for in subsection (g) or by one or a combination of the following:

(i) A sufficient number of personnel assigned to physically inspect each magazine containing explosives or detonators at least once every hour. All persons acting in this capacity shall at all times be equipped with a communications device capable of providing direct verbal communications with either the police department having jurisdiction or another person who has the ability to contact the police department having jurisdiction.

(ii) Closed Circuit Television (CCTV) continuously monitoring the entire outer perimeter, or any portion of the outer perimeter that is not protected by another measure.

(A) The images shall be recorded and maintained at least until magazine integrity is confirmed during the next required site inspection.

(B) The latest output images of all CCTV cameras shall be viewed at least once every hour by a person having direct verbal communications with the police department having jurisdiction.

(iii) Electronic intrusion detection devices including, but not limited to: microwave sensors, seismic detectors, vehicle detectors, alarms, or infrared motion detectors.

(A) If microwave sensors, seismic sensors, vehicle detectors, or similar devices are used, the zone of detection of the devices shall encompass the entire outer perimeter, or any portion of the outer perimeter that is not protected by another measure.

(B) All systems shall have the capability of providing initial notification of an alert within 15 minutes of an event and an onsite presence in response to an alert within 1 hour.

(C) All systems shall have a backup power supply and provide an alert in the event of a power loss or a compromise of the system integrity.

(iv) An earthen barrier, a minimum of 7 feet in height. Earthen barriers shall be constructed to obstruct, to the greatest extent possible, unauthorized access by wheeled vehicles. If made of loose soils the earthen barrier shall be compacted and vegetated to the greatest extent possible.

(v) A barrier constructed of boulders. The boulders shall be of a size and weight sufficient to deter, to the greatest extent possible, defeat of the barrier by wheeled vehicles.

(vi) A highwall that is a minimum of 7 feet in height and whose face or slopes are sufficient to obstruct, to the greatest extent possible, unauthorized access to the magazine site by wheeled vehicles.

(vii) Barriers composed of natural terrain features which are impassable, to the greatest extent possible, to wheeled vehicles.

(viii) A fencing system constructed of members that are of sufficient size, strength, and anchorage to deter, to the greatest extent possible, the fencing system from being bent over, broken through, or uprooted by a wheeled vehicle.

(ix) Other equivalent barriers approved by the Department, in writing.

(4) In addition to the requirements contained in paragraph (3), a magazine or group of magazines within a site that contains high explosives or detonators shall be enclosed by inner perimeter security designed to obstruct, to the greatest extent possible, access by unauthorized persons. The additional inner perimeter security shall be located at least 6 feet away from the exterior of any magazine within the site and at least 25 feet inside and away from the outer perimeter security. The inner perimeter security requirement can be met by measures approved by the Department as provided for in subsection (g) or by one or a combination of the following:

(i) A sufficient number of personnel assigned to physically inspect each magazine containing high explosives or detonators at least once every hour. All persons acting in this capacity shall at all times be equipped with a communications device capable of providing direct verbal communications with either the police department having jurisdiction or another person who has the ability to contact the police department having jurisdiction.

(ii) CCTV continuously monitoring the magazine interior or the exterior of the doors of each magazine containing high explosives or detonators.

(A) The images shall be recorded and maintained at least until magazine integrity is confirmed during the next required site inspection.

(B) The latest output images of all CCTV cameras shall be viewed at least once every hour by a person having direct verbal communications with the police department having jurisdiction.

(iii) Electronic intrusion detection devices including, but not limited to: microwave sensors, seismic detectors, alarms, or infrared motion detectors.

(A) If alarms, infrared motion detectors, or other similar devices are used, they shall be installed on each magazine containing high explosives or detonators. Alarms shall be installed on all magazine doors. Infrared motion detectors and other similar devices shall be installed on the interior of each magazine.

(B) If microwave sensors, seismic sensors, or similar devices are used, the zone of detection of the devices shall encompass the entire inner perimeter, or any portion of the inner perimeter that is not protected by another measure.

(C) All systems shall have the capability of providing initial notification of an alert within 15 minutes of an event and an onsite presence in response to an alert within 1 hour.

(D) All systems shall have a backup power supply and shall provide an alert in the event of a power loss or a compromise of the system integrity.

(iv) A highwall that is a minimum of 20 feet in height and whose face or slopes are sufficient to obstruct, to the greatest extent possible, access by unauthorized persons.

(v) A fence constructed of a minimum of 9-gauge chain link fencing with a maximum 2-inch mesh that is kept in a condition which maintains its original functionality. The fence shall:

(A) Be buried at least 1 foot at the base or be equipped with a minimum 1.66 inch outside diameter bottom rail.

(B) Have a minimum height of 8 feet above the ground.

(C) Have a top rail with a minimum 1.66 inch outside diameter.

(D) Have firmly anchored posts 10 feet or less on center. End, corner and pull posts shall have a minimum outside diameter of 2.875 inches if round or 2.5-inch square. Intermediate posts shall have a minimum outside diameter of 2.375 inches if round or 2.25-inch C-Section. Posts shall be set in concrete at a minimum depth of 33 inches. The post holes shall be a minimum of 12 inches in diameter and be completely filled with concrete.

(E) Have outriggers at the top with concertina razor wire attached.

(F) Have concertina razor wire attached on the inside at the bottom.

(G) Have as many gates as the licensee demonstrates are necessary to provide for the safe exit of employees in the event of an emergency.

(H) All inner perimeter security emergency exit gates shall meet the requirements specified in paragraph (6).

(I) Vegetation shall be kept trimmed or suppressed to a distance of 6 feet from each side of the fence.

(vi) The Department may approve, in writing, the use of other security fence systems or other barriers that provide at least equivalent security.

(5) In addition to outer perimeter security, all portable magazines being used as stationary magazines and magazines having an a volume of less than 3 cubic yards shall be immobilized by fastening the magazine securely to the earth or a terrain feature in a manner sufficient to prevent displacement of the magazine by a wheeled vehicle.

(6) Any single layer of perimeter security measures that obstructs, to the greatest extent possible, unauthorized access to the magazine by wheeled vehicles and deters, to the greatest extent possible, access by unauthorized persons, and is located at least 25 feet away from the exterior of any magazine within the site may be employed to satisfy the requirements of both paragraphs (3) and (4).

(7) Inner perimeter security gates shall be constructed at all access points. Gates shall have firmly anchored posts and shall be kept in a condition which maintains their original functionality. Each gate shall be securely padlocked whenever the site is unoccupied.

(i) Gates shall be constructed of a minimum of 9-gauge chain link fencing with a maximum 2-inch mesh. Gate frame members shall be a minimum outside diameter of 1.9 inches if round or 2.0-inch if square.

(ii) Gates shall have firmly anchored gate posts with a minimum 6.625-inch outside diameter. Posts shall be set in concrete at a minimum depth of 42 inches. The postholes shall be a minimum of 16 inches in diameter and shall be completely filled with concrete.

(iii) Gates shall have outriggers at the top with concertina razor wire attached.

(iv) The construction of the gates shall be contiguous with the surrounding fence.

(v) All gates shall have 2 locks. The locks shall have separate hasps and staples.

(vi) Each lock shall have a hood of at least 1/4-inch thick steel. The hoods must prevent sawing or lever-cutting action on the locks, hasps, and staples.

(vii) Each lock shall have at least five tumblers and a case-hardened shackle of at least 3/8 inches in diameter.

(viii) When a lock and chain are used to secure a gate, the minimum specification of the chain shall be 3/8-inch Grade 70, Transport.

(ix) The Department may approve, in writing, the use of other security gate systems that provide at least equivalent security.

(8) Outer perimeter security gates shall be constructed at all access points. Gates shall be designed and constructed to deter, to the greatest extent possible, defeat of the gate by wheeled vehicles. Gates shall have firmly anchored posts and be kept in a condition which maintains their original functionality. Gateposts shall be a minimum 6.625-inch outside diameter. Posts shall be set in concrete at a minimum depth of 42 inches. The postholes shall be a minimum of 16 inches in diameter and be completely filled with concrete. The Department may approve, in writing, the use of gateposts having smaller diameters or other shapes or alternate gatepost anchoring methods, or both, that provide at least equivalent security.

(9) Outer perimeter security gates shall be padlocked whenever the site is unoccupied. All gates shall have 2 locks which meet the specifications of paragraph (7)(vi)—(viii).

(10) "No Trespassing" signs shall be placed around the outer perimeter of the site. Warning signs shall be placed at all access points. Signs shall be well maintained.

(i) "No Trespassing" signs shall be spaced so that, except for corners, adjacent signs are visible.

(ii) Signs shall be placed so that a bullet passing directly through the sign will not impact a magazine.

(iii) Warning signs at all access points shall provide notice of private property and no trespassing, in addition to providing a notice substantially conforming to the following: "Danger, never fight explosives fires, explosives are stored on this site" to warn first responders and the public of the hazards contained within.

(iv) Warning signs at all access points shall provide an emergency contact phone number.

(v) Signs may not be obscured by vegetation or other obstructions.

(vi) Signs shall be constructed of a durable, weather-resistant material. Letters and numbers shall be of a minimum height of 2 inches that can be easily seen and read.

(11) Magazines shall be constructed to the standards contained in this paragraph. Magazines shall be constructed according to the construction standards found in 27 CFR Part 555, Subpart K (relating to storage) with the following additions:

(i) Mobile type 5 magazines being used as stationary magazines for more than 1 year must be located within the outer perimeter security, shall be immobilized in accordance with 27 CFR 555.211 (relating to construction of type 5 magazines) and be fastened securely to the earth or a terrain feature in a manner sufficient to prevent movement of the magazine by a motor vehicle. Motor vehicles used to transport bulk blasting agents that are left unattended at a magazine site must have two Department approved methods of disabling the vehicles to render them effectively immobilized and the vehicles must be kept within the outer perimeter security. Disabling methods may include:

(A) Steering locking devices,

(B) Pedal locking devices,

(C) Fuel or electrical system disablers,

(D) Other equivalent disabling measures approved by the Department.

(ii) Systems of pumps or tanks, or both, used to store, mix, or dispense bulk blasting agents at magazine sites shall be equipped with locks or shall otherwise be constructed to prevent the unauthorized removal of blasting agents from the system.

(12) A person who stores explosive materials shall notify both the local police having jurisdiction in the area where the explosives are being stored

and the Pennsylvania State Police of the storage. This notification must be made in the manner of and in addition to the notification requirements in 27 CFR 555.201(f) (relating to general).

(13) A person who stores explosive materials shall immediately notify the Department, the Pennsylvania State Police, and the local police jurisdiction, if any, when any of the following occur:

(i) Evidence is discovered of a break-in or theft at the magazine, or an attempted theft or break-in has occurred.

(ii) The security measures required by this section have been breached or disabled or partially breached or disabled. Short-term partial breaches of security of less than 48-hour duration need not be reported under this subsection if all of the following apply:

(A) The partial breach was due to equipment failure or accidental or natural causes.

(B) An account of the partial breach was recorded under paragraph (1).

(C) Immediate measures are being taken to repair or replace the partial breach.

(iii) Unauthorized persons exhibiting suspicious behavior are observed in the vicinity of the magazine.

(iv) Inventory records indicate that explosive material is missing and unaccounted for.

(14) The notifications to State and local agencies required in paragraphs (12) and (13) are in addition to any notification required by agencies of the United States.

(e) Licensees of magazines licensed prior to June 18, 2005, shall comply with this section according to the following schedule except as approved by the Department under subsections (f) and (g):

(1) Immediately upon June 18, 2005, the inspection and notification requirements shall be implemented.

(2) Within 180 days of approval of the plan required by subsections (f) or (g), implement either the outer or inner perimeter security measure requirements.

(3) Within 360 days of approval of the plan required by subsections (f) or (g), implement the remaining perimeter security measure requirements.

(4) The Department, at its sole discretion, may approve, in writing, a time extension to the requirements of either paragraph (2) or (3) if the licensee has demonstrated a good faith effort to comply with the perimeter security measure requirements imposed under this chapter.

(f) By August 17, 2005, licensees of magazines licensed prior to June 18, 2005, shall submit to the Department on forms provided by the Department:

(1) The plan required by § 211.113(b)(6) (relating to application contents).

(2) A schedule for the implementation of the plan required by § 211.113(b)(6).

(3) If the security enhancements required by subsection (d) cannot be implemented in the time frames required by subsection (e), the plan must include a request for a time extension. The request for a time extension must include a schedule and a justification for the extension. The Department will act upon time extension requests within 30 days of the receipt of the request.

(g) After consultation with the Pennsylvania State Police and the Pennsylvania Office of Homeland Security, the Department may approve, in writing, alternatives to specific requirements of this section which are based upon advanced technology or other alternatives and which, either alone or in combination with other measures, provide at least equivalent security at magazines or magazine sites. The Department will act upon requests for approval of alternative security measures or, upon the written request of the licensee, for approval of plans submitted pursuant to subsection (f) within 30 days of the receipt of the request. The Department may extend this review period for up to an additional 30 days if additional time is necessary to properly review the request.

(h) Requests for Department approval of plans submitted under subsection (f) or alternate requirements, including alternative security measures and time extensions under this section, shall be on forms provided by the Department.

(i) A licensee will be deemed to be in compliance with this section as to having deterred or obstructed, to the greatest extent possible, unauthorized intrusion upon a magazine site if the licensee constructs, installs, implements and maintains the security measures specified in subsection (d), which meet the requirements of this section and which are specified by the licensee in one of the following:

(1) A plan submitted to the Department under subsection (f).

(2) A plan submitted to and approved by the Department under subsection (g).

(3) A plan submitted to the Department under § 211.113(b)(6).

(j) All magazine licensees shall ensure that a person is available at all times to respond to emergencies and to provide the Department access to the licensed magazines for the purpose of determining regulatory compliance. Department access to the magazines shall be granted within 4 hours of a Department request or within a time frame agreed upon by the Department representative and the magazine licensee. Department requests may be verbal or written.

Authority

The provisions of this § 211.115 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.115 amended June 17, 2005, effective June 18, 2005, 35 Pa.B. 3409; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (311866) to (311874).

Cross References

This section cited in 25 Pa. Code § 211.113 (relating to application contents).

§ 211.116. Decommissioning magazines

Prior to the expiration or termination of a magazine license, the licensee shall remove and properly dispose of all explosives from the magazine and submit to the Department documentation as to the disposition of these explosives. This documentation shall be provided within 20 days of the expiration or termination of the magazine license.

Authority

The provisions of this § 211.116 issued under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.116 adopted June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711.

§ 211.117. Daily summary of magazine transactions

The licensee shall make records of inventory required under 27 CFR 555.122, 555.123, 555.124, 555.125 and 555.127 available to the Department upon request.

Authority

The provisions of this § 211.117 issued under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.117 adopted June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711.

Subchapter C. PERMITS

Sec.

Source

The provisions of this Subchapter C adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751, unless otherwise noted.

Cross References

This subchapter cited in 25 Pa. Code § 211.191 (relating to scope); and 25 Pa. Code § 211.192 (relating to permits).

§ 211.121. General requirements

(a) Except as otherwise provided in this subchapter, a person may not engage in blasting activities in this Commonwealth without first obtaining the appropriate permit from the Department issued under this chapter.

(b) Permits under this chapter are not required for the use of fireworks governed by the act of May 15, 1939 (P.L. 134, No. 65) (35 P. S. § § 1271—1277) (Repealed).

(c) A permit issued under the Surface Mining Conservation and Reclamation Act (52 P. S. § § 1396.1—1396.19b), or the Noncoal Surface Mining and Conservation and Reclamation Act (52 P. S. § § 3301—3326), and the regulations promulgated thereunder, authorizing blasting activity shall act as a blasting activity permit issued under this chapter.

(d) An application for a permit to conduct blasting activities must be on a form provided by the Department. A permit will not be issued unless the application is complete and demonstrates that the proposed activities comply with the applicable requirements of this chapter. The Department will notify applicants of an incomplete application and identify the items necessary to complete the application. The permittee shall comply with the approved application, the permit, and this chapter.

(e) The Department will not issue a permit to a person who either:

(1) Fails to comply with this chapter or a condition of a permit issued under this chapter or an order issued to enforce this chapter.

(2) Demonstrates an inability or lack of intention to comply with this chapter as indicated by past or continuing violations.

(f) The permittee, the blasting contractor listed on the permit and the blaster-in-charge of any blasts conducted on a permit shall comply with the approved application, the permit, and this chapter.

Authority

The provisions of this § 211.121 amended under section 5 of The Clean Streams Law (35 P.S. § 691.5); sections 4(a) and 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § § 1396.4(a) and 1396.4b); sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.121 amended August 21, 2015, effective August 22, 2015, 45 Pa.B. 4904; amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (378243).

§ 211.122. [Reserved]

Authority

The provisions of this § 211.122 reserved under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.122 reserved June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (378243) to (378244) and (281305).

§ 211.123. [Reserved]

Authority

The provisions of this § 211.123 reserved under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.123 reserved June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (281305).

§ 211.124. Blasting activity permits

(a) An application for a blasting activity permit shall be prepared by a blaster authorized by the Department to conduct the blasting proposed in the application and must include all of the following:

(1) The applicant's name, address, telephone number and type of business.

(2) The signature of the applicant or an authorized representative of the applicant.

(3) The ATF license or permit number of the applicant or the blasting contractor.

(4) The name, title and telephone number of a person who can be reached by the Department in the event of an emergency or other reason relating to the blasting activity permitted.

(5) The identity of independent subcontractors who will be performing the blasting activities.

(6) The specific types of explosives to be used.

(7) The maximum amount of explosives that will be detonated per delay interval of less than 8 milliseconds.

(8) The maximum amount of explosives that will be detonated in any one blast.

(9) The minimum square root scaled distance based on calculations made from actual site conditions except for demolition blasting operations where the cube root scaled distance must be used.

(10) A map indicating the location where the explosives will be used and the proximity of explosives use to public roads, buildings, or other structures.

(11) The purpose for which the explosives will be used.

(12) The location and license number of the magazine that will be used to store the explosives, if applicable.

(13) A description of how the monitoring requirements of Subchapter G (relating to requirements for monitoring) will be satisfied.

(14) Proof that the permittee has third-party general liability insurance in the amount of $1 million or greater per occurrence to cover the blasting activity. This requirement is not applicable if the permittee is a noncoal surface

mine operator who produces no more than 2,000 tons (1,814 metric tons) of marketable minerals per year from all its noncoal surface mining operations.

(15) The anticipated duration of the blasting activity for which the permit is needed.

(16) The anticipated days of the week and times when blasting may occur.

(17) The distance in feet and direction in degrees to the building not owned by the permittee or its customer that will be closest to the blasting.

(18) Other information needed by the Department to determine compliance with applicable laws and regulations.

(19) The printed name, signature and license number of the blaster who prepared the application.

(20) Loading plans which describe ranges of bore hole diameters and their depths, burdens and spacings.

(21) Types of stemming material.

(b) Blasting activity permits are not transferable.

(c) The blasting activity permit must specify all of the following:

(1) The blasting activity permittee.

(2) Any independent subcontractors performing work under this permit.

(3) Limits on particle velocity and airblast.

(4) The types of explosives that may be used.

(5) The duration of the permit.

(6) Other conditions necessary to ensure that the proposed blasting activity complies with the applicable statutes and this chapter.

(d) The permittee may request extensions and modifications by submitting an amended application.

(e) The blaster-in-charge shall have in his possession a copy of the approved blasting activity permit authorizing the blasting activity being conducted. For blasting activities conducted on and authorized by permits issued under the Surface Mining Conservation and Reclamation Act (52 P.S. § § 1396.1—1396.19b) or the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § § 3301—3326),

possession of the blasting plan for that permit constitutes possession of a copy of the approved blasting activity permit authorizing the blasting activity being conducted.

Authority

The provisions of this § 211.124 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.124 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281305) to (281306).

§ 211.125. Blasting activity permit-by-rule

(a) Except for blasting activities for the purpose of demolition or seismic exploration, a person will be deemed to have a permit for a blasting activity if:

(1) The blasts are designed and performed for a scaled distance of 90 or greater.

(2) No more than 15 pounds (6.81 kilograms) of explosives are detonated per delay interval of less than 8 milliseconds.

(3) The total charge weight per blast does not exceed 150 pounds (68.18 kilograms).

(4) The person notifies the Department either verbally, in writing, or by other means approved by the Department prior to the initial blast. If the person gives verbal notification, a written notice shall be received by the Department within 5 working days. The notification must indicate all of the following information for all blasts that will occur under this permit:

(i) The identity of the person.

(ii) The location where the blasting will occur.

(iii) The purpose of the blasting.

(iv) The distance to the nearest building not owned or leased by the person or its customer.

(v) The days of the week and times when blasting may occur.

(vi) The duration of blasting activities under this permit-by-rule.

(vii) The minimum scaled distance.

(viii) The maximum weight of explosives detonated per delay period of less than 8 milliseconds.

(ix) The maximum total weight of explosives per blast.

(x) A contact person and telephone number.

(5) Blast reports are completed in accordance with § 211.133 (relating to blast reports).

(6) The other monitoring and performance standards of this chapter are met.

(b) The Department may revoke a blasting activity permit-by-rule under one of the following:

(1) The permittee has demonstrated an unwillingness or inability to comply with the applicable regulations.

(2) The blasting activity possesses a sufficient risk of harm to the public or the environment to warrant an individual blasting activity permit.

Authority

The provisions of this § 211.125 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.125 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281306) to (281307).

Subchapter D. RECORDS OF DISPOSITION OF EXPLOSIVES

Sec.

Source

The provisions of this Subchapter D adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751, unless otherwise noted.

Cross References

This subchapter cited in 25 Pa. Code § 211.191 (relating to scope).

§ 211.131. [Reserved]

Authority

The provisions of this § 211.131 reserved under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.131 reserved June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (281307).

§ 211.132. [Reserved]

Authority

The provisions of this § 211.132 reserved under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.132 reserved June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (281307).

§ 211.133. Blast reports

(a) The blaster-in-charge shall prepare a report of each blast to provide the Department with sufficient information to reconstruct the conditions and events surrounding a blast. The Department may develop and require a blast report form to be used. The blasting activity permittee shall retain the blast report for at least 3 years and shall make the blast report available to the Department upon request. Blast reports must contain, at a minimum, all of the following:

(1) The location of at least one corner of the blast pattern expressed in latitude and longitude.

(2) The distance in feet and direction in degrees from the blast to the seismograph monitoring location.

(3) The latitude and longitude and a brief description of the monitoring locations. If monitoring is conducted at a home or other building with a 911 address, the address of the structure must be provided.

(4) The name of the blasting activity permittee and blasting contractor, if applicable.

(5) The blasting activity permit or appropriate mining permit number.

(6) The date and time of the blast.

(7) The printed name, signature, and license number of the blaster-in-charge.

(8) The type of material blasted.

(9) A sketch showing the number of blast holes, burden, spacing, pattern dimensions, delay timing sequence, description of the conditions of the area immediately surrounding the blast site which includes identifying if the area is solid rock, a muck pile from a previous blast or an open face, and point of initiation.

(10) The diameter and depth of each blast hole.

(11) The height or length of stemming and deck separation for each hole.

(12) The amount of explosives loaded in each borehole.

(13) The types of explosives used and arrangement in blast holes.

(14) The total weight in pounds of explosives, product density for bulk blasting agents, weight of packaged blasting agents and primer cartridges used.

(15) The maximum weight in pounds of explosives detonated per delay period of less than 8 milliseconds.

(16) The type of circuit, if electric detonation was used.

(17) The direction in degrees and distance in feet from the blast site to the nearest building not owned or leased by the blasting activity permittee or its customer.

(18) A general description, including the street address and latitude and longitude, of the nearest building not owned or leased by the blasting activity permittee or its customer.

(19) The square root scaled distance to the nearest building or other structure neither owned nor leased by the blasting activity permittee or its customer except for demolition blasting operations where the cube root scaled distance must be used.

(20) The weather conditions.

(21) The direction from which the wind was coming.

(22) The measures taken to control flyrock, including whether or not mats were used.

(23) The total quantity and type of detonators used, and delays used.

(24) The number of individuals in the blasting crew.

(25) The maximum number of blast holes or portions of blast holes detonated per delay period less than 8 milliseconds.

(26) A drill log showing the condition of all of the blast holes prior to loading and any other bore holes in the blast site.

(27) The monitoring records required under § 211.173 (relating to monitoring records). Monitoring records shall be made part of the blast report within 30 days of the blast. Beginning July 14, 2004, monitoring records shall be made part of the blast report within 14 days of the blast. The Department may grant a waiver to allow monitoring records to be made part of the blasting record within 30 days of the blast if all blasts, regardless of scaled distance, are monitored and monthly summaries of these reports, including the information required under subsection (b), are provided. Monitoring records shall be made part of the blast report within 7 days, if requested by the Department.

(28) If a misfire occurred, the actions taken to make the site safe as specified in § 211.157 (relating to postblast measures).

(b) The Department may require monthly summaries of these reports. The summaries must include the date and time of the blasts, scaled distance, peak particle velocity, airblast, monitoring location, amount and types of explosives used, and other information the Department deems necessary to ensure compliance with this chapter.

Authority

The provisions of this § 211.133 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.133 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281308) to (281309).

Cross References

This section cited in 25 Pa. Code § 211.125 (relating to blasting activity permit-by-rule); 25 Pa. Code § 211.154 (relating to preparing the blast); 25 Pa. Code § 211.157 (relating to postblast measures); and 25 Pa. Code § 211.193 (relating to blasting records).

Subchapter E. TRANSPORTATION OF EXPLOSIVES

Sec.

Source

The provisions of this Subchapter E adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751, unless otherwise noted.

Cross References

This subchapter cited in 25 Pa. Code § 211.191 (relating to scope).

§ 211.141. General requirements

The blasting activity permittee shall:

(1) Immediately unload a vehicle carrying explosives upon reaching a magazine location. The unloaded vehicle shall be removed from the site. The only exception to this requirement is if the vehicle is a licensed magazine under Subchapter B (relating to the storage and classification of explosives).

(2) Load or unload explosives from a vehicle only after the engine is turned off, unless power is needed for the loading or unloading operation. The permittee shall take all precautions necessary, such as blocking the wheels, to prevent the movement of the vehicle while it is being loaded or unloaded.

(3) Load explosives only into a vehicle that is marked in accordance with the Department of Transportation standards for placarding vehicles transporting explosives.

(4) Prohibit smoking within 100 feet of a vehicle used for transporting explosives. "NO SMOKING" signs shall be posted when a vehicle containing explosives is parked at a blast site or magazine.

(5) Load no more than 2,000 pounds (908 kilograms) of explosives into an open body vehicle for transporting. The ends and sides shall be high enough to prevent explosives from falling off, and the load shall be covered with a fire-resistant tarpaulin, unless the explosives are transported in a magazine securely attached to the vehicle.

(6) Load explosives into a closed body vehicle if the load is more than 2,000 pounds (908 kilograms) of explosives.

(7) Only load explosives into a vehicle with a bed made of wood or other nonsparking material.

(8) Load explosives into a vehicle which is also transporting metal, metal tools, blasting machines or other articles or materials likely to damage the explosives, only if these items are separated from the explosives by substantial nonsparking bulkheads constructed to prevent damage to the explosives.

(9) Load detonators and other explosives into the same vehicle only if the detonators are in containers that conform to the current version of the *Institute of Makers of Explosives Safety Library Publication # 22* available from the Institute of Makers of Explosives, 1120 Nineteenth Street, N. W., Suite 310, Washington, DC 20036-3605.

(10) Not load explosives into the same vehicle with materials such as matches, firearms, electric storage batteries, corrosive compounds, flammable substances, acids, oxidizing agents, and ammonium nitrate not in the original containers.

(11) Only load explosives into vehicles equipped with a fire extinguisher having a National Board of Underwriters Laboratories rating of 10 B:C or more. The fire extinguisher must be easily accessible and ready for immediate use.

(12) Load explosives into a vehicle so that explosives containers are not exposed to sparks or hot gases from the exhaust tailpipe. Exhaust systems that discharge upwards are recommended to avoid possible exposure of sparks or hot gases to explosives.

(13) Only load explosives into on-road vehicles that have passed the State safety inspection or certification or an FMCSA inspection.

(14) Only load explosives into off-road vehicles that are properly equipped to carry explosives.

(15) Remove explosives prior to conducting maintenance or repair work on vehicles containing explosives or detonators.

Authority

The provisions of this § 211.141 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act

of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.141 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281309) to (281310).

Subchapter F. BLASTING ACTIVITIES

Sec.

Source

The provisions of this Subchapter F adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751, unless otherwise noted.

Cross References

This subchapter cited in 25 Pa. Code § 211.191 (relating to scope); and 25 Pa. Code § 211.194 (relating to general requirements for handling explosives on a seismic exploration operation).

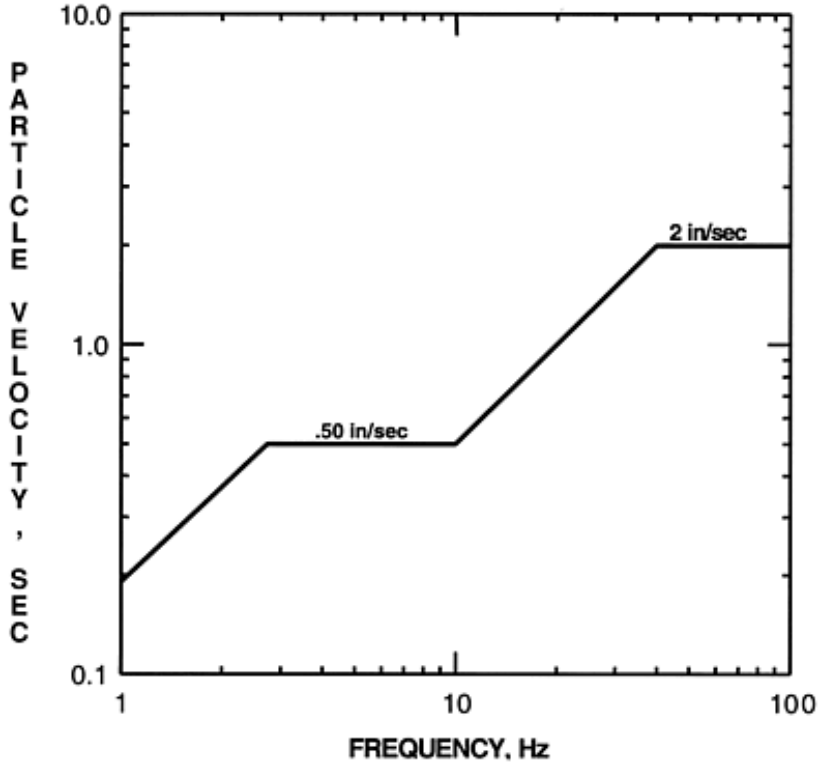
§ 211.151. Prevention of damage or injury

(a) Blasting shall be conducted to prevent injury to persons or damage to private or public property except for property owned or leased by the permittee or its customer. If damage to property or injuries to persons occurs, the blaster-in-charge shall notify the Department within 4 hours of learning of the damage or injuries occurring.

(b) Blasting may not cause flyrock. If flyrock occurs, the blaster-in-charge shall notify the Department within 4 hours of learning of the flyrock.

(c) Blasts shall be designed and conducted in a manner that achieves either a scaled distance of 90 at the closest building or other structure designated by the Department or meets the allowable particle velocity as indicated by Figure 1 at any building or other structure designated by the Department. The scaled distance and allowable particle velocity do not apply at a building or other structure owned or leased by the permittee or its customer.

Figure 1.



(d) Blasts shall be designed and conducted to control airblast so that it does not exceed 133 dBL at any building or other structure designated by the Department unless the building is owned or leased by the permittee or its customer.

(e) Except on permits issued under the Surface Mining Conservation and Reclamation Act (52 P.S. § § 1396.1—1396.19b), the Department may establish an alternative particle velocity or airblast level at a building or other structure if it determines that either:

(1) The alternative standard will provide for adequate protection of the building or other structure.

(2) The owner of the building or the other structure waives the ground vibration limit in subsection (c) or the airblast limit in subsection (d).

(f) The blasting activity permittee shall notify the Department within 24 hours of learning that the allowable particle velocity or the maximum allowable airblast level are exceeded at any building or other structure designated by the Department.

(g) All blasting activities shall be conducted in a manner which prevents damage to utility lines.

Authority

The provisions of this § 211.151 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.151 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281311) to (281313).

Cross References

This section cited in 25 Pa. Code 25 Pa. Code § 211.102 (relating to scope); and § 211.173 (relating to monitoring records).

§ 211.152. Control of gases, including carbon monoxide and oxides of nitrogen

(a) A blast shall be conducted so that the gases generated by the blast, including carbon monoxide and oxides of nitrogen, do not affect the health or safety of individuals. Gas migration may be prevented or minimized by taking measures such as venting the gases to the atmosphere and interrupting the path along which gases may flow. Evacuating people from areas that may contain gases could prevent their health from being affected.

(b) The blasting activity permittee shall notify the Department within 4 hours if the gases generated by the blast affect the health or safety, or both, of individuals.

Authority

The provisions of this § 211.152 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e));

sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.152 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (281313).

§ 211.153. General requirements for handling explosives

(a) Only a nonferrous, nonsparking tool shall be used to open containers of explosives.

(b) Matches, lighters and smoking are prohibited within 100 feet (30.48 meters) of the blast site and areas where explosives are used or stored.

(c) If it becomes necessary to destroy damaged or deteriorated explosives, the permittee shall immediately contact the manufacturer for technical advice and assistance.

(d) Detonators may not be forced into cartridges of explosive or cast boosters. Detonators shall be completely inserted into a hole in an explosive cartridge made with an approved powder punch or into the detonator well of a cast booster.

(e) Explosives may not be left unattended. They are to be stored in a licensed magazine or kept under the permittee's supervision and control.

(f) A loaded blast shall always be under the continuous observation of the blaster-in-charge or a designee.

(g) Shooting or carrying ammunition or firearms on a blast site and in areas where explosives are used or stored is prohibited, except for material needed to initiate the blast.

(h) If blasting activities are conducted in the vicinity of electric lines such as transmission lines or electrified railways, a test shall be made for presence of stray electric currents. Electric blasting caps may not be used if stray electric currents in excess of 50 milliamperes are present.

(i) A package of explosives may not be thrown, slid along floors or over other packages of explosives, or handled roughly.

(j) If an electrical storm approaches an area where there is an activity involving explosives, the area shall be cleared by the permittee or licensee, who shall post guards at all approaches to prevent trespass of unauthorized persons.

(k) Explosives and equipment that are obviously damaged or deteriorated may not be used.

(l) Explosives may not be abandoned.

Cross References

This section cited in 25 Pa. Code § 211.194 (relating to general requirements for handling explosives on a seismic exploration operation).

§ 211.154. Preparing the blast

(a) The blasting activity permittee shall designate a blaster-in-charge for each blast. The blaster-in-charge shall control and supervise the blasting activity. A blaster-in-charge is responsible for all effects of the blasts that the blaster-in-charge detonates. The blasting activity permittee is responsible for the effects of all blasts detonated under the blasting activity permit.

(b) Only equipment necessary for loading blast holes may be allowed to operate within 50 feet (15.24 meters) of the blast site. The Department may establish, in writing, a different distance limitation. If a written request for a lower distance limitation is submitted to the Department, the request must provide detailed information including why the lower distance limitation is necessary and how blast site safety will be maintained. The Department's written establishment for a lower distance limitation will include all necessary safety requirements.

(c) A blaster-in-charge may not prepare or detonate a blast unless another person is present, able, and ready to render assistance in the event of accident or injury.

(d) The blaster-in-charge shall determine the condition of the material to be blasted from the individual who drilled the blast holes, from the drill log or at-the-hole communication prior to loading a blast. The permittee shall ensure that a written drill log or at-the-hole communication is available to the blaster-in-charge.

(e) Only the blaster-in-charge, other blasters, and up to six assistants per blaster may be at a blast site once loading of blast holes begins.

(f) While loading a blast hole, the following measures shall be followed:

(1) Ferrous material may not be used in the blast hole unless the use is approved by the Department in writing. This includes the use of steel casings, ferrous tools and retrieving equipment.

(2) Only nonferrous, nonsparking tamping sticks may be used in loading a blast hole. Sectional poles connected by brass fittings are permitted, if only the nonferrous, nonsparking end of the pole is used for tamping. Retrieving hooks must be made from nonsparking metal such as brass or bronze.

(3) When using a pneumatic loading device, every precaution shall be taken to prevent an accumulation of static electricity. A loading operation shall be stopped immediately if static electricity or stray electrical currents are detected. The condition shall be remedied before loading may be resumed.

(4) The blast hole shall be carefully checked for obstructions with a nonferrous, nonsparking tamping pole, a tape, a light, or a mirror before it is loaded. The use of magnifying mirrors is prohibited. Explosives may not be forced past an obstruction in a blast hole.

(5) Each blast hole shall be logged throughout the leading process to measure the amount and location of explosives placed in the blast hole. The information is to be recorded on the blast report required by § 211.133 (relating to blast reports).

(6) A blast hole containing loose dynamite shall be stemmed but not tamped.

(7) The Department may specify the type and amount of stemming.

(g) Before connecting one loaded blast hole to another, all activity within the blast area shall cease, and all nonessential persons shall retreat to a safe place. The blaster-in-charge shall determine the blast area.

(h) Primers shall be prepared only at the hole to be loaded, immediately prior to loading. The components of the primer are to be kept separated at the collar of the blast hole. The primer may not be slit, dropped, deformed, or carelessly handled and may not be tamped or forced into the blast hole.

(i) Immediately upon completing the loading of a blast hole, any wood, paper, or other materials used to pack explosives shall be inspected for the presence of explosives and removed to an isolated area. These materials may be burned after the blast has been fired. Persons may not be within 100 feet (30.48 meters) of these burning materials.

(j) Measures shall be taken to reduce the chance of flyrock including:

(1) The use of blasting mats or other protective devices, if, in the opinion of the blaster-in-charge, the measures are necessary to prevent injuries to persons or damage to property.

(2) When blasting to an open, vertical face, checking the face for loose, hanging material or other faults prior to loading the blast holes.

(k) Explosives may not be brought to a blast site in greater quantities than are expected to be needed for that blast. Surplus explosives may not be stored in the blast area.

(l) Before a blast hole is loaded, it shall be checked to ensure that it is cool and does not contain any hot metal or smoldering material remaining from drilling the hole.

(m) The use of abrasive or sharp-edged constituents in stemming material shall be avoided if tamping is necessary and the tamping may sever blasting cap leg wires, shock tubes or detonating cords.

(n) The permittee shall ensure that public highways and entrances to the areas where blasting will occur are barricaded and guarded if the highways and entrances to areas where blasting will occur are located within 800 feet of a point where a blast is about to be fired. The permittee may use an alternative measure to this requirement if the permittee demonstrates, to the Department's satisfaction, that the alternative measure is at least as effective at protecting persons and property from the adverse effects of a blast. Alternative measures are measures such as:

(1) Slowing or stopping traffic in coordination with appropriate State or local authorities, including local police.

(2) Using mats to suppress flyrock.

(3) Designing the blast to prevent damage or injury to persons and property located on the public highways or at the operation's entrances by using design elements such as:

(i) Orienting the blast so that the direction of relief is away from public highways or operation entrances.

(ii) Adjusting blast design parameters including:

(A) The diameter of holes.

(B) The number of rows.

(C) The number of holes.

(D) The amount and type of explosive.

(E) The burden and spacing.

(F) The amount and type of stemming.

(G) The powder factor.

(o) The permittee shall post signs at access points of all approaches to a blast site which clearly warn of explosive use. If there are no specific access points, a minimum of four signs shall be posted on all sides of the blast site at a distance of 100 feet from the blast site. Posting of signs shall comply with 29 CFR 1926.905(p)

(relating to loading of explosives or blasting agents), 30 CFR 56.6306(a) (relating to loading, blasting, and security) or 30 CFR 77.1303(g) (relating to explosives, handling and use), as applicable.

Authority

The provisions of this § 211.154 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.154 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281314) to (281315).

§ 211.155. Preblast measures

Prior to detonating a blast, the blaster-in-charge shall:

(1) Ensure that all excess explosives have been removed from the blast area and are located in a safe area.

(2) Inspect the blast site to ensure that connections are proper and adequate.

(3) Ensure that the blast area is cleared and safeguarded.

(4) In addition to the warning signal, notify all persons who may be in danger.

(5) Ensure that the necessary precautions are in place to protect the public on public roads.

(6) At least 1 minute but no more than 2 minutes prior to detonation, sound a warning signal of three blasts, each lasting approximately 5 seconds. The warning signal shall be of sufficient power to be heard 1,000 feet (304.80 meters) from the blast site.

§ 211.156. Detonating the blast

(a) A blast may be detonated only between sunrise and sunset unless the Department authorizes a blast at another time of day.

(b) Only the blaster-in-charge may detonate a blast.

§ 211.157. Postblast measures

(a) After a blast has been detonated, no one may return to the blast area until all smoke and fumes have dissipated.

(b) After the smoke and fumes have cleared, the blaster-in-charge shall return to the blast site and closely inspect the blast site to ensure that it is safe with respect to the blasting activity.

(c) After the blaster-in-charge has determined the blast area is safe, the blaster-in-charge shall sound an all-clear signal, consisting of one long blast, lasting approximately 10 seconds. This all-clear signal shall be of sufficient power to be heard 1,000 feet (304.80 meters) from the blast site.

(d) The blaster-in-charge shall determine if a misfire occurred and shall take all actions necessary to render the blast site safe. The blast site shall be made safe before drilling or muck removal begins.

(e) If the blaster-in-charge suspects that undetonated ammonium nitrate/fuel mixture remains in the muck pile, the muck pile shall be thoroughly wetted down with water before any digging is attempted. Special attention shall be given to determine if primers, other explosives, or detonators are present in the muck pile.

(f) The blaster-in-charge shall immediately complete the blast report as required by § 211.133 (relating to blast report).

(g) The blaster-in-charge shall notify the Department within 24 hours of the occurrence of a misfire. A copy of the blast report shall be forwarded to the Department.

Cross References

This section cited in 25 Pa. Code § 211.133 (relating to blast reports).

§ 211.158. Mudcapping

Mudcapping in blasting activities is allowed only if the blaster-in-charge determines that drilling the material to be blasted would endanger the safety of the workers. If mudcapping is necessary, no more than 1 pound (0.454 kilogram) of explosives shall be used for a blast.

Authority

The provisions of this § 211.158 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.158 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (281317).

§ 211.159. Electric detonation

(a) Electric blasting caps shall be tested for continuity with a blaster's galvanometer or blaster's multimeter specifically designed for testing blasting circuits. Testing shall be done:

(1) Before the primers are made up.

(2) After the blast hole has been loaded but prior to stemming.

(3) As the final connecting of the circuit progresses.

(b) When a shunt is removed from electric blasting cap leg wires, the exposed wires shall be reshunted.

(c) Electric blasting caps may not be employed in a blast if there is any possibility of wires from the circuit being thrown against overhead or nearby electric lines.

(d) An effort may not be made to reclaim or reuse electric blasting caps if the leg wires have been broken off near the top of the cap.

(e) Leg wires on electric blasting caps shall extend above the top of the blast hole. Wire connections and splices are not allowed in the blast hole.

(f) Only solid wire shall be used in a blasting circuit. The use of stranded wire is prohibited.

(g) When electric detonation is used near public roads, signs shall be erected at least 500 feet (152.40 meters) from the blast areas reading: "BLAST AREA - SHUT OFF ALL TWO-WAY RADIOS."

(h) A blasting machine is the only permissible source of electrical power for a detonation.

(i) The blasting circuit shall remain shunted until the time for detonation unless the circuit is being tested or connections are being made.

(j) A sticker shall be displayed on blasting machines that shows they have been tested within the last 30 days by procedures recommended by the manufacturer or supplier to ensure performance at rated capacity. If blasting caps are used in the test, they shall be covered with earth or sand.

(k) When electronic detonation is used, the blaster-in-charge shall determine that adequate current, as specified by the manufacturer of the detonators, is available to properly energize the detonators in the circuit.

§ 211.160. Nonelectric detonation

Nonelectric initiation systems shall be checked and tested for secure connections in accordance with recommendations of the manufacturer of the system in use.

§ 211.161. Detonating cords

(a) Detonating cord shall be cut from the supply roll immediately after placement in the blast hole. A sufficient length of downlines shall be left at the top of the blast hole for connections to trunk lines. The supply roll shall be immediately removed from the site. Scrap pieces of detonating cord shall be destroyed after connections are made.

(b) A trunk line shall be covered with at least 12 inches (0.30 meter) of earth or sand, unless otherwise authorized by the Department.

(c) Detonating cord may not be spliced if the resulting splice will fall within a blast hole.

§ 211.162. Safety fuse

(a) When safety fuse is used in blasting, it shall be long enough to provide a burn time of 120 seconds or longer.

(b) Prior to using safety fuse, the blaster-in-charge shall conduct a test burn. The test burn will utilize at least a 12-inch (0.30-meter) section of fuse which is lit, then timed to determine actual burn time.

(c) A blasting cap shall only be crimped to a safety fuse with a proper crimping tool. A blasting cap may not be attached to a safety fuse in or within 10 feet (3.05 meters) of a magazine.

Subchapter G. REQUIREMENTS FOR MONITORING

Sec.

Source

The provisions of this Subchapter G adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751, unless otherwise noted.

Cross References

This subchapter cited in 25 Pa. Code § 211.124 (relating to blasting activity permits); and 25 Pa. Code § 211.191 (relating to scope).

§ 211.171. General provisions for monitoring

(a) If the square root scaled distance of a blast is 90 or numerically less at the closest building not owned or leased by the blasting activity permittee or its customer, ground vibration and airblast monitoring shall be conducted. The Department may require the permittee to conduct ground vibration and airblast monitoring at other buildings or structures even if the scaled distance is greater than 90.

(b) If monitoring is required, a ground vibration and airblast record of each blast shall be made part of the blast report.

(c) If monitoring is performed with instruments that have variable "trigger levels," the trigger for ground vibration shall be set at a particle velocity of no more than 0.25 inch per second unless otherwise directed by the Department.

(d) If the peak particle velocity and airblast from a blast are below the set trigger level of the instrument, a printout from the instrument must be attached to the blast report. This printout must provide the date and time when the instrument was turned on and off, the set trigger levels and information concerning the status of the instrument during the activation period. When an instrument is used that does not provide this information, the Department will allow the permittee to supply on/off times on a signed statement.

(e) Blasting seismographs shall be deployed in the field according to the guidelines established by the International Society of Explosives Engineers' Standards Committee.

Authority

The provisions of this § 211.171 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.171 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281318) to (281319).

§ 211.172. Monitoring instruments

(a) If monitoring is required, the monitoring instrument must provide a permanent record of each blast.

(b) The monitoring instrument must be constructed to meet the guideline established by the International Society of Explosives Engineers' Standards Committee.

(c) A monitoring instrument shall be calibrated annually and when an instrument is repaired and the repair may affect the response of the instrument. Calibration shall be done by the manufacturer of the equipment, by an organization approved by the manufacturer or by an organization having verifiable knowledge of the calibration procedures developed by the manufacturer. The calibration procedure shall include testing the response of the entire system to externally generated dynamic inputs. These inputs must test the entire monitoring system at a sufficient number of discrete frequency intervals to assure flat response throughout the frequency ranges specified by this chapter. Dynamic reference standards used for calibration shall be traceable to the National Institute of Standards and Technology. Calibration procedures and documentation of calibration shall be made available for review by the Department.

(d) A nonalterable sticker that is clearly visible must be firmly affixed to the instrument. The sticker must indicate the name of the calibration facility, the calibration technician, the date of calibration and frequency range of the airblast monitor.

Authority

The provisions of this § 211.172 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e));

sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.172 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial pages (281319) to (281320).

§ 211.173. Monitoring records

(a) Anyone using a monitoring instrument shall be trained on the proper use of that instrument by a representative of the manufacturer or distributor, or other competent individual. A record of that training is to be maintained and available for review by the Department.

(b) Monitoring records, at a minimum, shall contain:

(1) A calibration pulse on each of the mutually perpendicular ground vibration traces. These pulses shall represent the dynamic response of the entire recording system to an internally generated calibration signal and shall allow the Department to verify that the seismograph is recording ground vibration to its specific accuracy.

(2) The time history of particle velocities for three mutually perpendicular ground vibration traces and one air-overpressure trace, including time base, amplitude scales and peak values for all traces.

(3) The results of a field calibration test for each channel.

(4) The frequency content of all vibration signals using either single degree of freedom (SDF) response spectrum or half-cycle zero-crossing analysis methods.

(5) Frequency versus particle velocity plots as indicated in § 211.151(c), Figure 1 (relating to prevention of damage).

(6) The name and signature of the individual taking the recording.

(7) The location of the monitoring instrument, date, and time of the recording.

(8) The last calibration date of the monitoring instrument.

(c) If the Department questions the validity of a ground vibration or airblast record, or the interpretation of the record, the Department may require a ground vibration or airblast recording to be analyzed or certified by an independent, qualified consultant who is not related to the blasting activity permittee or its customer. When the Department requires that a recording be analyzed or certified, it shall be performed and included with the blast report within 30 days.

Cross References

This section cited in 25 Pa. Code § 211.133 (relating to blast reports).

Subchapter H. BLASTING ACTIVITIES NEAR UNDERGROUND UTILITY LINES

Sec.

Source

The provisions of this Subchapter H adopted July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751, unless otherwise noted.

Cross References

This subchapter cited in 25 Pa. Code § 211.191 (relating to scope).

§ 211.181. Scope

This subchapter applies to buried or underground utility lines and utility lines making contact with the surface of the ground.

§ 211.182. General provisions

(a) Prior to conducting blasting activities within 200 feet of an underground utility line, the blasting activity permittee shall ensure that the owner of the line is notified of the blasting activities and demonstrate to the Department that that notification has been made.

(b) Blasts shall be designed and conducted so that they provide the greatest relief possible in a direction away from the utility line and to keep the resulting vibration and actual ground movement to the lowest possible level.

(c) Blasting in the vicinity of a utility line shall be conducted as follows:

(1) Excavation from the ground surface to a depth corresponding to the elevation of the top of the buried utility line may proceed at the discretion of the blaster-in-charge, using safe, accepted techniques.

(2) Once the excavation has attained a depth equal to the elevation of the top of the buried utility line or if the line is exposed, or makes solid contact with the surface, the vertical depth of subsequent blast holes shall be restricted to 1/2 the horizontal distance from the closest portion of the utility line.

(d) If one or more of the requirements in this section are not feasible or create a potential safety problem, the permittee may apply to the Department for a waiver of the provision or provisions in question. This waiver will be granted if, in the judgment of the Department and the utility owning the lines, the alternate procedure does not endanger the utility line.

Authority

The provisions of this § 211.182 amended under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this § 211.182 amended June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711. Immediately preceding text appears at serial page (281321).

Subchapter I. SEISMIC EXPLORATION

Sec.

Authority

The provisions of this Subchapter I issued under sections 1917-A and 1920-A of The Administrative Code of 1929 (71 P.S. § § 510-17 and 510-20); section 4.2 of the

Surface Mining Conservation and Reclamation Act (52 P.S. § 1396.4b); section 11(e) of the Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. § 3311(e)); sections 7 and 11 of the act of July 1, 1937 (P.L. 2681, No. 537) (73 P.S. § § 157 and 161); sections 3 and 4 of the act of July 10, 1957 (P.L. 685, No. 362) (73 P.S. § § 166 and 167); Reorganization Plan No. 8 of 1981 (71 P.S. § 751-35); section 2(f) of the act of May 18, 1937 (P.L. 654, No. 174) (43 P.S. § 25-2(f)); and Reorganization Plan No. 2 of 1975 (71 P.S. § 751-22).

Source

The provisions of this Subchapter I adopted June 22, 2018, effective June 23, 2018, 48 Pa.B. 3711.

§ 211.191. Scope

This subchapter applies to seismic exploration activities which employ explosives. Unless otherwise specified, Subchapters A—H apply to persons engaging in seismic exploration activities using explosives.

§ 211.192. Permits

In addition to the requirements in Subchapter C (relating to permits), an application for a blasting activity permit for seismic exploration must include all of the following:

(1) A detailed plan describing how explosives loaded in the ground will be kept under the control of the permittee, secured against being compromised, detonated, unearthed, or otherwise tampered with.

(2) The maximum time, in days, that explosives will be allowed to remain in the borehole from loading until detonation.

(3) A map clearly delineating all of the areas where the placement of explosives charges is planned and the footprint of any mining permits where mining, reclamation or water treatment are occurring, or may occur, within 500 feet of where the placement of explosives charges is planned.

(4) Detailed information, including data sheets and warranty information, on the explosives products to be used.

§ 211.193. Blasting records

In addition to the requirements of § 211.133 (relating to blast reports), blast reports on seismic exploration operations must contain, at a minimum, all of the following:

(1) The time and date the explosives were loaded into holes.

(2) The blaster-in-charge who supervised or loaded the charges, or both.

(3) The specific location of the loading of the charges, expressed in latitude and longitude.

(4) The blaster-in-charge who detonated the charges.

(5) The time and date the charges were detonated.

§ 211.194. General requirements for handling explosives on a seismic exploration operation

(a) Section 211.153(e) and (f) (relating to general requirements for handling explosives) is not applicable to the handling and use of explosives for seismic exploration operations.

(b) Except as specified in subsection (a), in addition to the requirements of Subchapter F (relating to blasting activities), all of the following provisions apply to the handling and use of explosives on seismic exploration operations:

(1) All explosives loaded into boreholes shall either be detonated or removed from the borehole after the maximum number of days specified in the applicable blasting activity permit.

(2) Explosives charges may not be placed closer than 300 feet from any building or other structure designated by the Department unless authorized by the Department.

(3) All detonators used in seismic exploration operations must employ the best technology available for security and functionality under the conditions into which the detonators are loaded.

(4) Explosives may not be placed on areas permitted for mining activities under Chapter 77 or 86 (relating to noncoal mining; and surface and underground coal mining: general) without prior Department approval. To obtain Department approval to place explosives on area permitted for mining activities, the permit applicant shall provide information including all of the following:

(i) Demonstration of authorization to place explosives charges and to conduct activities on the site.

(ii) A plan to ensure the safety and security of explosives charges on the mining permit from loading through detonation of the charges.

(iii) A map detailing the specific location of where charges are to be placed on the mining permit area.

(iv) If the MSHA-required training is necessary, how and when that training will be obtained and who will obtain the training. The permittee shall provide written documentation of the training to the Department prior to entry onto the mining permit.

(5) The permittee is responsible for the security of all charges in the ground to prevent the charges from being detonated, removed, or otherwise tampered with. The permittee shall secure all explosives charges in accordance with the approved blasting activity permit.

(6) For all incidents where explosives are loaded into boreholes and have had their functionality compromised by loading, handling, or manufacturing defects, the permittee shall remove the explosives from the borehole or destroy them in place.

(7) The permittee may not allow explosives charges to remain in the ground for more than 1 year.

APPENDIX A. [Reserved]

Source

The provisions of this Appendix A reserved July 13, 2001, effective July 14, 2001, 31 Pa.B. 3751. Immediately preceding text appears at serial pages (243499) to (243502).

Section VI: Safe Explosives Act Fact Sheet

ATF Background Checks

Department of the Treasury
Bureau of Alcohol, Tobacco and Firearms
Washington, DC 20226

SAFE EXPLOSIVES ACT FACT SHEET

12/12/02

The Safe Explosives Act (the "**Act**") was signed into law by the President on November 25, 2002. The legislation takes effect in two parts. The first two provisions outlined below are effective 60 days after enactment. The last three provisions outlined below are effective 180 days after enactment.

Effective January 24, 2003:

1. **New Prohibited Persons Categories**: The Act adds three new categories of persons prohibited from receiving or possessing explosives: (1) aliens (with limited exceptions); (2) persons who have been dishonorably discharged from the military; and (3) citizens of the United States who have renounced their citizenship. These categories have been added to the pre-existing list of prohibited persons, which includes felons; fugitives; users of, and persons addicted to, controlled substances; and persons who have been adjudicated mental defectives or committed to mental institutions. All prohibited persons are permitted to apply to the Bureau of Alcohol, Tobacco and Firearms (ATF) for relief from Federal explosives disabilities.

2. **Samples**: When requested by ATF, manufacturers and importers of explosive materials, including Ammonium Nitrate, must submit samples of these materials to ATF, as well as information on their chemical composition or other information. This will assist ATF in the identification of explosives found at crime scenes.

Effective May 24, 2003:

1. **Intrastate Permit**: Intrastate users of explosives must first obtain an ATF "limited permit" prior to receiving explosive materials. Intrastate users may include, for example, farmers or construction companies that acquire and use explosives infrequently and within their own State of residence. The limited permit will allow the purchaser to receive explosive materials from an in-State explosives licensee or permittee on no more than six (6) occasions during the period of the permit. The limited permit will be valid for one year. Currently, intrastate users are exempt from most provisions of Federal explosives law. By contrast, *interstate* users of explosives must obtain ATF user permits; importers, manufacturers, and dealers in explosive materials must obtain ATF licenses. The limited permit will not authorize the permittee to transport or use explosives interstate. This provision is significant, as ultimately all persons possessing explosive materials in either interstate or intrastate commerce must first obtain a Federal license or permit issued by ATF.

2. **New Required Industry Information for More Thorough ATF Background Checks**: ATF must approve an explosives license or permit application if, among other things, the applicant is not prohibited from possessing explosives. Responsible persons (e.g., facility site managers, corporate officers) will now be required to submit to ATF identifying information, fingerprints, and photographs. Employees of licensees and permittees who will be possessing explosive materials must submit only identifying information. ATF must issue "letters of clearance" for those responsible persons and possessor employees who are not prohibited from possessing explosives. If ATF determines that a responsible person or employee is subject to an explosives prohibition, ATF must provide specific information to the employer and to the prohibited person (e.g., advise of appeal procedures). This new provision is significant, as all persons possessing explosive materials in either interstate or intrastate commerce will have to undergo a background check conducted by ATF.

3. **Inspections**: Generally, ATF will have to physically inspect all ATF licensees and permittees at least once every three calendar years for compliance with Federal explosives storage regulations.

    - In the case of user permits and licenses, ATF must verify by visual inspection that new applicants and renewal applicants have places of storage for explosive materials that meet the standards of safety and security set forth in the regulations.

- In the case of new applicants for limited permits, ATF is not required to conduct a visual inspection of places of storage. Instead, ATF may verify by inspection or by "such other means as the Secretary determines appropriate" that there is acceptable storage. For the first and second renewal of limited permits, ATF may continue to verify storage by "such other means." However, if a field inspection has not been conducted during the previous three years, ATF must, for the third renewal and at least once every three years after that renewal, verify by a field inspection that the limited permittee has acceptable places of storage.

Section VII: 27 CFR Part 555 Subpart K

ATF—Subpart K—STORAGE

§ 555.201 General

(a) Section 842(j) of the Act and § 555.29 of this part require that the storage of explosive materials by any person must be in accordance with the regulations in this part. Further, section 846 of this Act authorizes regulations to prevent the recurrence of accidental explosions in which explosive materials were involved. The storage standards prescribed by this subpart confer no right or privileges to store explosive materials in a manner contrary to State or local law.

(b) The Director may authorize alternate construction for explosives storage magazines when it is shown that the alternate magazine construction is substantially equivalent to the standards of safety and security contained in this subpart. Any alternate explosive magazine construction approved by the Director prior to August 9, 1982, will continue as approved unless notified in writing by the Director. Any person intending to use alternate magazine construction shall submit a letter application to the Director, Industry Operations for transmittal to the Director, specifically describing the proposed magazine. Explosive materials may not be stored in alternate magazines before the applicant has been notified that the application has been approved.

(c) A licensee or permittee who intends to make changes in his magazines, or who intends to construct or acquire additional magazines, shall comply with § 555.63.

(d) The regulations set forth in § § 555.221 through 555.224 pertain to the storage of display fireworks, pyrotechnic compositions, and explosive materials used in assembling fireworks and articles pyrotechnic.

(e) [Reserved]

(f) Any person who stores explosive materials shall notify the authority having jurisdiction for fire safety in the locality in which the explosive materials are being stored of the type, magazine capacity, and location of each site where such explosive materials are stored. Such notification shall be made orally before the end of the day on which storage of the explosive materials commenced and in writing within 48 hours from the time such storage commenced.

(Paragraph (f) approved by the Office of Management and Budget under control number 1140–0071)

[T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by T.D. ATF-293, 55 FR 3722, Feb. 5, 1990; T.D. ATF-400, 63 FR 45003, Aug. 24, 1998; ATF-11F, 73 FR 57242, Oct. 2, 2008; ATF 2013R-9F, 79 FR 46694, Aug. 11, 2014; ATF 2017R-21, 84 FR 13800, Apr. 8, 2019]

§ 555.202 Classes of explosive materials

For purposes of this part, there are three classes of explosive materials. These classes, together with the description of explosive materials comprising each class, are as follows:

(a) **High explosives**. Explosive materials which can be caused to detonate by means of a blasting cap when unconfined, (for example, dynamite, flash powders, and bulk salutes).

(b) **Low explosives**. Explosive materials which can be caused to deflagrate when confined (for example, black powder, safety fuses, igniters, igniter cords, fuse lighters, and "display fireworks" classified as UN0333, UN0334, or UN0335 by the U.S. Department of Transportation regulations at 49 CFR 172.101, except for bulk salutes).

(c) **Blasting agents**. (For example, ammonium nitrate-fuel oil and certain water-gels (see also § 555.11).

[T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by T.D. ATF-293, 55 FR 3722, Feb. 5, 1990; T.D. ATF-400, 63 FR 45003, Aug. 24, 1998; ATF 2017R-21, 84 FR 13800, Apr. 8, 2019]

§ 555.203 Types of magazines

For purposes of this part, there are five types of magazines. These types, together with the classes of explosive materials, as defined in § 555.202, which will be stored in them, are as follows:

(a) **Type 1 magazines**. Permanent magazines for the storage of high explosives, subject to the limitations prescribed by § § 555.206 and 555.213. Other classes of explosive materials may also be stored in type 1 magazines.

(b) **Type 2 magazines**. Mobile and portable indoor and outdoor magazines for the storage of high explosives, subject to the limitations prescribed by § § 555.206, 555.208(b), and 555.213. Other classes of explosive materials may also be stored in type 2 magazines.

(c) **Type 3 magazines**. Portable outdoor magazines for the temporary storage of high explosives while attended (for example, a "day-box"), subject to the limitations prescribed by § § 555.206 and 555.213. Other classes of explosives materials may also be stored in type 3 magazines.

(d) **Type 4 magazines**. Magazines for the storage of low explosives, subject to the limitations prescribed by § § 555.206(b), 555.210(b), and 555.213. Blasting agents may be stored in type 4 magazines, subject to the limitations prescribed by § § 555.206(c), 555.211(b), and 555.213. Detonators that will not mass detonate may also be stored in type 4 magazines, subject to the limitations prescribed by § § 555.206(a), 555.210(b), and 555.213.

(e) **Type 5 magazines**. Magazines for the storage of blasting agents, subject to the limitations prescribed by § § 555.206(c), 555.211(b), and 555.213.

§ 555.204 Inspection of magazines

Any person storing explosive materials shall inspect his magazines at least every seven days. This inspection need not be an inventory, but must be sufficient to determine whether there has been unauthorized entry or attempted entry into the magazines, or unauthorized removal of the contents of the magazines.

§ 555.205 Movement of explosive materials

All explosive materials must be kept in locked magazines meeting the standards in this subpart unless they are:

(a) In the process of manufacture;

(b) Being physically handled in the operating process of a licensee or user;

(c) Being used; or

(d) Being transported to a place of storage or use by a licensee or permittee or by a person who has lawfully acquired explosive materials under § 555.106.

§ 555.206 Location of magazines

(a) Outdoor magazines in which high explosives are stored must be located no closer to inhabited buildings, passenger railways, public highways, or other magazines in which high explosives are stored, than the minimum distances specified in the table of distances for storage of explosive materials in § 555.218.

(b) Outdoor magazines in which low explosives are stored must be located no closer to inhibited buildings, passenger railways, public highways, or other magazines in which explosive materials are stored, than the minimum distances specified in the table of distances for storage of low explosives in § 555.219, except that the table of distances in § 555.224 shall apply to the storage of display fireworks. The distances shown in § 555.219 may not be reduced by the presence of barricades.

(c) (1) Outdoor magazines in which blasting agents in quantities of more than 50 pounds are stored must be located no closer to inhabited buildings, passenger railways, or public highways than the minimum distances specified in the table of distances for storage of explosive materials in § 555.218.

(2) Ammonium nitrate and magazines in which blasting agents are stored must be located no closer to magazines in which high explosives or other blasting agents are stored than the minimum distances specified in the table of distances for the separation of ammonium nitrate and blasting

agents in § 555.220. However, the minimum distances for magazines in which explosives and blasting agents are stored from inhabited buildings, etc., may not be less than the distances specified in the table of distances for storage of explosives materials in § 555.218.

[T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by T.D. ATF-293, 55 FR 3722, Feb. 5, 1990; T.D. ATF-400, 63 FR 45003, Aug. 24, 1998]

§ 555.207 Construction of type 1 magazines

A type 1 magazine is a permanent structure: a building, an igloo or "Army-type structure", a tunnel, or a dugout. It is to be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and ventilated.

(a) **Buildings**. All building type magazines are to be constructed of masonry, wood, metal, or a combination of these materials, and have no openings except for entrances and ventilation. The ground around building magazines must slope away for drainage or other adequate drainage provided.

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

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

(3) **Wood frame wall construction**. The exterior of outer wood walls is to be covered with iron or aluminum not less than number 26-gauge. An inner wall of or covered with nonsparking material will be constructed so as to provide a space of not less than six inches between the outer and inner walls. The space is to be filled with coarse, dry sand or weak concrete.

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

(5) **Foundations**. Foundations are to be constructed of brick, concrete, cement block, stone, or wood posts. If piers or posts are used, in lieu of a continuous foundation, the space under the buildings is to be enclosed with metal.

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

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

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

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

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

(9) **Locks**. Each door is to be equipped with

(i) two mortise locks;

(ii) two padlocks fastened in separate hasps and staples;

(iii) a combination of a mortise lock and a padlock;

(iv) a mortise lock that requires two keys to open; or

(v) a three-point lock. Padlocks must have at least five tumblers and a casehardened shackle of at least 3/8-inch diameter. Padlocks must be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

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

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

(b) **Igloos**, "**Army-type structures**", **tunnels**, **and dugouts**. Igloo, "Army-type structure", tunnel, and dugout magazines are to be constructed of reinforced concrete, masonry, metal, or a combination of these materials. They must have an earthmound covering of not less than 24 inches on the top, sides and rear unless the magazine meets the requirements of paragraph (a)(7) of this section. Interior walls and floors must be constructed of, or covered with, a nonsparking material. Magazines of this type are also to be constructed in conformity with the requirements of paragraph (a)(4) and paragraphs (a)(8) through (11) of this section.

§ 555.208 Construction of type 2 magazines

A type 2 magazine is a box, trailer, semitrailer, or other mobile facility.

(a) **Outdoor magazines**—

(1) **General**. Outdoor magazines are to be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and ventilated. They are to be supported to prevent direct contact with the ground and, if less than one cubic yard in size, must be securely fastened to a fixed object. The ground around outdoor magazines must slope away for drainage or other adequate drainage provided. When unattended, vehicular magazines must have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the Director.

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

(3) **Hinges and hasps**. Hinges and hasps are to be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps

must be installed so that they cannot be removed when the doors are closed and locked.

(4) **Locks**. Each door is to be equipped with

(i) two mortise locks;

(ii) two padlocks fastened in separate hasps and staples;

(iii) a combination of a mortise lock and a padlock;

(iv) a mortise lock that requires two keys to open; or

(v) a three-point lock. Padlocks must have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks must be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

(b) **Indoor magazines**—

(1) **General**. Indoor magazines are to be fire-resistant and theft-resistant. They need not be bullet-resistant and weather-resistant if the buildings in which they are stored provide protection from the weather and from bullet penetration. No indoor magazine is to be located in a residence or dwelling. The indoor storage of high explosives must not exceed a quantity of 50 pounds. More than one indoor magazine may be located in the same building if the total quantity of explosive materials stored does not exceed 50 pounds. Detonators must be stored in a separate magazine (except as provided in § 555.213) and the total quantity of detonators must not exceed 5,000.

(2) **Exterior construction**. Indoor magazines are to be constructed of wood or metal according to one of the following specifications:

(i) Wood indoor magazines are to have sides, bottoms and doors constructed of at least two inches of hardwood and are to be well braced at the corners. They are to be covered with sheet metal of not less than number 26-gauge (.0179 inches). Nails exposed to the interior of magazines must be countersunk.

(ii) Metal indoor magazines are to have sides, bottoms and doors constructed of not less than number 12-gauge (.1046 inches) metal and be lined inside with a nonsparking material. Edges of metal covers must overlap sides at least one inch.

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

(4) **Locks**. Each door is to be equipped with

(i) two mortise locks;

(ii) two padlocks fastened in separate hasps and staples;

(iii) a combination of a mortise lock and a padlock;

(iv) a mortise lock that requires two keys to open; or

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

(c) **Detonator boxes**. Magazines for detonators in quantities of 100 or less are to have sides, bottoms and doors constructed of not less than number 12-gauge (.1046 inches) metal and lined with a nonsparking material. Hinges and hasps must be attached so they cannot be removed from the outside. One steel padlock (which need not be protected by a steel hood) having at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter is sufficient for locking purposes.

§ 555.209 Construction of type 3 magazines

A type 3 magazine is a "day-box" or other portable magazine. It must be fire-resistant, weather-resistant, and theft-resistant. A type 3 magazine is to be constructed of not less than number 12-gauge (.1046 inches) steel, lined with at least either 1/2-inch plywood or 1/2-inch Masonite-type hardboard. Doors must overlap sides by at least one inch. Hinges and hasps are to be attached by welding, riveting, or bolting (nuts on inside). One steel padlock (which need not be protected by a steel hood) having at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter is sufficient for locking purposes. Explosive materials are not to be left unattended in type 3 magazines and must be removed to type 1 or 2 magazines for unattended storage.

§ 555.210 Construction of type 4 magazines

A type 4 magazine is a building, igloo or "Army-type structure", tunnel, dugout, box, trailer, or a semitrailer or other mobile magazine.

(a) **Outdoor magazines**—

(1) **General**. Outdoor magazines are to be fire-resistant, weather-resistant, and theft-resistant. The ground around outdoor magazines must slope away for drainage or other adequate drainage be provided. When unattended, vehicular magazines must have wheels removed or otherwise be effectively immobilized by kingpin locking devices or other methods approved by the Director.

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

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

(4) **Locks**. Each door is to be equipped with

(i) two mortise locks;

(ii) two padlocks fastened in separate hasps and staples;

(iii) a combination of a mortise lock and a padlock;

(iv) a mortise lock that requires two keys to open; or

(v) a three-point lock. Padlocks must have at least five tumblers and case-hardened shackle of at least 3/8-inch diameter. Padlocks must be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

(b) **Indoor magazine**—

(1) **General**. Indoor magazines are to be fire-resistant and theft-resistant. They need not be weather-resistant if the buildings in which they are stored provide protection from the weather. No indoor magazine is to be located in a residence or dwelling. The indoor storage of low explosives must not exceed a quantity of 50 pounds. More than one indoor magazine may be located in the same building if the total quantity of explosive materials stored does not exceed 50 pounds. Detonators that will not mass detonate must be stored in a separate magazine and the total number of electric detonators must not exceed 5,000.

(2) **Construction**. Indoor magazines are to be constructed of masonry, metal-covered wood, fabricated metal, or a combination of these materials. The walls and floors are to be constructed of, or covered with, a nonsparking material. The doors must be metal or solid wood covered with metal.

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

(4) **Locks**. Each door is to be equipped with

(i) two mortise locks;

(ii) two padlocks fastened in separate hasps and staples;

(iii) a combination of a mortise lock and padlock;

(iv) a mortise lock that requires two keys to open; or

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

§ 555.211 Construction of type 5 magazines

A type 5 magazine is a building, igloo or "Army-type structure", tunnel, dugout, bin, box, trailer, or a semitrailer or other mobile facility.

(a) **Outdoor magazines**—

(1) **General**. Outdoor magazines are to be weather-resistant and theft-resistant. The ground around magazines must slope away for drainage or other adequate drainage be provided. When unattended, vehicular magazines must have wheels removed or otherwise be effectively immobilized by kingpin locking devices or other methods approved by the Director.

(2) **Construction**. The doors are to be constructed of solid wood or metal.

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

(4) **Locks**. Each door is to be equipped with

(i) two mortise locks;

(ii) two padlocks fastened in separate hasps and staples;

(iii) a combination of a mortise lock and a padlock;

(iv) a mortise lock that requires two keys to open; or

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

(5) **Placards**. The placards required by Department of Transportation regulations at 49 CFR part 172, subpart F, for the transportation of blasting agents shall be displayed on all magazines.

(b) **Indoor magazines**—

(1) **General**. Indoor magazines are to be theft-resistant. They need not be weather-resistant if the buildings in which they are stored provide protection from the weather. No indoor magazine is to be located in a residence or dwelling. Indoor magazines containing quantities of blasting agents in excess of 50 pounds are subject to the requirements of § 555.206 of this subpart.

(2) **Construction**. The doors are to be constructed of wood or metal.

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

(4) **Locks**. Each door is to be equipped with

(i) two mortise locks;

(ii) two padlocks fastened in separate hasps and staples;

(iii) a combination of a mortise lock and a padlock;

(iv) a mortise lock that requires two keys to open; or

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

[T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by T.D. ATF-298, 55 FR 21863, May 30, 1990]

§ 555.212 Smoking and open flames

Smoking, matches, open flames, and spark producing devices are not permitted:

(a) In any magazine;

(b) Within 50 feet of any outdoor magazine; or

(c) Within any room containing an indoor magazine.

§ 555.213 Quantity and storage restrictions

(a) Explosive materials in excess of 300,000 pounds or detonators in excess of 20 million are not to be stored in one magazine unless approved by the Director.

(b) Detonators are not to be stored in the same magazine with other explosive materials, except under the following circumstances:

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

(2) In a type 1 or type 2 magazine, detonators may be stored with delay devices and any of the items listed in paragraph (b)(1) of this section.

[T.D. ATF-487, 68 FR 3748, Jan. 24, 2003, as amended by ATF 15F, 75 FR 3163, Jan. 20, 2010]

§ 555.214 Storage within types 1, 2, 3, and 4 magazines

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

(b) Containers of explosive materials are to be stored so that marks are visible. Stocks of explosive materials are to be stored so they can be easily counted and checked upon inspection.

(c) Except with respect to fiberboard or other nonmetal containers, containers of explosive materials are not to be unpacked or repacked inside a magazine or within 50 feet of a magazine, and must not be unpacked or repacked close to other explosive materials. Containers of explosive materials must be closed while being stored.

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

§ 555.215 Housekeeping

Magazines are to be kept clean, dry, and free of grit, paper, empty packages and containers, and rubbish. Floors are to be regularly swept. Brooms and other utensils used in the cleaning and maintenance of magazines must have no spark-producing metal parts and may be kept in magazines. Floors stained by leakage from explosive materials are to be cleaned according to instructions of the explosives manufacturer. When any explosive material has deteriorated it is to be destroyed in accordance with the advice or instructions of the manufacturer. The area surrounding magazines is to be kept clear of rubbish, brush, dry grass, or trees (except live trees more than 10 feet tall), for not less than 25 feet in all directions. Volatile materials are to be kept a distance of not less than 50 feet from outdoor magazines. Living foliage which is used to stabilize the earthen covering of a magazine need not be removed.

§ 555.216 Repair of magazines

Before repairing the interior of magazines, all explosive materials are to be removed and the interior cleaned. Before repairing the exterior of magazines, all explosive materials must be removed if there exists any possibility that repairs may produce sparks or flame. Explosive materials removed from magazines under repair must be (a) placed in other magazines appropriate for the storage of those explosive materials under this subpart, or (b) placed a safe distance from the magazines under repair where they are to be properly guarded and protected until the repairs have been completed.

§ 555.217 Lighting

(a) Battery-activated safety lights or battery-activated safety lanterns may be used in explosives storage magazines.

(b) Electric lighting used in any explosives storage magazine must meet the standards prescribed by the "National Electrical Code," (National Fire Protection Association, NFPA 70–81), for the conditions present in the magazine at any time. All electrical switches are to be located outside of the magazine and also meet the standards prescribed by the National Electrical Code.

(c) Copies of invoices, work orders or similar documents which indicate the lighting complies with the National Electrical Code must be available for inspection by ATF officers.

§ 555.218 Table of distances for storage of explosive materials

Quantity of explosives		Distances in feet							
Pounds over	Pounds not over	Inhabited buildings		Public highways with traffic volume of 3000 or fewer vehicles/day		Passenger railways – public highways with traffic volume of more than 3,000 vehicles/day		Separation of magazines	
		Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
0	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	61	122

Quantity of explosives		Distances in feet							
Pounds over	Pounds not over	Inhabited buildings		Public highways with traffic volume of 3000 or fewer vehicles/day		Passenger railways – public highways with traffic volume of more than 3,000 vehicles/day		Separation of magazines	
		Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	723	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188
18,000	20,000	975	1,950	290	580	813	1,626	98	196
20,000	25,000	1,055	2,000	315	630	876	1,752	105	210
25,000	30,000	1,130	2,000	340	680	933	1,866	112	224
30,000	35,000	1,205	2,000	360	720	981	1,962	119	238
35,000	40,000	1,275	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,340	2,000	400	800	1,068	2,000	129	258
45,000	50,000	1,400	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,460	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,515	2,000	455	910	1,173	2,000	145	290
60,000	65,000	1,565	2,000	470	940	1,206	2,000	150	300
65,000	70,000	1,610	2,000	485	970	1,236	2,000	155	310
70,000	75,000	1,655	2,000	500	1,000	1,263	2,000	160	320
75,000	80,000	1,695	2,000	510	1,020	1,293	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000	195	390
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000	205	410
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000	215	430
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000	225	450

Quantity of explosives		Distances in feet							
Pounds over	Pounds not over	Inhabited buildings		Public highways with traffic volume of 3000 or fewer vehicles/day		Passenger railways – public highways with traffic volume of more than 3,000 vehicles/day		Separation of magazines	
		Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000	235	470
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000	245	490
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000	255	510
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000	265	530
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000	275	550
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000	285	570
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000	295	590
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000	315	630
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000	335	670
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000	360	720
275,000	300,000	2,275	2,275	690	1,380	2,000	2,000	385	770

***TABLE*: AMERICAN TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES (DECEMBER 1910), AS REVISED AND APPROVED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES - JUNE 1991.**

NOTES TO THE TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES

(1) Terms found in the table of distances for storage of explosive materials are defined in § 555.11.

(2) When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and, in addition, they should be separated from each other by not less than the distances shown for "Separation of Magazines," except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives. If any two or more magazines are separated from each other by less than the specified "Separation of Magazines" distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosives stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways, and highways.

(3) All types of blasting caps in strengths through No. 8 cap should be rated at 1 ½ lbs. (1.5 lbs.) of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the manufacturer.

(4) For quantity and distance purposes, detonating cord of 50 or 60 grains per foot should be calculated as equivalent to 9 lbs. of high explosives per 1,000 feet. Heavier or lighter core loads should be rated proportionately.

[T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by T.D. ATF-400, 63 FR 45003, Aug. 24, 1998; T.D. ATF-446, 66 FR 16602, Mar. 27, 2001; T.D. ATF-446a, 66 FR 19089, Apr. 13, 2001; ATF 2017R-21, 84 FR 13800, Apr. 8, 2019]

§ 555.219 Table of distances for storage of low explosives

Pounds		From inhabited building distance (feet)	From public railroad and highway distance (feet)	From above ground magazine (feet)
Over	Not Over			
0	1,000	75	75	50
1,000	5,000	115	115	75
5,000	10,000	150	150	100
10,000	20,000	190	190	125
20,000	30,000	215	215	145
30,000	40,000	235	235	155
40,000	50,000	250	250	165
50,000	60,000	260	260	175
60,000	70,000	270	270	185
70,000	80,000	280	280	190
80,000	90,000	295	295	195
90,000	100,000	300	300	200
100,000	200,000	375	375	250
200,000	300,000	450	450	300

***TABLE*: DEPARTMENT OF DEFENSE AMMUNITION AND EXPLOSIVES STANDARDS, TABLE 5-4.1 EXTRACT; 4145.27 M, MARCH 1969**

[T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by ATF 2017R-21, 84 FR 13800, Apr. 8, 2019]

§ 555.220 Table of separation distances of ammonium nitrate and blasting agents from explosives or blasting agents

Donor weight (pounds)		Minimum separation distance of acceptor from donor when barricaded (ft.)		Minimum thickness of artificial barricades (in.)
Over	Not Over	Ammonium nitrate	Blasting agent	
	100	3	11	12
100	300	4	14	12
300	600	5	18	12
600	1,000	6	22	12
1,000	1,600	7	25	12
1,600	2,000	8	29	12
2,000	3,000	9	32	15
3,000	4,000	10	36	15
4,000	6,000	11	40	15
6,000	8,000	12	43	20
8,000	10,000	13	47	20
10,000	12,000	14	50	20
12,000	16,000	15	54	25
16,000	20,000	16	58	25
20,000	25,000	18	65	25
25,000	30,000	19	68	30
30,000	35,000	20	72	30
35,000	40,000	21	76	30
40,000	45,000	22	79	35
45,000	50,000	23	83	35
50,000	55,000	24	86	35
55,000	60,000	25	90	35

Donor weight (pounds)		Minimum separation distance of acceptor from donor when barricaded (ft.)		Minimum thickness of artificial barricades (in.)
Over	Not Over	Ammonium nitrate	Blasting agent	
60,000	70,000	26	94	40
70,000	80,000	28	101	40
80,000	90,000	30	108	40
90,000	100,000	32	115	40
100,000	120,000	34	122	50
120,000	140,000	37	133	50
140,000	160,000	40	144	50
160,000	180,000	44	158	50
180,000	200,000	48	173	50
200,000	220,000	52	187	60
220,000	250,000	56	202	60
250,000	275,000	60	216	60
275,000	300,000	64	230	60

***TABLE*: NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) OFFICIAL STANDARD NO. 492, 1968**

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

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

(2) When the ammonium nitrate and/or blasting agent is not barricaded, the distances shown in the table must be multiplied by six. These distances

allow for the possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers, and the like which may enclose the "donor." Where explosives storage is in bullet-resistant magazines or where the storage is protected by a bullet-resistant wall, distances and barricade thicknesses in excess of those prescribed in the table in § 555.218 are not required.

(3) These distances apply to all ammonium nitrate with respect to its separation from stores of high explosives and blasting agents. Ammonium nitrate explosive mixtures that are high explosives pursuant to § 555.202(a) or are defined as a blasting agent pursuant to § 555.11 are subject to the table of distances for storage of explosive materials in § 555.218 and to the table of separation distances of ammonium nitrate and blasting agents from explosives or blasting agents in this section.

(4) These distances apply to blasting agents which pass the insensitivity test prescribed in regulations of the U.S. Department of Transportation (49 CFR part 173).

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

(6) For determining the distances to be maintained from inhabited buildings, passenger railways, and public highways, use the table in § 555.218.

[T.D. ATF-87, 46 FR 40384, Aug. 7, 1981, as amended by ATF 2017R-21, 84 FR 13800, Apr. 8, 2019; ATF 2002R-226F, 84 FR 12097, Apr. 1, 2019]

§ 555.221 Requirements for display fireworks, pyrotechnic compositions, and explosive materials used in assembling fireworks or articles pyrotechnic

(a) Display fireworks, pyrotechnic compositions, and explosive materials used to assemble fireworks and articles pyrotechnic shall be stored at all times as required by this Subpart unless they are in the process of manufacture, assembly, packaging, or are being transported.

(b) No more than 500 pounds (227 kg) of pyrotechnic compositions or explosive materials are permitted at one time in any fireworks mixing building, any building or area in which the pyrotechnic compositions or explosive materials are pressed or otherwise prepared for finishing or assembly, or any finishing or assembly building. All pyrotechnic compositions or explosive materials not in immediate use will be stored in covered, non-ferrous containers.

(c) The maximum quantity of flash powder permitted in any fireworks process building is 10 pounds (4.5 kg).

(d) All dry explosive powders and mixtures, partially assembled display fireworks, and finished display fireworks shall be removed from fireworks process buildings at the conclusion of a day's operations and placed in approved magazines.

[T.D. ATF-293, 55 FR 3722, Feb. 5, 1990, as amended by T.D. ATF-400, 63 FR 45004, Aug. 24, 1998]

§ 555.222 Table of distances between fireworks process buildings and between fireworks process and fireworks nonprocess buildings

Net weight of fireworks[1] (pounds)	Display fireworks[2] (feet)	Consumer fireworks[3] (feet)
0-100	57	37
101-200	69	37
201-300	77	37
301-400	85	37
401-500	91	37
Above 500	Not permitted[4 5]	Not permitted[4 5]

[1] Net weight is the weight of all pyrotechnic compositions, and explosive materials and fuse only.

[2] The distances in this column apply only with natural or artificial barricades. If such barricades are not used, the distances must be doubled.

[3] While consumer fireworks or articles pyrotechnic in a finished state are not subject to regulation, explosive materials used to manufacture or assemble such fireworks or articles are subject to regulation. Thus, fireworks process buildings where consumer fireworks or articles pyrotechnic are being processed shall meet these requirements.

[4] A maximum of 500 pounds of in-process pyrotechnic compositions, either loose or in partially-assembled fireworks, is permitted in any fireworks process building. Finished display fireworks may not be stored in a fireworks process building.

[5] A maximum of 10 pounds of flash powder, either in loose form or in assembled units, is permitted in any fireworks process building. Quantities in excess of 10 pounds must be kept in an approved magazine.

[T.D. ATF-293, 55 FR 3723, Feb. 5, 1990, as amended by T.D. ATF-400, 63 FR 45004, Aug. 24, 1998]

§ 555.223 Table of distances between fireworks process buildings and other specified areas

Distance from Passenger Railways, Public Highways, Fireworks Plant Buildings used to Store Consumer Fireworks and Articles Pyrotechnic, Magazines and Fireworks Shipping Buildings, and Inhabited Buildings.[3] [4] [5]

Net weight of fireworks[1] (pounds)	Display fireworks[1] (feet)	Consumer fireworks[2] (feet)
0-100	200	25
101-200	200	50
201-300	200	50
301-400	200	50
401-500	200	50
Above 500	Not permitted	Not permitted

[1] Net weight is the weight of all pyrotechnic compositions, and explosive materials and fuse only.

[2] While consumer fireworks or articles pyrotechnic in a finished state are not subject to regulation, explosive materials used to manufacture or assemble such fireworks or articles are subject to regulation. Thus, fireworks process buildings where consumer fireworks or articles pyrotechnic are being processed shall meet these requirements.

[3] This table does not apply to the separation distances between fireworks process buildings (see § 555.222) and between magazines (see § § 555.218 and 555.224).

[4] The distances in this table apply with or without artificial or natural barricades or screen barricades. However, the use of barricades is highly recommended.

[5] No work of any kind, except to place or move items other than explosive materials from storage, shall be conducted in any building designated as a warehouse. A fireworks plant warehouse is not subject to § 555.222 or this section, tables of distances.

[T.D. ATF-293, 55 FR 3723, Feb. 5, 1990, as amended by T.D. ATF-400, 63 FR 45004, Aug. 24, 1998]

§ 555.224 Table of distances for the storage of display fireworks (except bulk salutes)

Net weight of firework[1] (pounds)	Distance between magazine and inhabited building, passenger railway, or public highway[3 4] (feet)	Distance between magazines[2 3] (feet)
0-1000	150	100
1001-5000	230	150
5001-10000	300	200
Above 10000	Use table § 555.218	

[1] Net weight is the weight of all pyrotechnic compositions, and explosive materials and fuse only.

[2] For the purposes of applying this table, the term "magazine" also includes fireworks shipping buildings for display fireworks.

[3] For fireworks storage magazines in use prior to March 7, 1990, the distances in this table may be halved if properly barricaded between the magazine and potential receptor sites (55 FR 3717).

[4] This table does not apply to the storage of bulk salutes. Use table at § 555.218.

[T.D. ATF-293, 55 FR 3723, Feb. 5, 1990, as amended by T.D. ATF-400, 63 FR 45004, Aug. 24, 1998; ATF 2017R-21, 84 FR 13800, Apr. 8, 2019]

Section VIII: 30 CFR Part 57

PART 57 - SAFETY AND HEALTH STANDARDS - UNDERGROUND METAL AND NONMETAL MINES

Authority: 30 U.S.C. 811.

Source: 50 FR 4082, Jan. 29, 1985, unless otherwise noted.

Subpart A - GENERAL

§ 57.1 Purpose and scope

This part 57 sets forth mandatory safety and health standards for each underground metal or nonmetal mine, including related surface operations, subject to the Federal Mine Safety and Health Act of 1977. The purpose of these standards is the protection of life, the promotion of health and safety, and the prevention of accidents.

§ 57.2 Definitions

The following definitions apply to this part. In addition, definitions contained in any subpart of part 57 apply in that subpart. If inconsistent with the general definitions in this section, the definition in the subpart will apply in that subpart:

Abandoned areas means areas in which work has been completed, no further work is planned, and travel is not permitted.

Abandoned mine means all work has stopped on the mine premises and an office with a responsible person in charge is no longer maintained at the mine.

Abandoned workings means deserted mine areas in which further work is not intended.

Active workings means areas at, in, or around a mine or plant where men work or travel.

American Table of Distances means the current edition of "The American Table of Distances for Storage of Explosives" published by the Institute of Makers of Explosives.

Approved means tested and accepted for a specific purpose by a nationally recognized agency.

Attended means presence of an individual or continuous monitoring to prevent unauthorized entry or access. In addition, areas containing explosive material at underground areas of a mine can be considered attended when all access to the underground areas of the mine is secured from unauthorized entry. Vertical shafts shall

be considered secure. Inclined shafts or adits shall be considered secure when locked at the surface.

Authorized person means a person approved or assigned by mine management to perform a specific type of duty or duties or to be at a specific location or locations in the mine.

Auxiliary fan means a fan used to deliver air to a working place off the main airstream; generally used with ventilation tubing.

Barricaded means obstructed to prevent the passage of persons, vehicles, or flying materials.

Barrier means a material object, or objects that separates, keeps apart, or demarcates in a conspicuous manner such as cones, a warning sign, or tape.

Berm means a pile or mound of material along an elevated roadway capable of moderating or limiting the force of a vehicle in order to impede the vehicle's passage over the bank of the roadway.

Blast area means the area in which concussion (shock wave), flying material, or gases from an explosion may cause injury to persons. In determining the blast area, the following factors, shall be considered:

(1) Geology or material to be blasted.

(2) Blast pattern.

(3) Burden, depth, diameter, and angle of the holes.

(4) Blasting experience of the mine.

(5) Delay system, powder factor, and pounds per delay.

(6) Type and amount of explosive material.

(7) Type and amount of stemming.

Blast site means the area where explosive material is handled during loading, including the perimeter formed by the loaded blastholes 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-foot (15.2-meter) requirement if the perimeter of loaded holes is demarcated with a barrier. The 50-foot (15.2-meter) and alternative 30-foot (9.1-meter) requirements also apply in all directions along the full depth of the hole. In underground mines, at least 15 feet (4.6 meters) of solid rib, pillar, or broken rock can be substituted for the 50-foot (15.2-meter) distance. In underground mines utilizing a block-caving system or similar system, at least 6 feet (1.8 meters) of solid rib or pillar, including concrete reinforcement

of at least 10 inches (254 millimeters), with overall dimensions of not less than 6 feet (1.8 meters) may be substituted for the 50-foot (15.2-meter) distance requirement.

Blasting agent means any substance classified as a blasting agent by the Department of Transportation in 49 CFR 173.114(a) (44 FR 31182, May 31, 1979) which is incorporated by reference. This document is available for inspection at each Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration and may be obtained from the U.S. Government Printing Office, Washington, DC 20402.

Blasting area means the area near blasting operations in which concussion or flying material can reasonably be expected to cause injury.

Blasting cap means a detonator which is initiated by a safety fuse.

Blasting circuit means the electrical circuit used to fire one or more electric blasting caps.

Blasting switch means a switch used to connect a power source to a blasting circuit.

Blowout means a sudden, violent, release of gas or liquid due to the reservoir pressure in a petroleum mine.

Booster means any unit of explosive or blasting agent used for the purpose of perpetuating or intensifying an initial detonation.

Booster fan means a fan installed in the main airstream or a split of the main airstream to increase airflow through a section or sections of a mine.

Capped fuse means a length of safety fuse to which a blasting cap has been attached.

Capped primer means a package or cartridge of explosives which is specifically designed to transmit detonation to other explosives, and which contains a detonator.

Circuit breaker means a device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent setting without injury to itself when properly applied within its rating.

Combustible means capable of being ignited and consumed by fire.

Combustible material means a material that, in the form in which it is used and under the conditions anticipated, will ignite, burn, support combustion or release flammable vapors when subjected to fire or heat. Wood, paper, rubber, and plastics are examples of combustible materials.

Company official means a member of the company supervisory or technical staff.

Competent person means a person having abilities and experience that fully qualify him to perform the duty to which he is assigned.

Conductor means a material, usually in the form of a wire, cable, or bus bar, capable of carrying an electric current.

Delay connector means a nonelectric short interval delay device for use in delaying blasts which are initiated by detonating cord.

Detonating cord means a flexible cord containing a solid core of high explosives.

Detonator means any device containing a detonating charge that is used to initiate an explosive and includes but is not limited to blasting caps, electric blasting caps and non-electric instantaneous or delay blasting caps.

Distribution box means a portable apparatus with an enclosure through which an electric circuit is carried to one or more cables from a single incoming feed line; each cable circuit being connected through individual overcurrent protective devices.

Electric blasting cap means a detonator designed for and capable of being initiated by means of an electric current.

Electrical grounding means to connect with the ground to make the earth part of the circuit.

Employee means a person who works for wages or salary in the service of an employer.

Employer means a person or organization which hires one or more persons to work for wages or salary.

Emulsion means an explosive material containing substantial amounts of oxidizers dissolved in water droplets, surrounded by an immiscible fuel.

Escapeway means a passageway by which persons may leave a mine.

Explosive means any substance classified as an explosive by the Department of Transportation in 49 CFR 173.53, 173.88 and 173.100 which are incorporated by reference. Title 49 CFR is available for inspection at each Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration and may be obtained from the U.S. Government Printing Office, Washington, DC 20402.

Face or **bank** means that part of any mine where excavating is progressing or was last done.

Fire resistance rating means the time, in minutes or hours, that an assembly of materials will retain its protective characteristics or structural integrity upon exposure to fire.

Flame spread rating means the numerical designation that indicates the extent flame will spread over the surface of a material during a specified period of time.

Flammable means capable of being easily ignited and of burning rapidly.

Flammable gas means a gas that will burn in the normal concentrations of oxygen in the air.

Flammable liquid a liquid that has a flash point below 100 °F (37.8 °C), a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100 °F (37.8 °C), and is known as a Class I liquid.

Flash point means the minimum temperature at which sufficient vapor is released by a liquid or solid to form a flammable vapor-air mixture at atmospheric pressure.

Geological area means an area characterized by the presence of the same ore bodies, the same stratigraphic sequence of beds, or the same ore-bearing geological formation.

Highway means any public street, public alley, or public road.

High potential means more than 650 volts.

Hoist means a power-driven windlass or drum used for raising ore, rock, or other material from a mine, and for lowering or raising persons and material.

Igniter cord means a fuse, cordlike in appearance, which burns progressively along its length with an external flame at the zone of burning and is used for lighting a series of safety fuses in the desired sequence.

Insulated means separated from other conducting surfaces by a dielectric substance permanently offering a high resistance to the passage of current and to disruptive discharge through the substance. When any substance is said to be insulated, it is understood to be insulated in a manner suitable for the conditions to which it is subjected. Otherwise, it is, within the purpose of this definition, uninsulated. Insulating covering is one means for making the conductor insulated.

Insulation means a dielectric substance offering a high resistance to the passage of current and to a disruptive discharge through the substance.

Laminated partition means a partition composed of the following material and minimum nominal dimensions: ½-inch-thick plywood, ½-inch-thick gypsum wallboard, ⅛-inch-thick low carbon steel, and ¼-inch-thick plywood, bonded together in that order (IME-22 Box). A laminated partition also includes alternative construction materials described in the Institute of Makers of Explosives (IME) Safety Library Publication No. 22, “Recommendations for the Safe Transportation of Detonators in a Vehicle with Other Explosive Materials” (May 1993), and the “Generic Loading Guide for the IME-22 Container” (October 1993). The IME is located at

1120 19th Street NW, Suite 310, Washington, DC 20036-3605; 202-429-9280; *https://www.ime.org*. This incorporation by reference has been approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies are available at MSHA's Office of Standards, Regulations, and Variances, 201 12th Street South, Arlington, VA 22202-5452; 202-693-9440; and at all Metal and Nonmetal Mine Safety and Health District Offices, or available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*.

Lay means the distance parallel to the axis of the rope in which a strand makes one complete turn about the axis of the rope.

Loading means placing explosive material either in a blasthole or against the material to be blasted.

Low potential means 650 volts or less.

Magazine means a facility for the storage of explosives, blasting agents, or detonators.

Main fan means a fan that controls the entire airflow of the mine, or the airflow of one of the major air circuits.

Major electrical installation means an assemblage of stationary electrical equipment for the generation, transmission, distribution, or conversion of electrical power.

Mantrip means a trip on which persons are transported to and from a work area.

Mill includes any ore mill, sampling works, concentrator, and any crushing, grinding, or screening plant used at, and in connection with, an excavation or mine.

Mine atmosphere means any point at least 12 inches away from the back, face, rib, and floor in any mine; and additionally, in a Category IV mine, at least 3 feet laterally away from the collar of a borehole which releases gas into a mine.

Mine opening means any opening or entrance from the surface into a mine.

Misfire means the complete or partial failure of a blasting charge to explode as planned.

Mobile equipment means wheeled, skid-mounted, track-mounted, or rail-mounted equipment capable of moving or being moved.

Multipurpose dry-chemical fire extinguisher means an extinguisher having a rating of at least 2-A:10-B:C and containing a nominal 4.5 pounds or more of dry-chemical agent.

Noncombustible material means a material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Concrete, masonry block, brick, and steel are examples of noncombustible materials.

Non-electric delay blasting cap means a detonator with an integral delay element and capable of being initiated by miniaturized detonating cord.

Outburst means the sudden, violent release of solids and high-pressure occluded gases, including methane in a domal salt mine.

Overburden means material of any nature, consolidated or unconsolidated, that overlies a deposit of useful materials or ores that are to be mined.

Overload means that current which will cause an excessive or dangerous temperature in the conductor or conductor insulation.

Permissible means a machine, material, apparatus, or device which has been investigated, tested, and approved by the Bureau of Mines or the Mine Safety and Health Administration, and is maintained in permissible condition.

Potable water means water which shall meet the applicable minimum health requirements for drinking water established by the State or community in which the mine is located or by the Environmental Protection Agency in 40 CFR part 141, pages 169-182 revised as of July 1, 1977. Where no such requirements are applicable, the drinking water provided shall conform with the Public Health Service Drinking Water Standards, 42 CFR part 72, subpart J, pages 527-533, revised as of October 1, 1976. Publications to which references are made in this definition are hereby made a part hereof. These incorporated publications are available for inspection at each Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration.

Powder chest means a substantial, nonconductive portable container equipped with a lid and used at blasting sites for explosives other than blasting agents.

Primer means a unit, package, or cartridge of explosives used to initiate other explosives or blasting agents, and which contains a detonator.

Reverse-current protection means a method or device used on direct-current circuits or equipment to prevent the flow of current in a reverse direction.

Rock burst means a sudden and violent failure of overstressed rock resulting in the instantaneous release of large amounts of accumulated energy. Rock burst does not include a burst resulting from pressurized mine gases.

Rock fixture means any tensioned or nontensioned device or material inserted into the ground to strengthen or support the ground.

Roll protection means a framework, safety canopy or similar protection for the operator when equipment overturns.

Safety can means an approved container, of not over 5 gallons capacity, having a spring-closing lid and spout cover.

Safety fuse means a flexible cord containing an internal burning medium by which fire is conveyed at a continuous and uniform rate for the purpose of firing blasting caps or a black powder charge.

Safety switch means a sectionalizing switch that also provides shunt protection in blasting circuits between the blasting switch and the shot area.

Scaling means removal of insecure material from a face or highwall.

Secondary safety connection means a second connection between a conveyance and rope, intended to prevent the conveyance from running away or falling in the event the primary connection fails.

Shaft means a vertical or inclined shaft, a slope, incline, or winze.

Short circuit means an abnormal connection of relatively low resistance, whether made accidentally or intentionally, between two points of difference potential in a circuit.

Slurry (as applied to blasting). See "Water gel."

Storage facility means the entire class of structures used to store explosive materials. A "storage facility" used to store blasting agents corresponds to a BATF Type 4 or 5 storage facility.

Storage tank means a container exceeding 60 gallons in capacity used for the storage of flammable or combustible liquids.

Stray current means that portion of a total electric current that flows through paths other than the intended circuit.

Substantial construction means construction of such strength, material, and workmanship that the object will withstand all reasonable shock, wear, and usage to which it will be subjected.

Suitable means that which fits and has the qualities or qualifications to meet a given purpose, occasion, condition, function, or circumstance.

Travelway means a passage, walk or way regularly used and designated for persons to go from one place to another.

Water gel or **Slurry** (as applied to blasting) means an explosive or blasting agent containing substantial portions of water.

Wet drilling means the continuous application of water through the central hole of hollow drill steel to the bottom of the drill hole.

Working level (**WL**) means any combination of the short-lived radon daughters in one liter of air that will result in ultimate emission of 1.3×10^5 MeV (million electron volts) of potential alpha energy, and exposure to these radon daughters over a period of time is expressed in terms of "working level months" (WLM). Inhalation of air containing a radon daughter concentration of 1 WL for 173 hours results in an exposure of 1 WLM.

Working place means any place in or about a mine where work is being performed.

[69 FR 38840, June 29, 2004, as amended at 80 FR 52987, Sept. 2, 2015]

Procedures

§ 57.1000 Notification of commencement of operations and closing of mines

The owner, operator, or person in charge of any metal and nonmetal mine shall notify the nearest MSHA Metal and Nonmental Mine Safety and Health district office before starting operations, of the approximate or actual date mine operation will commence. The notification shall include the mine name, location, the company name, mailing address, person in charge, and whether operations will be continuous or intermittent. When any mine is closed, the person in charge shall notify the nearest district office as provided above and indicate whether the closure is temporary or permanent.

[51 FR 36198, Oct. 8, 1986, as amended at 60 FR 33723, June 29, 1995; 60 FR 35695, July 11, 1995; 71 FR 16667, Apr. 3, 2006]

Subpart B - GROUND CONTROL

Authority: 30 U.S.C. 811.

Source: 51 FR 36198, Oct. 8, 1986, unless otherwise noted.

§ 57.3000 Definitions

The following definitions apply in this subpart.

Travelway. A passage, walk, or haulageway regularly used or designated for persons to go from one place to another.

[51 FR 36198, Oct. 8, 1986, as amended at 69 FR 38842, June 29, 2004]

§ 57.3200 Correction of hazardous conditions

Ground conditions that create a hazard to persons shall be taken down or supported before other work or travel is permitted in the affected area. Until corrective work is completed, the area shall be posted with a warning against entry and, when left unattended, a barrier shall be installed to impede unauthorized entry.

§ 57.3201 Location for performing scaling

Scaling shall be performed from a location which will not expose persons to injury from falling material, or other protection from falling material shall be provided.

§ 57.3202 Scaling tools

Where manual scaling is performed, a scaling bar shall be provided. This bar shall be of a length and design that will allow the removal of loose material without exposing the person performing the work to injury.

§ 57.3203 Rock fixtures

(a) For rock bolts and accessories addressed in ASTM F432-95, "Standard Specification for Roof and Rock Bolts and Accessories," the mine operator shall -

(1) Obtain a manufacturer's certification that the material was manufactured and tested in accordance with the specifications of ASTM F432-95; and

(2) Make this certification available to an authorized representative of the Secretary and to the representative of miners.

(b) Fixtures and accessories not addressed in ASTM F432-95 may be used for ground support provided they -

(1) Have been successful in supporting the ground in an area with similar strata, opening dimensions and ground stresses in any mine; or

(2) Have been tested and shown to be effective in supporting ground in an area of the affected mine which has similar strata, opening dimensions, and ground stresses as the area where the fixtures are expected to be used. During the test process, access to the test area shall be limited to persons necessary to conduct the test.

(c) Bearing plates shall be used with fixtures when necessary for effective ground support.

(d) The diameter of finishing bits shall be within a tolerance of plus or minus 0.030 inch of the manufacturer's recommended hole diameter for the anchor used. When separate finishing bits are used, they shall be distinguishable from other bits.

(e) Damaged or deteriorated cartridges of grouting material shall not be used.

(f) When rock bolts tensioned by torquing are used as a means of ground support,

(1) Selected tension level shall be -

(i) At least 50 percent of either the yield point of the bolt or anchorage capacity of the rock, whichever is less; and

(ii) No greater than the yield point of the bolt or anchorage capacity of the rock.

(2) The torque of the first bolt, every tenth bolt, and the last bolt installed in each work area during the shift shall be accurately determined immediately after installation. If the torque of any fixture tested does not fall within the installation torque range, corrective action shall be taken.

(g) When grouted fixtures can be tested by applying torque, the first fixture installed in each work place shall be tested to withstand 150 foot-pounds of torque. Should it rotate in the hole, a second fixture shall be tested in the same manner. If the second fixture also turns, corrective action shall be taken.

(h) When other tensioned and nontensioned fixtures are used, test methods shall be established and used to verify their effectiveness.

(i) The mine operator shall certify that tests were conducted and make the certification available to an authorized representative of the Secretary.

[51 FR 36198, Oct. 8, 1986, as amended at 51 FR 36804, Oct. 16, 1986; 63 FR 20030, Apr. 22, 1998]

Scaling and Support - Underground Only

§ 57.3360 Ground support use

Ground support shall be used where ground conditions, or mining experience in similar ground conditions in the mine, indicate that it is necessary. When ground support is necessary, the support system shall be designed, installed, and maintained to control the ground in places where persons work or travel in performing their assigned tasks. Damaged, loosened, or dislodged timber use for ground support which creates a hazard to persons shall be repaired or replaced prior to any work or travel in the affected area.

Precautions - Surface and Underground

§ 57.3400 Secondary breakage

Prior to secondary breakage operations, the material to be broken, other than hanging material, shall be positioned or blocked to prevent movement which would endanger persons in the work area. Secondary breakage shall be performed from a location which would not expose persons to danger.

§ 57.3401 Examination of ground conditions

Persons experienced in examining and testing for loose ground shall be designated by the mine operator. Appropriate supervisors or other designated persons shall examine and, where applicable, test ground conditions in areas where work is to be performed, prior to work commencing, after blasting, and as ground conditions warrant during the work shift. Underground haulageways and travelways and surface area highwalls and banks adjoining travelways shall be examined weekly or more often if changing ground conditions warrant.

Precautions - Surface Only

§ 57.3430 Activity between machinery or equipment and the highwall or bank

Persons shall not work or travel between machinery or equipment and the highwall or bank where the machinery or equipment may hinder escape from falls or slides of the highwall or bank. Travel is permitted when necessary for persons to dismount.

Precautions - Underground Only

§ 57.3460 Maintenance between machinery or equipment and ribs

Persons shall not perform maintenance work between machinery or equipment and ribs unless the area has been tested and, when necessary, secured.

§ 57.3461 Rock bursts

(a) Operators of mines which have experienced a rock burst shall -

(1) Within twenty-four hours report to the nearest MSHA office each rock burst which:

(i) Causes persons to be withdrawn;

(ii) Impairs ventilation;

(iii) Impedes passage; or

(iv) Disrupts mining activity for more than one hour.

(2) Develop and implement a rock burst control plan within 90 days after a rock burst has been experienced.

(b) The plan shall include -

(1) Mining and operating procedures designed to reduce the occurrence of rock bursts;

(2) Monitoring procedures where detection methods are used; and

(3) Other measures to minimize exposure of persons to areas which are prone to rock bursts.

(c) The plan shall be updated as conditions warrant.

(d) The plan shall be available to an authorized representative of the Secretary and to miners or their representatives.

Subpart C - FIRE PREVENTION AND CONTROL

Authority: Sec. 101, Federal Mine Safety and Health Act of 1977, Pub. L. 91-173 as amended by Pub. L. 95-164, 91 Stat. 1291 (30 U.S.C. 811).

§ 57.4000 Definitions

The following definitions apply in this subpart.

Combustible liquids. Liquids having a flash point at or above 100 °F (37.8 °C). They are divided into the following classes:

Class II liquids - those having flash points at or above 100 °F (37.8 °C) and below 140 °F (60 °C).

Class IIIA liquids - those having flash points at or above 140 °F (60 °C) and below 200 °F (93.4 °C).

Class IIIB liquids - those having flash points at or above 200 °F (93.4 °C).

Escapeway. A designated passageway by which persons can leave an underground mine.

Flash point. The minimum temperature at which sufficient vapor is released by a liquid to form a flammable vapor-air mixture near the surface of the liquid.

Main fan. A fan that controls the entire airflow of an underground mine or the airflow of one of the major air circuits of the mine.

Mine opening. Any opening or entrance from the surface into an underground mine.

Safety can. A container of not over five gallons capacity that is designed to safely relieve internal pressure when exposed to heat and has a spring-closing lid and spout cover.

[50 FR 4082, Jan. 29, 1985, as amended at 68 FR 32361, May 30, 2003; 69 FR 38842, June 29, 2004]

§ 57.4011 Abandoned electric circuits

Abandoned electric circuits shall be deenergized and isolated so that they cannot become energized inadvertently.

§ 57.4057 Underground trailing cables

Underground trailing cables shall be accepted or approved by MSHA as flame resistant.

[57 FR 61223, Dec. 23, 1992]

Prohibitions/Precautions/Housekeeping

§ 57.4100 Smoking and use of open flames

No person shall smoke or use an open flame where flammable or combustible liquids, including greases, or flammable gases are -

(a) Used or transported in a manner that could create a fire hazard; or

(b) Stored or handled.

§ 57.4101 Warning signs

Readily visible signs prohibiting smoking and open flames shall be posted where a fire or explosion hazard exists.

§ 57.4102 Spillage and leakage

Flammable or combustible liquid spillage or leakage shall be removed in a timely manner or controlled to prevent a fire hazard.

§ 57.4103 Fueling internal combustion engines

Internal combustion engines shall be switched off before refueling if the fuel tanks are integral parts of the equipment. This standard does not apply to diesel-powered equipment.

§ 57.4104 Combustible waste

(a) Waste materials, including liquids, shall not accumulate in quantities that could create a fire hazard.

(b) Waste or rags containing flammable or combustible liquids that could create a fire hazard shall be placed in the following containers until disposed of properly:

(1) Underground - covered metal containers.

(2) On the surface - covered metal containers or equivalent containers with flame containment characteristics.

§ 57.4130 Surface electric substations and liquid storage facilities

The requirements of this standard apply to surface areas only.

(a) If a hazard to persons could be created, no combustible materials shall be stored or allowed to accumulate within 25 feet of the following:

(1) Electric substations.

(2) Unburied, flammable or combustible liquid storage tanks.

(3) Any group of containers used for storage of more than 60 gallons of flammable or combustible liquids.

(b) The area within the 25-foot perimeter shall be kept free of dry vegetation.

§ 57.4131 Surface fan installations and mine openings

(a) On the surface, no more than one day's supply of combustible materials shall be stored within 100 feet of mine openings or within 100 feet of fan installations used for underground ventilation.

(b) The one-day supply shall be kept at least 25 feet away from any mine opening except during transit into the mine.

(c) Dry vegetation shall not be permitted within 25 feet of mine openings.

§ 57.4160 Underground electric substations and liquid storage facilities

The requirements of this standard apply to underground areas only.

(a) Areas within 25 feet of the following shall be free of combustible materials:

(1) Electric substations.

(2) Unburied, combustible liquid storage tanks.

(3) Any group of containers used for storage of more than 60 gallons of combustible liquids.

(b) This standard does not apply to installed wiring or timber that is coated with at least one inch of shotcrete, one-half inch of gunite, or other noncombustible materials with equivalent fire protection characteristics.

§ 57.4161 Use of fire underground

Fires shall not be lit underground, except for open-flame torches. Torches shall be attended at all times while lit.

Firefighting Equipment

§ 57.4200 General requirements

(a) For fighting fires that could endanger persons, each mine shall have -

(1) Onsite firefighting equipment for fighting fires in their early stages; and

(2) Onsite firefighting equipment for fighting fires beyond their early stages, or the mine shall have made prior arrangements with a local fire department to fight such fires.

(b) This onsite firefighting equipment shall be -

(1) Of the type, size, and quantity that can extinguish fires of any class which would occur as a result of the hazards present; and

(2) Strategically located, readily accessible, plainly marked, and maintained in fire-ready condition.

[50 FR 4082, Jan. 29, 1985, as amended at 50 FR 20100, May 14, 1985]

§ 57.4201 Inspection

(a) Firefighting equipment shall be inspected according to the following schedules:

(1) Fire extinguishers shall be inspected visually at least once a month to determine that they are fully charged and operable.

(2) At least once every twelve months, maintenance checks shall be made of mechanical parts, the amount and condition of extinguishing agent and expellant, and the condition of the hose, nozzle, and vessel to determine that the fire extinguishers will operate effectively.

(3) Fire extinguishers shall be hydrostatically tested according to Table C-1 or a schedule based on the manufacturer’s specifications to determine the integrity of extinguishing agent vessels.

(4) Water pipes, valves, outlets, hydrants, and hoses that are part of the mine’s firefighting system shall be visually inspected at least once every

three months for damage or deterioration and use-tested at least once every twelve months to determine that they remain functional.

(5) Fire suppression systems shall be inspected at least once every twelve months. An inspection schedule based on the manufacturer's specifications or the equivalent shall be established for individual components of a system and followed to determine that the system remains functional. Surface fire suppression systems are exempt from these inspection requirements if the systems are used solely for the protection of property and no persons would be affected by a fire.

(b) At the completion of each inspection or test required by this standard, the person making the inspection or test shall certify that the inspection or test has been made and the date on which it was made. Certifications of hydrostatic testing shall be retained until the fire extinguisher is retested or permanently removed from service. Other certifications shall be retained for one year.

Table C-1 - Hydrostatic Test Intervals for Fire Extinguishers

Extinguisher type	Test interval (years)
Soda Acid	5
Cartridge-Operated Water and/or Antifreeze	5
Stored-Pressure Water and/or Antifreeze	5
Wetting Agent	5
Foam	5
AFFF (Aqueous Film Forming Foam)	5
Loaded Stream	5
Dry-Chemical with Stainless Steel Shells	5
Carbon Dioxide	5
Dry-Chemical, Stored Pressure, with Mild Steel Shells, Brazed Brass Shells, or Aluminum Shells	12
Dry-Chemical, Cartridge or Cylinder Operated, with Mild Steel Shells	12
Bromotrifluoromethane-Halon 1301	12
Bromochlorodifluoromethane-Halon 1211	12
Dry-Powder, Cartridge or Cylinder-Operated, with Mild Steel Shells[1]	12

[1] Except for stainless steel and steel used for compressed gas cylinders, all other steel shells are defined as "mild steel" shells.

§ 57.4202 Fire hydrants

If fire hydrants are part of the mine's firefighting system, the hydrants shall be provided with -

(a) Uniform fittings or readily available adapters for onsite firefighting equipment;

(b) Readily available wrenches or keys to open the valves; and

(c) Readily available adapters capable of connecting hydrant fittings to the hose equipment of any firefighting organization relied upon by the mine.

§ 57.4203 Extinguisher recharging or replacement

Fire extinguishers shall be recharged or replaced with a fully charged extinguisher promptly after any discharge.

§ 57.4230 Surface self-propelled equipment

(a) (1) Whenever a fire or its effects could impede escape from self-propelled equipment, a fire extinguisher shall be on the equipment.

(2) Whenever a fire or its effects would not impede escape from the equipment but could affect the escape of other persons in the area, a fire extinguisher shall be on the equipment or within 100 feet of the equipment.

(b) A fire suppression system may be used as an alternative to fire extinguishers if the system can be manually activated.

(c) Fire extinguishers or fire suppression systems shall be of a type and size that can extinguish fires of any class in their early stages which could originate from the equipment's inherent fire hazards. Fire extinguishers or manual actuators for the suppression system shall be located to permit their use by persons whose escape could be impeded by fire.

§ 57.4260 Underground self-propelled equipment

(a) Whenever self-propelled equipment is used underground, a fire extinguisher shall be on the equipment. This standard does not apply to compressed-air powered equipment without inherent fire hazards.

(b) A fire suppression system may be used as an alternative to fire extinguishers if the system can be manually actuated.

(c) Fire extinguishers or fire suppression systems shall be of a type and size that can extinguish fires of any class in their early stages which could originate from the

equipment's inherent fire hazards. The fire extinguishers or the manual actuator for the suppression system shall be readily accessible to the equipment operator.

§ 57.4261 Shaft-station waterlines

Waterline outlets that are located at underground shaft stations and are part of the mine's fire protection system shall have at least one fitting located for, and capable of, immediate connection to firefighting equipment.

§ 57.4262 Underground transformer stations, combustible liquid storage and dispensing areas, pump rooms, compressor rooms, and hoist rooms

Transformer stations, storage and dispensing areas for combustible liquids, pump rooms, compressor rooms, and hoist rooms shall be provided with fire protection of a type, size, and quantity that can extinguish fires of any class in their early stages which could occur as a result of the hazards present.

§ 57.4263 Underground belt conveyors

Fire protection shall be provided at the head, tail, drive, and take-up pulleys of underground belt conveyors. Provisions shall be made for extinguishing fires along the beltline. Fire protection shall be of a type, size, and quantity that can extinguish fires of any class in their early stages which could occur as a result of the fire hazards present.

Firefighting Procedures/Alarms/Drills

§ 57.4330 Surface firefighting, evacuation, and rescue procedures

(a) Mine operators shall establish emergency firefighting, evacuation, and rescue procedures for the surface portions of their operations. These procedures shall be coordinated in advance with available firefighting organizations.

(b) Fire alarm procedures or systems shall be established to promptly warn every person who could be endangered by a fire.

(c) Fire alarm systems shall be maintained in operable condition.

§ 57.4331 Surface firefighting drills

Emergency firefighting drills shall be held at least once every six months for persons assigned surface firefighting responsibilities by the mine operator.

§ 57.4360 Underground alarm systems

(a) Fire alarm systems capable of promptly warning every person underground, except as provided in paragraph (b), shall be provided and maintained in operating condition.

(b) If persons are assigned to work areas beyond the warning capabilities of the system, provisions shall be made to alert them in a manner to provide for their safe evacuation in the event of a fire.

§ 57.4361 Underground evacuation drills

(a) At least once every six months, mine evacuation drills shall be held to assess the ability of all persons underground to reach the surface or other designated points of safety within the time limits of the self-rescue devices that would be used during an actual emergency.

(b) The evacuation drills shall -

(1) Be held for each shift at some time other than a shift change and involve all persons underground;

(2) Involve activation of the fire alarm system; and

(3) Include evacuation of all persons from their work areas to the surface or to designated central evacuation points.

(c) At the completion of each drill, the mine operator shall certify the date and the time the evacuation began and ended. Certifications shall be retained for at least one year after each drill.

§ 57.4362 Underground rescue and firefighting operations

Following evacuation of a mine in a fire emergency, only persons wearing and trained in the use of mine rescue apparatus shall participate in rescue and firefighting operations in advance of the fresh air base.

§ 57.4363 Underground evacuation instruction

(a) At least once every twelve months, all persons who work underground shall be instructed in the escape and evacuation plans and procedures and fire warning signals in effect at the mine.

(b) Whenever a change is made in escape and evacuation plans and procedures for any area of the mine, all persons affected shall be instructed in the new plans or procedures.

(c) Whenever persons are assigned to work in areas other than their regularly assigned areas, they shall be instructed about the escapeway for that area at the time of such assignment. However, persons who normally work in more than one area of the mine shall be instructed at least once every twelve months about the location of escapeways for all areas of the mine in which they normally work or travel.

(d) At the completion of any instruction given under this standard, the mine operator shall certify the date that the instruction was given. Certifications shall be retained for at least one year.

Flammable and Combustible Liquids and Gases

§ 57.4400 Use restrictions

(a) Flammable liquids shall not be used for cleaning.

(b) Solvents shall not be used near an open flame or other ignition source, near any source of heat, or in an atmosphere that can elevate the temperature of the solvent above the flash point.

§ 57.4401 Storage tank foundations

Fixed, unburied, flammable or combustible liquid storage tanks shall be securely mounted on firm foundations. Piping shall be provided with flexible connections or other special fittings where necessary to prevent leaks caused by tanks settling.

§ 57.4402 Safety can use

Small quantities of flammable liquids drawn from storage shall be kept in safety cans labeled to indicate the contents.

§ 57.4430 Surface storage facilities

The requirements of this standard apply to surface areas only.

(a) Storage tanks for flammable or combustible liquids shall be -

(1) Capable of withstanding working pressures and stresses and compatible with the type of liquid stored;

(2) Maintained in a manner that prevents leakage;

(3) Isolated or separated from ignition sources to prevent fire or explosion; and

(4) Vented or otherwise constructed to prevent development of pressure or vacuum as a result of filling, emptying, or atmospheric temperature changes. Vents for storage of Class I, II, or IIIA liquids shall be isolated or separated from ignition sources. These pressure relief requirements do not apply to tanks used for storage of Class IIIB liquids that are larger than 12,000 gallons in capacity.

(b) All piping, valves, and fittings shall be -

(1) Capable of withstanding working pressures and stresses;

(2) Compatible with the type of liquid stored; and

(3) Maintained in a manner that prevents leakage.

(c) Fixed, unburied tanks located where escaping liquid could present a hazard to persons shall be provided with -

(1) Containment for the entire capacity of the largest tank; or

(2) Drainage to a remote impoundment area that does not endanger persons. However, storage of only Class IIIB liquids does not require containment or drainage to remote impoundment.

§ 57.4431 Surface storage restrictions

(a) On the surface, no unburied flammable or combustible liquids or flammable gases shall be stored within 100 feet of the following:

(1) Mine openings or structures attached to mine openings.

(2) Fan installations for underground ventilation.

(3) Hoist houses.

(b) Under this standard, the following may be present in the hoist house in quantities necessary for the day-to-day maintenance of the hoist machinery:

(1) Flammable liquids in safety cans or in other containers placed in tightly closed cabinets. The safety cans and cabinets shall be kept away from any heat source, and each cabinet shall be labeled “flammables.”

(2) Combustible liquids in closed containers. The containers shall be kept away from any heat source and the hoist operator’s workstation.

§ 57.4460 Storage of flammable liquids underground

(a) Flammable liquids shall not be stored underground, except -

(1) Small quantities stored in tightly closed cabinets away from any heat source. The small quantities shall be stored in safety cans or in non-glass containers of a capacity equal to or less than a safety can. Each cabinet shall be labeled “flammables.”

(2) Acetylene and liquefied petroleum gases stored in containers designed for that specific purpose.

(b) Gasoline shall not be stored underground in any quantity.

§ 57.4461 Gasoline use restrictions underground

If gasoline is used underground to power internal combustion engines -

(a) The mine shall be nongassy and shall have multiple horizontal or inclined roadways from the surface large enough to accommodate vehicular traffic;

(b) All roadways and other openings shall connect with another opening every 100 feet by a passage large enough to accommodate any vehicle in the mine or alternate routes shall provide equivalent escape capabilities; and

(c) No roadway or other opening shall be supported or lined with wood or other combustible materials.

§ 57.4462 Storage of combustible liquids underground

The requirements of this standard apply to underground areas only.

(a) Combustible liquids, including oil or grease, shall be stored in non-glass containers or storage tanks. The containers or storage tanks shall be -

(1) Capable of withstanding working pressures and stresses and compatible with the type of liquid stored;

(2) Maintained in a manner that prevents leakage;

(3) Located in areas free of combustible materials or in areas where any exposed combustible materials are coated with one inch of shotcrete, one-half inch of gunite, or other noncombustible material with equivalent fire protection characteristics; and

(4) Separated from explosives or blasting agents, shaft stations, and ignition sources including electric equipment that could create sufficient heat or sparks to pose a fire hazard. Separation shall be sufficient to prevent the occurrence or minimize the spread of fire.

(b) Storage tanks shall be vented or otherwise constructed to prevent development of pressure or vacuum as a result of filling, emptying, or atmospheric temperature changes. Vents for storage of Class II or IIIA liquids shall be isolated or separated from ignition sources.

(c) At permanent storage areas for combustible liquids, means shall be provided for confinement or removal of the contents of the largest storage tank in the event of tank rupture.

(d) All piping, valves, and fittings shall be:

(1) Capable of withstanding working pressures and stresses;

(2) Compatible with the type of liquid stored; and

(3) Maintained in a manner which prevents leakage.

§ 57.4463 Liquefied petroleum gas use underground

Use of liquefied petroleum gases underground shall be limited to maintenance work.

Installation/Construction/Maintenance

§ 57.4500 Heat sources

Heat sources capable of producing combustion shall be separated from combustible materials if a fire hazard could be created.

§ 57.4501 Fuel lines

Fuel lines shall be equipped with valves capable of stopping the flow of fuel at the source and shall be located and maintained to minimize fire hazards. This standard does not apply to fuel lines on self-propelled equipment.

§ 57.4502 Battery-charging stations

(a) Battery-charging stations shall be ventilated with a sufficient volume of air to prevent the accumulation of hydrogen gas.

(b) Smoking, use of open flames, or other activities that could create an ignition source shall be prohibited at the battery charging station during battery charging.

(c) Readily visible signs prohibiting smoking or open flames shall be posted at battery-charging stations during battery charging.

§ 57.4503 Conveyor belt slippage

(a) Surface belt conveyors within confined areas where evacuation would be restricted in the event of a fire resulting from belt-slippage shall be equipped with a detection system capable of automatically stopping the drive pulley.

(b) Underground belt conveyors shall be equipped with a detection system capable of automatically stopping the drive pulley if slippage could cause ignition of the belt.

(c) A person shall attend the belt at the drive pulley when it is necessary to operate the conveyor while temporarily bypassing the automatic function.

§ 57.4504 Fan installations

(a) Fan houses, fan bulkheads for main and booster fans, and air ducts connecting main fans to underground openings shall be constructed of noncombustible materials.

(b) Areas within 25 feet of main fans or booster fans shall be free of combustible materials, except installed wiring, ground and track support, headframes, and direct-fired heaters. Other timber shall be coated with one inch of shotcrete, one-half inch of gunite, or other noncombustible materials.

§ 57.4505 Fuel lines to underground areas

Fuel lines into underground storage or dispensing areas shall be drained at the completion of each transfer of fuel unless the following requirements are met:

(a) The valve at the supply source shall be kept closed when fuel is not being transferred.

(b) The fuel line shall be -

(1) Capable of withstanding working pressures and stresses;

(2) Located to prevent damage; and

(3) Located in areas free of combustible materials or in areas where any exposed combustible materials are coated with one inch of shotcrete, one-half inch of gunite, or other noncombustible material with equivalent fire protection characteristics.

(c) Provisions shall be made for control or containment of the entire volume of the fuel line so that leakage will not create a fire hazard.

§ 57.4530 Exits for surface buildings and structures

Surface buildings or structures in which persons work shall have a sufficient number of exits to permit prompt escape in case of fire.

§ 57.4531 Surface flammable or combustible liquid storage buildings or rooms

(a) Surface storage buildings or storage rooms in which flammable or combustible liquids, including grease, are stored and that are within 100 feet of any person's workstation shall be ventilated with a sufficient volume of air to prevent the accumulation of flammable vapors.

(b) In addition, the buildings or rooms shall be -

(1) Constructed to meet a fire resistance rating of at least one hour; or

(2) Equipped with an automatic fire suppression system; or

(3) Equipped with an early warning fire detection device that will alert any person who could be endangered by a fire, provided that no person's workstation is in the building.

(c) Flammable or combustible liquids in use for day-to-day maintenance and operational activities are not considered in storage under this standard.

§ 57.4532 Blacksmith shops

Blacksmith shops located on the surface shall be -

(a) At least 100 feet from fan installations used for intake air and mine openings;

(b) Equipped with exhaust vents over the forge and ventilated to prevent the accumulation of the products of combustion; and

(c) Inspected for smoldering fires at the end of each shift.

§ 57.4533 Mine opening vicinity

Surface buildings or other similar structures within 100 feet of mine openings used for intake air or within 100 feet of mine openings that are designated escapeways in exhaust air shall be -

(a) Constructed of noncombustible materials; or

(b) Constructed to meet a fire resistance rating of no less than one hour; or

(c) Provided with an automatic fire suppression system; or

(d) Covered on all combustible interior and exterior structural surfaces with noncombustible material or limited combustible material, such as five-eighth inch, type “X” gypsum wallboard.

§ 57.4560 Mine entrances

For at least 200 feet inside the mine portal or collar timber used for ground support in intake openings and in exhaust openings that are designated as escapeways shall be -

(a) Provided with a fire suppression system, other than fire extinguishers and water hoses, capable of controlling a fire in its early stages; or

(b) Covered with shotcrete, gunite, or other material with equivalent fire protection characteristics; or

(c) Coated with fire-retardant paint or other material to reduce its flame spread rating to 25 or less and maintained in that condition.

[50 FR 4082, Jan. 29, 1985, as amended at 50 FR 20100, May 14, 1985]

§ 57.4561 Stationary diesel equipment underground

Stationary diesel equipment underground shall be -

(a) Supported on a noncombustible base; and

(b) Provided with a thermal sensor that automatically stops the engine if overheating occurs.

Welding/Cutting/Compressed Gases

§ 57.4600 Extinguishing equipment

(a) When welding, cutting, soldering, thawing, or bending -

(1) With an electric arc or with an open flame where an electrically conductive extinguishing agent could create an electrical hazard, a multipurpose dry-chemical fire extinguisher or other extinguisher with at least a 2-A:10-B:C rating shall be at the worksite.

(2) With an open flame in an area where no electrical hazard exists, a multipurpose dry-chemical fire extinguisher or equivalent fire extinguishing equipment for the class of fire hazard present shall be at the worksite.

(b) Use of halogenated fire extinguishing agents to meet the requirements of this standard shall be limited to Halon 1211 ($CBrClF_2$) and Halon 1301 ($CBrF_3$). When these agents are used in confined or unventilated areas, precautions based on the manufacturer's use instructions shall be taken so that the gases produced by thermal decomposition of the agents are not inhaled.

§ 57.4601 Oxygen cylinder storage

Oxygen cylinders shall not be stored in rooms or areas used or designated for storage of flammable or combustible liquids, including grease.

§ 57.4602 Gauges and regulators

Gauges and regulators used with oxygen or acetylene cylinders shall be kept clean and free of oil and grease.

§ 57.4603 Closure of valves

To prevent accidental release of gases from hoses and torches attached to oxygen and acetylene cylinders or to manifold systems, cylinder or manifold system valves shall be closed when -

(a) The cylinders are moved;

(b) The torch and hoses are left unattended; or

(c) The task or series of tasks is completed.

§ 57.4604 Preparation of pipelines or containers

Before welding, cutting, or applying heat with an open flame to pipelines or containers that have contained flammable or combustible liquids, flammable gases, or explosive solids, the pipelines or containers shall be -

(a) Drained, ventilated, and thoroughly cleaned of any residue;

(b) Vented to prevent pressure build-up during the application of heat; and

(c) (1) Filled with an inert gas or water, where compatible; or

(2) Determined to be free of flammable gases by a flammable gas detection device prior to and at frequent intervals during the application of heat.

§ 57.4660 Work in shafts, raises, or winzes and other activities involving hazard areas

During performance of an activity underground described in Table C-2 or when falling sparks or hot metal from work performed in a shaft, raise, or winze could pose a fire hazard -

(a) A multipurpose dry-chemical fire extinguisher shall be at the worksite to supplement the fire extinguishing equipment required by § 57.4600; and

(b) At least one of the following actions shall be taken:

(1) Wet down the area before and after the operation, taking precaution against any hazard of electrical shock.

(2) Isolate any combustible material with noncombustible material.

(3) Shield the activity so that hot metal and sparks cannot cause a fire.

(4) Provide a second person to watch for and extinguish any fire.

Table C-2

Activity	Distance	Fire hazard
Welding or cutting with an electric arc or open flame		More than 1 gallon of combustible liquid, unless in a closed, metal container.
Using an open flame to bend or heat materials	Within 35 feet of -	More than 50 pounds of non-fire-retardant wood.
Thawing pipes electrically, except with heat tape		More than 10 pounds of combustible plastics.
Soldering or thawing with an open flame	Within 10 feet of -	Materials in a shaft, raise, or winze that could be ignited by hot metal or sparks.

(5) Cover or bulkhead the opening immediately below and adjacent to the activity with noncombustible material to prevent sparks or hot metal from falling down the shaft, raise, or winze. This alternative applies only to activities involving a shaft, raise, or winze.

(c) The affected area shall be inspected during the first hour after the operation is completed. Additional inspections shall be made, or other fire prevention measures shall be taken if a fire hazard continues to exist.

Ventilation Control Measures

§ 57.4760 Shaft mines

(a) Shaft mines shall be provided with at least one of the following means to control the spread of fire, smoke, and toxic gases underground in the event of a fire: control doors, reversal of mechanical ventilation, or effective evacuation procedures. Under this standard, "shaft mine" means a mine in which any designated escapeway includes a mechanical hoisting device or a ladder ascent.

(1) **Control doors**. If used as an alternative, control doors shall be -

(i) Installed at or near shaft stations of intake shafts and any shaft designated as an escapeway under § 57.11053 or at other locations that provide equivalent protection;

(ii) Constructed and maintained according to Table C-3;

(iii) Provided with a means of remote closure at landings of timbered intake shafts unless a person specifically designated to close each door in the event of a fire can reach the door within three minutes;

(iv) Closed or opened only according to predetermined conditions and procedures;

(v) Constructed so that once closed they will not reopen as a result of a differential in air pressure;

(vi) Constructed so that they can be opened from either side by one person, or be provided with a personnel door that can be opened from either side; and

(vii) Clear of obstructions.

(2) **Mechanical ventilation reversal**. If used as an alternative, reversal of mechanical ventilation shall -

(i) Provide at all times at least the same degree of protection to persons underground as would be afforded by the installation of control doors;

(ii) Be accomplished by a main fan. If the main fan is located underground -

(A) The cable or conductors supplying power to the fan shall be routed through areas free of fire hazards; or

(B) The main fan shall be equipped with a second, independent power cable or set of conductors from the surface. The power cable or conductors shall be located so that an underground fire disrupting power in one cable or set of conductors will not affect the other; or

(C) A second fan capable of accomplishing ventilation reversal shall be available for use in the event of failure of the main fan;

(iii) Provide rapid air reversal that allows persons underground time to exit in fresh air by the second escapeway or find a place of refuge; and

(iv) Be done according to predetermined conditions and procedures.

(3) **Evacuation**. If used as an alternative, effective evacuation shall be demonstrated by actual evacuation of all persons underground to the surface in ten minutes or less through routes that will not expose persons to heat, smoke, or toxic fumes in the event of a fire.

(b) If the destruction of any bulkhead on an inactive level would allow fire contaminants to reach an escapeway, that bulkhead shall be constructed and maintained to provide at least the same protection as required for control doors under Table C-3.

Table C-3 - Control Door Construction

Location	Minimum required construction
At least 50 feet from: timbered areas, exposed combustible rock, and any other combustible material[1]	Control door that meets the requirements for a ventilation door in conformance with 30 CFR 57.8531.
Within 50 feet but no closer than 20 feet of: timbered areas, exposed combustible rock, or other combustible material[1] Within 20 feet of: any timbered areas or combustible rock, provided that the timber and combustible rock within the 20 foot distance are coated with one inch of shotcrete, one-half inch of gunite, or other material with equivalent fire protection characteristics and no other combustible material[1] is within that distance	Control door that serves as a barrier to the effects of fire and air leakage. The control door shall provide protection at least equivalent to a door constructed of no less than one-quarter inch of plate steel with channel or angle-iron reinforcement to minimize warpage. The framework assembly of the door and the surrounding bulkhead, if any, shall be at least equivalent to the door in fire and air-leakage resistance, and in physical strength.
Within 20 feet of: timbered areas, exposed combustible rock, or other combustible material[1]	Control door that serves as a barrier to fire, the effects of fire, and air-leakage. The door shall provide protection at least equivalent to a door constructed of two layers of wood, each a minimum of three-quarters of an inch in thickness. The wood grain of one layer shall be perpendicular to the wood grain of the other layer. The wood construction shall be covered on all sides and edges with no less than twenty-four-gauge sheet steel. The framework assembly of the door and the surrounding bulkhead, if any, shall be at least equivalent to the door in fire and air-leakage resistance, and in physical strength. Roll-down steel doors with a fire-resistance rating of 1½ hours or greater, but without an insulation core, are acceptable if an automatic sprinkler or deluge system is installed that provides even coverage of the door on both sides.

[1] In this table, "combustible material" does not refer to installed wiring or track support.

[50 FR 4082, Jan. 29, 1985; 50 FR 20100, May 14, 1985]

§ 57.4761 Underground shops

To confine or prevent the spread of toxic gases from a fire originating in an underground shop where maintenance work is routinely done on mobile equipment, one of the following measures shall be taken: use of control doors or bulkheads, routing of the mine shop air directly to an exhaust system, reversal of mechanical ventilation, or use of an automatic fire suppression system in conjunction with an alternate escape route. The alternative used shall at all times provide at least the same degree of safety as control doors or bulkheads.

(a) **Control doors or bulkheads**. If used as an alternative, control doors or bulkheads shall meet the following requirements:

(1) Each control door or bulkhead shall be constructed to serve as a barrier to fire, the effects of fire, and air leakage at each opening to the shop.

(2) Each control door shall be -

(i) Constructed so that, once closed, it will not reopen as a result of a differential in air pressure;

(ii) Constructed so that it can be opened from either side by one person or be provided with a personnel door that can be opened from either side;

(iii) Clear of obstructions; and

(iv) Provided with a means of remote or automatic closure unless a person specifically designated to close the door in the event of a fire can reach the door within three minutes.

(3) If located 20 feet or more from exposed timber or other combustible material, the control doors or bulkheads shall provide protection at least equivalent to a door constructed of no less than one-quarter inch of plate steel with channel or angle-iron reinforcement to minimize warpage. The framework assembly of the door and the surrounding bulkhead, if any, shall be at least equivalent to the door in fire and air-leakage resistance, and in physical strength.

(4) If located less than 20 feet from exposed timber or other combustibles, the control door or bulkhead shall provide protection at least equivalent to a door constructed of two layers of wood, each a minimum of three-quarters of an inch in thickness. The woodgrain of one layer shall be perpendicular to the woodgrain of the other layer. The wood construction shall be covered on all sides and edges with no less than 24-gauge sheet steel. The framework assembly of the door and the surrounding bulkhead, if any, shall be at least equivalent to the door in fire and air-leakage resistance, and in physical strength. Roll-down steel doors with a fire-resistance

rating of 1½ hours or greater, but without an insulation core, are acceptable provided that an automatic sprinkler or deluge system is installed that provides even coverage of the door on both sides.

(b) **Routing air to exhaust system**. If used as an alternative, routing the mine shop exhaust air directly to an exhaust system shall be done so that no person would be exposed to toxic gases in the event of a shop fire.

(c) **Mechanical ventilation reversal**. If used as an alternative, reversal of mechanical ventilation shall -

(1) Be accomplished by a main fan. If the main fan is located underground:

(i) The cable or conductors supplying power to the fan shall be routed through areas free of fire hazards; or

(ii) The main fan shall be equipped with a second, independent power cable or set of conductors from the surface. The power cable or conductors shall be located so that an underground fire disrupting power in one cable or set of conductors will not affect the other; or

(iii) A second fan capable of accomplishing ventilation reversal shall be available for use in the event of failure of the main fan;

(2) Provide rapid air reversal that allows persons underground time to exit in fresh air by the second escapeway or find a place of refuge; and

(3) Be done according to predetermined conditions and procedures.

(d) **Automatic fire suppression system and escape route**. If used as an alternative, the automatic fire suppression system and alternate escape route shall meet the following requirements:

(1) The suppression system shall be -

(i) Located in the shop area;

(ii) The appropriate size and type for the particular fire hazards involved; and

(iii) Inspected at weekly intervals and properly maintained.

(2) The escape route shall bypass the shop area so that the route will not be affected by a fire in the shop area.

Appendix I to Subpart C of Part 57 - NATIONAL CONSENSUS STANDARDS

Mine operators seeking further information in the area of fire prevention and control may consult the following national consensus standards.

MSHA standard	National consensus standard
§ § 57.4200, 57.4201, 57.4261, and 57.4262	NFPA No. 10 - Portable Fire Extinguisher. NFPA No. 11 - Low Expansion Foam and Combined Agent Systems. NFPA No. 11A - High Expansion Foam Systems.
	NFPA No. 12 - Carbon Dioxide Extinguishing Systems.
	NFPA No. 12A - Halon 1301 Extinguishing Systems.
	NFPA No. 13 - Water Sprinkler Systems.
	NFPA No. 14 - Standpipe and Hose Systems.
	NFPA No. 15 - Water Spray Fixed Systems.
	NFPA No. 16 - Foam Water Spray Systems.
	NFPA No. 17 - Dry-Chemical Extinguishing Systems.
	NFPA No. 121 - Mobile Surface Mining Equipment.
	NFPA No. 291 - Testing and Marking Hydrants.
	NFPA No. 1962 - Care, Use, and Maintenance of Fire Hose, Connections, and Nozzles.
§ 57.4202	NFPA No. 14 - Standpipe and Hose Systems.
	NFPA No. 291 - Testing and Marking Hydrants.
§ 57.4203	NFPA No. 10 - Portable Fire Extinguishers.
§ 57.4230	NFPA No. 10 - Portable Fire Extinguishers.
	NFPA No. 121 - Mobile Surface Mining Equipment.
§ 57.4260	NFPA No. 10 - Portable Fire Extinguishers.
§ 57.4261	NFPA No. 14 - Standpipe and Hose Systems.
§ 57.4533	NFPA Fire Protection Handbook.
§ 57.4560	ASTM E-162 - Surface Flammability of Materials Using a Radiant Heat Energy Source.

Subpart D - AIR QUALITY, RADIATION, PHYSICAL AGENTS, AND DIESEL PARTICULATE MATTER

Air Quality - Surface and Underground

§ 57.5001 Exposure limits for airborne contaminants

Except as permitted by § 57.5005 -

(a) Except as provided in paragraph (b), the exposure to airborne contaminants shall not exceed, on the basis of a time weighted average, the threshold limit values adopted by the American Conference of Governmental Industrial Hygienists, as set forth and explained in the 1973 edition of the Conference's publication, entitled "TLV's Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1973," pages 1 through 54, which are hereby incorporated by reference and made a part hereof. This publication may be obtained from the American Conference of Governmental Industrial Hygienists by writing to 1330 Kemper Meadow Drive, Attn: Customer Service, Cincinnati, OH 45240, *http://www.acgih.org*, or may be examined in any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration. Excursions above the listed thresholds shall not be of a greater magnitude than is characterized as permissible by the Conference.

(b) **Asbestos standard** -

(1) **Definitions**. Asbestos is a generic term for a number of asbestiform hydrated silicates that, when crushed or processed, separate into flexible fibers made up of fibrils.

Asbestos means chrysotile, cummingtonite-grunerite asbestos (amosite), crocidolite, anthophyllite asbestos, tremolite asbestos, and actinolite asbestos.

Asbestos fiber means a fiber of asbestos that meets the criteria of a fiber.

Fiber means a particle longer than 5 micrometers (μm) with a length-to-diameter ratio of at least 3-to-1.

(2) **Permissible Exposure Limits** (**PELs**) -

(i) **Full-shift limit**. A miner's personal exposure to asbestos shall not exceed an 8-hour time-weighted average full-shift airborne concentration of 0.1 fiber per cubic centimeter of air (f/cc).

(ii) **Excursion limit**. No miner shall be exposed at any time to airborne concentrations of asbestos in excess of 1 fiber per cubic centimeter of air (f/cc) as averaged over a sampling period of 30 minutes.

(3) **Measurement of airborne asbestos fiber concentration**. Potential asbestos fiber concentration shall be determined by phase contrast microscopy (PCM) using the OSHA Reference Method in OSHA's asbestos standard found in 29 CFR 1910.1001, Appendix A, or a method at least equivalent to that method in identifying a potential asbestos exposure exceeding the 0.1 f/cc full-shift limit or the 1 f/cc excursion limit. When PCM results indicate a potential exposure exceeding the 0.1 f/cc full-shift limit or the 1 f/cc excursion limit, samples shall be further analyzed using transmission electron microscopy according to NIOSH Method 7402 or a method at least equivalent to that method.

(c) Employees shall be withdrawn from areas where there is present an airborne contaminant given a "C" designation by the Conference and the concentration exceeds the threshold limit value listed for that contaminant.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 35695, July 11, 1995; 71 FR 16667, Apr. 3, 2006; 73 FR 11303, Feb. 29, 2008; 73 FR 66172, Nov. 7, 2008]

§ 57.5002 Exposure monitoring

Dust, gas, mist, and fume surveys shall be conducted as frequently as necessary to determine the adequacy of control measures.

§ 57.5005 Control of exposure to airborne contaminants

Control of employee exposure to harmful airborne contaminants shall be, insofar as feasible, by prevention of contamination, removal by exhaust ventilation, or by dilution with uncontaminated air. However, where accepted engineering control measures have not been developed or when necessary by the nature of work involved (for example, while establishing controls or occasional entry into hazardous atmospheres to perform maintenance or investigation), employees may work for reasonable periods of time in concentrations of airborne contaminants exceeding permissible levels if they are protected by appropriate respiratory protective equipment. Whenever respiratory protective equipment is used a program for selection, maintenance, training, fitting, supervision, cleaning, and use shall meet the following minimum requirements:

(a) Respirators approved by NIOSH under 42 CFR part 84 which are applicable and suitable for the purpose intended shall be furnished and miners shall use the protective equipment in accordance with training and instruction.

(b) A respirator program consistent with the requirements of ANSI Z88.2-1969, published by the American National Standards Institute and entitled "American National Standards Practices for Respiratory Protection ANSI Z88.2-1969,"

approved August 11, 1969, which is hereby incorporated by reference and made a part hereof. This publication may be obtained from the American National Standards Institute, Inc., 25 W. 43rd Street, 4th Floor, New York, NY 10036; *http://www.ansi.org*, or may be examined in any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration.

(c) When respiratory protection is used in atmospheres immediately harmful to life, the presence of at least one other person with backup equipment and rescue capability shall be required in the event of failure of the respiratory equipment.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 30400, June 8, 1995; 60 FR 33723, June 29, 1995; 60 FR 35695, July 11, 1995; 71 FR 16667, Apr. 3, 2006]

§ 57.5006 Restricted use of chemicals

The following chemical substances shall not be used or stored except by competent persons under laboratory conditions approved by a nationally recognized agency acceptable to the Secretary.

(a) Carbon tetrachloride,

(b) Phenol,

(c) 4-Nitrobiphenyl,

(d) Alpha-naphthylamine,

(e) 4,4-Methylene Bis (2-chloroaniline),

(f) Methyl-chloromethyl ether,

(g) 3,3 Dichlorobenzidine,

(h) Bis (chloromethyl) ether,

(i) Beta-naphthylamine,

(j) Benzidine,

(k) 4-Aminodiphenyl,

(l) Ethyleneimine,

(m) Beta-propiolactone,

(n) 2-Acetylaminofluorene,

(o) 4-Dimethylaminobenzene, and

(p) N-Nitrosodimethylamine.

Air Quality - Surface Only [Reserved]

Air Quality - Underground Only

§ 57.5015 Oxygen deficiency

Air in all active workings shall contain at least 19.5 volume percent oxygen.

Radiation - Underground Only

§ 57.5037 Radon daughter exposure monitoring

(a) In all mines at least one sample shall be taken in exhaust mine air by a competent person to determine if concentrations of radon daughters are present. Sampling shall be done using suggested equipment and procedures described in section 14.3 of ANSI N13.8-1973, entitled "American National Standard Radiation Protection in Uranium Mines," approved July 18, 1973, pages 13-15, by the American National Standards Institute, Inc., which is incorporated by reference and made a part of the standard or equivalent procedures and equipment acceptable to the Administrator, MSHA Metal and Nonmetal Mine Safety and Health district office. This publication may be examined at any Metal and Nonmetal Mine Safety and Health Subdistrict Office of the Mine Safety and Health Administration, or may be obtained from the American National Standards Institute, Inc., 25 W. 43rd Street, 4th Floor, New York, NY 10036; *http://www.ansi.org*. The mine operator may request that the required exhaust mine air sampling be done by the Mine Safety and Health Administration. If concentrations of radon daughters in excess of 0.1 WL are found in an exhaust air sample, thereafter -

(1) Where uranium is mined - radon daughter concentrations representative of worker's breathing zone shall be determined at least every two weeks at random times in all active working areas such as stopes, drift headings, travelways, haulageways, shops, stations, lunch rooms, magazines, and any other place or location where persons work, travel, or congregate. However, if concentrations of radon daughters are found in excess of 0.3 WL in an active working area, radon daughter concentrations thereafter shall be determined weekly in that working area until such time as the weekly determinations in that area have been 0.3 WL or less for 5 consecutive weeks.

(2) Where uranium is not mined - when radon daughter concentrations between 0.1 and 0.3 WL are found in an active working area, radon daughter concentration measurements representative of worker's breathing zone shall be determined at least every 3 months at random times until such time as the radon daughter concentrations in that area are below 0.1 WL, and annually thereafter. If concentrations of radon daughters are

found in excess of 0.3 WL in an active working area radon daughter concentrations thereafter shall be determined at least weekly in that working area until such time as the weekly determinations in that area have been 0.3 WL or less for 5 consecutive weeks.

(b) If concentrations of radon daughters less than 0.1 WL are found in an exhaust mine air sample, thereafter:

(1) Where uranium is mined - at least one sample shall be taken in the exhaust mine air monthly.

(2) Where uranium is not mined - no further exhaust mine air sampling is required.

(c) The sample date, locations, and results obtained under (a) and (b) above shall be recorded and retained at the mine site or nearest mine office for at least two years and shall be made available for inspection by the Secretary or his authorized representative.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33723, June 29, 1995; 71 FR 16667, Apr. 3, 2006]

§ 57.5038 Annual exposure limits

No person shall be permitted to receive an exposure in excess of 4 WLM in any calendar year.

§ 57.5039 Maximum permissible concentration

Except as provided by standard § 57.5005, persons shall not be exposed to air containing concentrations of radon daughters exceeding 1.0 WL in active workings.

§ 57.5040 Exposure records

(a) The operator shall calculate and record complete individual exposures to concentrations of radon daughters as follows:

(1) Where uranium is mined - the complete individual exposures of all mine personnel working underground shall be calculated and recorded. These records shall include the individual's time in each active working area such as stopes, drift headings, travelways, haulageways, shops, stations, lunch rooms, magazines and any other place or location where persons work, travel or congregate, and the concentration of airborne radon daughters for each active working area.

(2) Where uranium is not mined - the complete individual exposure of all mine personnel working in active working areas with radon daughter concentrations in excess of 0.3 WL shall be calculated and recorded.

These records shall include the individual's time in each active working area and the concentrations of airborne radon daughters for each active working area. The operator may discontinue calculating and recording the individual exposures of any personnel assigned to work in active working areas where radon daughter concentrations have been reduced to 0.3 WL or less for 5 consecutive weeks provided that such exposure calculation and recordation shall not be discontinued with respect to any person who has accumulated more exposure than 1⁄12 (one-twelfth) of a WLM times the number of months for which exposures have been calculated and recorded in the calendar year in which the exposure calculation and recordation is proposed to be discontinued.

(b) The operator shall maintain the form entitled "Record of Individual Exposure to Radon Daughters" (Form 4000-9), or equivalent forms that are acceptable to the Administrator, Metal and Nonmetal Mine Safety and Health, Mine Safety and Health Administration, on which there shall be recorded the specific information required by the form with respect to each person's time-weighted current and cumulative exposure to concentrations of radon daughters.

(1) The form entitled "Record of Individual Exposure to Radon Daughters" (Form 4000-9), shall consist of an original of each form for the operator's records which shall be available for examination by the Secretary or his authorized representative.

(2) On or before February 15 of each calendar year, or within 45 days after the shutdown of mining operations for the calendar year, each mine operator shall submit to the Mine Safety and Health Administration a copy of the "Record of Individual Exposure to Radon Daughters" (Form 4000-9), or acceptable equivalent form, showing the data required by the form for all personnel for whom calculation and recording of exposure was required during the previous calendar year.

(3) Errors detected by the operator shall be corrected on any forms kept by the operator and a corrected copy of any forms submitted to the Mine Safety and Health Administration shall be submitted to the Mine Safety and Health Administration within 60 days of detection and shall identify the errors and indicate the date the corrections are made.

(4) The operator's records of individual exposure to concentrations of radon daughters and copies of "Record of Individual Exposure to Radon Daughters" (Form 4000-9) or acceptable equivalent form or true legible facsimiles thereof (microfilm or other), shall be retained at the mine or nearest mine office for a period as specified in paragraph 9.8, ANSI N13.8-1973, or shall be submitted to the Mine Safety and Health Administration. These records, if retained by the operator, shall be open for inspection by the Secretary of Labor, his authorized representative, and authorized representatives of the official mine inspection agency of the

State in which the mine is located. Paragraph 9.8, ANSI N13.8-1973, is incorporated by reference and made a part of this standard. ANSI N13.8-1973 may be examined at any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration, and may be obtained from the American National Standards Institute, Inc., at 25 W. 43rd Street, 4th Floor, New York, NY 10036; *http://www.ansi.org*.

(5) Upon written request from a person who is a subject of these records, a statement of the year-to-date and cumulative exposure applicable to that person shall be provided to the person or to whomever such person designates.

(6) The blank form entitled "Record of Individual Exposure to Radon Daughters" (Form 4000-9) may be obtained on request from any MSHA Metal and Nonmetal Mine Safety and Health district office.

Note:

To calculate an individual's exposure to WLM for a given period of time, multiply the total exposure time (hours to the nearest half-hour) in an active working area by the average concentration of airborne radon daughters for the applicable active working area (average working level calculated to the nearest hundredth working level) and divide the product by the constant 173 hours per month.

An average airborne radon daughter concentration for a designated active working area shall be determined by averaging all sampling results for that working area during the time that persons are present. Any sample taken by Federal or State mine inspectors, which represents exposure to miners and reported to the operator within three days of being taken, shall be included in the average concentration; except that if the mine operator samples simultaneously with the inspector, he may use his own sample results.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33723, June 29, 1995; 60 FR 35695, July 11, 1995; 71 FR 16667, Apr. 3, 2006]

§ 57.5041 Smoking prohibition

Smoking shall be prohibited in all areas of a mine where exposure records are required to be kept in compliance with standard 57.5040.

§ 57.5042 Revised exposure levels

If levels of permissible exposures to concentrations of radon daughters different from those prescribed in 57.5038 are recommended by the Environmental Protection Agency and approved by the President, no employee shall be permitted to receive exposures in excess of those levels after the effective dates established by the Agency.

§ 57.5044 Respirators

In environments exceeding 1.0 WL, miners shall wear respirators approved by NIOSH for radon daughters prior to July 10, 1995 or under the equivalent section of 42 CFR part 84 and such respirator use shall be in compliance with § 57.5005.

[60 FR 30400, June 8, 1995]

§ 57.5045 Posting of inactive workings

Inactive workings in which radon daughter concentrations are above 1.0 WL, shall be posted against unauthorized entry and designated by signs indicating them as areas in which approved respirators shall be worn.

§ 57.5046 Protection against radon gas

Where radon daughter concentrations exceed 10 WL, respirator protection against radon gas shall be provided in addition to protection against radon daughters. Protection against radon gas shall be provided by supplied air devices or by face masks containing absorbent material capable of removing both the radon and its daughters.

§ 57.5047 Gamma radiation surveys

(a) Gamma radiation surveys shall be conducted annually in all underground mines where radioactive ores are mined.

(b) Surveys shall be in accordance with American National Standards (ANSI) Standard N13.8-1973, entitled "Radiation Protection in Uranium Mines", section 14.1 page 12, which is hereby incorporated by reference and made a part hereof. This publication may be examined in any Metal and Nonmetal Mine Safety and Health District Office, Mine Safety and Health Administration, or may be obtained from the American National Standards Institute, Inc., 25 W. 43rd Street, 4th Floor, New York, NY 10036; *http://www.ansi.org*.

(c) Where average gamma radiation measurements are in excess of 2.0 milliroentgens per hour in the working place, gamma radiation dosimeters shall be provided for all persons affected, and records of cumulative individual gamma radiation exposure shall be kept.

(d) Annual individual gamma radiation exposure shall not exceed 5 rems.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33723, June 29, 1995; 60 FR 35695, July 11, 1995; 71 FR 16667, Apr. 3, 2006]

Diesel Particulate Matter - Underground Only

Source: 66 FR 5907, Jan. 19, 2001, unless otherwise noted.

§ 57.5060 Limit on exposure to diesel particulate matter

(a) A miner's personal exposure to diesel particulate matter (DPM) in an underground mine must not exceed an average eight-hour equivalent full shift airborne concentration of 308 micrograms of elemental carbon per cubic meter of air (308_{EC} $\mu g/m^3$). [This interim permissible exposure limit (PEL) remains in effect until the final DPM exposure limit becomes effective. When the final DPM exposure limit becomes effective, MSHA will publish a document in the FEDERAL REGISTER.]

(b) (1) Effective May 20, 2006, a miner's personal exposure to diesel particulate matter (DPM) in an underground mine must not exceed an average eight-hour equivalent full shift airborne concentration of 308 micrograms of elemental carbon per cubic meter of air (308_{EC} $\mu g/m^3$).

(2) Effective January 20, 2007, a miner's personal exposure to diesel particulate matter (DPM) in an underground mine must not exceed an average eight-hour equivalent full shift airborne concentration of 350 micrograms of total carbon per cubic meter of air (350_{TC} $\mu g/m^3$).

(3) Effective May 20, 2008, a miner's personal exposure to diesel particulate matter (DPM) in an underground mine must not exceed an average eight-hour equivalent full shift airborne concentration of 160 micrograms of total carbon per cubic meter of air (160_{TC} $\mu g/m^3$).

(c) (1) If a mine requires additional time to come into compliance with the final DPM limit established in § 57.5060 (b) due to technological or economic constraints, the operator of the mine may file an application with the District Manager for a special extension.

(2) The mine operator must certify on the application that the operator has posted one copy of the application at the mine site for at least 30 days prior to the date of application and has provided another copy to the authorized representative of miners.

(3) No approval of a special extension shall exceed a period of one year from the date of approval. Mine operators may file for additional special extensions provided each extension does not exceed a period of one year. An application must include the following information:

(i) Documentation supporting that controls are technologically or economically infeasible at this time to reduce the miner's exposure to the final DPM limit.

(ii) The most recent DPM monitoring results.

(iii) The actions the operator will take during the extension to minimize exposure of miners to DPM.

(4) A mine operator must comply with the terms of any approved application for a special extension, post a copy of the approved application for a special extension at the mine site for the duration of the special extension period, and provide a copy of the approved application to the authorized representative of miners.

(d) The mine operator must install, use, and maintain feasible engineering and administrative controls to reduce a miner's exposure to or below the applicable DPM PEL established in this section. When controls do not reduce a miner's DPM exposure to the PEL, controls are infeasible, or controls do not produce significant reductions in DPM exposures, controls must be used to reduce the miner's exposure to as low a level as feasible and must be supplemented with respiratory protection in accordance with § 57.5005(a), (b), and paragraphs (d)(1) through (d)(8) of this section.

(1) Air purifying respirators must be equipped with the following:

(i) Filters certified by NIOSH under 30 CFR part 11 (appearing in the July 1, 1994 edition of 30 CFR, parts 1 to 199) as a high efficiency particulate air (HEPA) filter;

(ii) Filters certified by NIOSH under 42 CFR part 84 as 99.97% efficient; or

(iii) Filters certified by NIOSH for DPM.

(2) Non-powered, negative-pressure, air purifying, particulate-filter respirators shall use an R- or P-series filter or any filter certified by NIOSH for DPM. An R-series filter shall not be used for longer than one work shift.

(3) The mine operator must provide a confidential medical evaluation by a physician or other licensed health care professional (PLHCP), at no cost to the miner, to determine the miner's ability to use a respirator before the miner is required to be fit tested or to use a respirator at the mine. If the PLHCP determines that the miner cannot wear a negative pressure respirator, the mine operator must make certain that the PLHCP evaluates the miner's ability to wear a powered air purifying respirator (PAPR).

(4) The mine operator must provide the miner with an opportunity to discuss their evaluation results with the PLHCP before the PLHCP submits the written determination to the mine operator regarding the miner's ability to wear a respirator. If the miner disagrees with the evaluation results of the PLHCP, the miner may submit within 30 days additional evidence of his or her medical condition to the PLHCP.

(5) The mine operator must obtain a written determination from the PLHCP regarding the miner's ability to wear a respirator, and the mine operator

must assure that the PLHCP provides a copy of the determination to the miner.

(6) The miner must be reevaluated when the mine operator has reason to believe that conditions have changed which could adversely affect the miner's ability to wear the respirator.

(7) Upon written notification that the PLHCP has determined that the miner is unable to wear a respirator, including a PAPR, the miner must be transferred to work in an existing position in an area of the same mine where respiratory protection is not required. The miner must be transferred within 30 days of the final determination by the PLHCP.

(i) The miner must continue to receive compensation at no less than the regular rate of pay in the classification held by that miner immediately prior to the transfer.

(ii) Increases in wages of the transferred miner must be based upon the new work classification.

(8) The mine operator must maintain a record of the identity of the PLHCP and the most recent written determination of each miner's ability to wear a respirator for the duration of the miner's employment plus six months.

(e) Rotation of miners shall not be considered an acceptable administrative control used for compliance with the DPM standard.

[70 FR 32966, June 6, 2005; 70 FR 37901, June 30, 2005, as amended at 70 FR 55019, Sept. 19, 2005; 71 FR 29011, 29012, May 18, 2006; 71 FR 36483, June 27, 2006]

§ 57.5061 Compliance determinations

(a) MSHA will use a single sample collected and analyzed by the Secretary in accordance with the requirements of this section as an adequate basis for a determination of noncompliance with the DPM limit.

(b) The Secretary will collect samples of DPM by using a respirable dust sampler equipped with a submicrometer impactor and analyze the samples for the amount of elemental carbon using the method described in NIOSH Analytical Method 5040, except that the Secretary also may use any methods of collection and analysis subsequently determined by NIOSH to provide equal or improved accuracy for the measurement of DPM.

(c) The Secretary will use full-shift personal sampling for compliance determinations.

[70 FR 32966, June 6, 2005]

§ 57.5065 Fueling practices

(a) Diesel fuel used to power equipment in underground areas must not have a sulfur content greater than 0.05 percent. The operator must retain purchase records that demonstrate compliance with this requirement for one year after the date of purchase.

(b) The operator must only use fuel additives registered by the U.S. Environmental Protection Agency in diesel powered equipment operated in underground areas.

[66 FR 5907, Jan. 19, 2001; 66 FR 35520, July 5, 2001]

§ 57.5066 Maintenance standards

(a) Any diesel-powered equipment operated at any time in underground areas must meet the following maintenance standards:

(1) The operator must maintain any approved engine in approved condition;

(2) The operator must maintain the emission related components of any non-approved engine to manufacturer specifications; and

(3) The operator must maintain any emission or particulate control device installed on the equipment in effective operating condition.

(b) (1) A mine operator must authorize each miner operating diesel-powered equipment underground to affix a visible and dated tag to the equipment when the miner notes evidence that the equipment may require maintenance in order to comply with the maintenance standards of paragraph (a) of this section. The term "evidence" means visible smoke or odor that is unusual for that piece of equipment under normal operating procedures, or obvious or visible defects in the exhaust emissions control system or in the engine affecting emissions.

(2) A mine operator must ensure that any equipment tagged pursuant to this section is promptly examined by a person authorized to maintain diesel equipment, and that the affixed tag not be removed until the examination has been completed. The term "promptly" means before the end of the next shift during which a qualified mechanic is scheduled to work.

(3) A mine operator must retain a log of any equipment tagged pursuant to this section. The log must include the date the equipment is tagged, the date the equipment is examined, the name of the person examining the equipment, and any action taken as a result of the examination. The operator must retain the information in the log for one year after the date the tagged equipment was examined.

(c) Persons authorized by a mine operator to maintain diesel equipment covered by paragraph (a) of this section must be qualified, by virtue of training or experience, to ensure that the maintenance standards of paragraph (a) of this section are observed. An operator must retain appropriate evidence of the competence of any person to perform specific maintenance tasks in compliance with those standards for one year after the date of any maintenance, and upon request must provide the documentation to the authorized representative of the Secretary.

[66 FR 5907, Jan. 19, 2001, as amended at 67 FR 9184, Feb. 27, 2002]

Effective Date Note

Effective Date Note: At 66 FR 5907, Jan. 19, 2001, § 57.5066 was added, effective July 5, 2001, except for paragraph (b). At 66 FR 35518, July 5, 2001, the effective date of paragraph (b) was delayed pending disposition of current litigation challenging the rule. At 67 FR 9184, Feb. 27, 2002, paragraphs (b)(1) and (b)(2) were revised, effective Mar. 29, 2002.

§ 57.5067 Engines

(a) Any diesel engine introduced into an underground area of a mine covered by this part after July 5, 2001, other than an engine in an ambulance or firefighting equipment which is utilized in accordance with mine firefighting and evacuation plans, must either:

(1) Have affixed a plate evidencing approval of the engine pursuant to subpart E of Part 7 of this title or pursuant to Part 36 of this title; or

(2) Meet or exceed the applicable particulate matter emission requirements of the Environmental Protection Administration listed in Table 57.5067-1, as follows:

Table 57.5067-1

EPA requirement	EPA category	PM limit
40 CFR 86.094-8(a)(1)(i)(A)(2)	light duty vehicle	0.1 g/mile.
40 CFR 86.094-9(a)(1)(i)(A)(2)	light duty truck	0.1 g/mile.
40 CFR 86.094-11(a)(1)(iv)(B)	heavy duty highway engine	0.1 g/bhp-hr.
40 CFR 89.112(a)	nonroad (tier, power range)	varies by power range:
	tier 1 kW<8 (hp<11)	1.0 g/kW-hr (0.75 g/bhp-hr).
	tier 1 8≤kW<19 (11≤hp<25)	0.80 g/kW-hr (0.60 g/bhp-hr).
	tier 1 19≤kW<37 (25≤hp<50)	0.80 g/kW-hr (0.60 g/bhp-hr).
	tier 2 37≤kW<75 (50≤hp<100)	0.40 g/kW-hr (0.30 g/bhp-hr).
	tier 2 75≤kW<130 (100≤hp<175)	0.30 g/kW-hr (0.22 g/bhp-hr).
	tier 1 130≤kW<225 (175≤hp<300)	0.54 g/kW-hr (0.40 g/bhp-hr).
	tier 1 225≤kW<450 (300≤hp<600)	0.54 g/kW-hr (0.40 g/bhp-hr).
	tier 1 450≤kW<560 (600≤hp<750)	0.54 g/kW-hr (0.40 g/bhp-hr).
	tier 1 kW≥560 (hp≥750)	0.54 g/kW-hr (0.40 g/bhp-hr).

Notes:

“g” means grams.

“hp” means horsepower.

“g/bhp-hr” means grams/brake horsepower-hour.

“kW” means kilowatt.

“g/kW-hr” means grams/kilowatt-hour.

(b) For purposes of paragraph (a):

(1) The term “introduced” means any engine added to the underground inventory of engines of the mine in question, including:

(i) An engine in newly purchased equipment;

(ii) An engine in used equipment brought into the mine; and

(iii) A replacement engine that has a different serial number than the engine it is replacing; but

(2) The term “introduced” does not include engines that were previously part of the mine inventory and rebuilt.

(3) The term “introduced” does not include the transfer of engines or equipment from the inventory of one underground mine to another underground mine operated by the same mine operator.

[66 FR 5907, Jan. 19, 2001, as amended at 66 FR 27864, May 21, 2001; 67 FR 9184, Feb. 27, 2002]

§ 57.5070 Miner training

(a) Mine operators must provide annual training to all miners at a mine covered by this part who can reasonably be expected to be exposed to diesel emissions on that property. The training must include -

(1) The health risks associated with exposure to diesel particulate matter;

(2) The methods used in the mine to control diesel particulate matter concentrations;

(3) Identification of the personnel responsible for maintaining those controls; and

(4) Actions miners must take to ensure the controls operate as intended.

(b) An operator must retain a record at the mine site of the training required by this section for one year after completion of the training.

§ 57.5071 Exposure monitoring

(a) Mine operators must monitor as often as necessary to effectively determine, under conditions that can be reasonably anticipated in the mine, whether the average personal full-shift airborne exposure to DPM exceeds the DPM limit specified in § 57.5060.

(b) The mine operator must provide affected miners and their representatives with an opportunity to observe exposure monitoring required by this section. Mine operators must give prior notice to affected miners and their representatives of the date and time of intended monitoring.

(c) If any monitoring performed under this section indicates that a miner's exposure to diesel particulate matter exceeds the DPM limit specified in § 57.5060, the operator must promptly post notice of the corrective action being taken on the mine bulletin board, initiate corrective action by the next work shift, and promptly complete such corrective action.

(d) (1) The results of monitoring for diesel particulate matter, including any results received by a mine operator from sampling performed by the Secretary, must be posted on the mine bulletin board within 15 days of receipt and must remain posted for 30 days. The operator must provide a copy of the results to the authorized representative of miners.

(2) The mine operator must retain for five years (from the date of sampling), the results of any samples the operator collected as a result of monitoring under this section, and information about the sampling method used for obtaining the samples.

[70 FR 32966, June 6, 2005]

§ 57.5075 Diesel particulate records

(a) The table entitled "Diesel Particulate Matter Recordkeeping Requirements" lists the records the operator must maintain pursuant to § § 57.5060 through 57.5071, and the duration for which particular records need to be retained.

Table 57.5075(a) - Diesel Particulate Recordkeeping Requirements

Record	Section reference	Retention time
1. Approved application for extension of time to comply with exposure limits	§ 57.5060(c)	Duration of extension.
2. Identity of PLHCP and most recent written determination of miner's ability to wear a respirator	§ 57.5060(d)	Duration of miner's employment plus 6 months.
3. Purchase records noting sulfur content of diesel fuel	§ 57.5065(a)	1 year beyond date of purchase.
4. Maintenance log	§ 57.5066(b)	1 year after date any equipment is tagged.
5. Evidence of competence to perform maintenance	§ 57.5066(c)	1 year after date maintenance performed.
6. Annual training provided to potentially exposed miners	§ 57.5070(b)	1 year beyond date training completed.
7. Record of corrective action	§ 57.5071(c)	Until the corrective action is completed.
8. Sampling method used to effectively evaluate a miner's personal exposure, and sample results	§ 57.5071(d)	5 years from sample date.

(b) (1) Any record listed in this section which is required to be retained at the mine site may, notwithstanding such requirement, be retained elsewhere if the mine operator can immediately access the record from the mine site by electronic transmission.

(2) Upon request from an authorized representative of the Secretary of Labor, the Secretary of Health and Human Services, or from the authorized representative of miners, mine operators must promptly provide access to any record listed in the table in this section.

(3) An operator must provide access to a miner, former miner, or, with the miner's or former miner's written consent, a personal representative of a miner, to any record required to be maintained pursuant to § 57.5071 or § 57.5060(d) to the extent the information pertains to the miner or former miner. The operator must provide the first copy of a requested record at no cost, and any additional copies at reasonable cost.

(4) Whenever an operator ceases to do business, that operator must transfer all records required to be maintained by this part, or a copy thereof, to any successor operator who must maintain them for the required period.

[70 FR 32966, June 6, 2005; 70 FR 37901, June 30, 2005; 71 FR 29012, May 18, 2006]

Subpart E - EXPLOSIVES

Source: 61 FR 36801, July 12, 1996, unless otherwise noted.

§ 57.6000 Definitions

The following definitions apply in this subpart.

Blasting agent. Any substance classified as a blasting agent by the Department of Transportation in 49 CFR 173.114a(a). This document is available at any MSHA Metal and Nonmetal Safety and Health district office.

Detonating cord. A flexible cord containing a center core of high explosives which may be used to initiate other explosives.

Detonator. Any device containing a detonating charge used to initiate an explosive. These devices include electronic detonators, electric or nonelectric instantaneous or delay blasting caps, and delay connectors. The term "detonator" does not include detonating cord. Detonators may be either "Class A" detonators or "Class C" detonators, as classified by the Department of Transportation in 49 CFR 173.53 and 173.100, which is available at any MSHA Metal and Nonmetal Safety and Health district office.

Explosive. Any substance classified as an explosive by the Department of Transportation in 49 CFR 173.53, 173.88, and 173.100. This document is available at any MSHA Metal and Nonmetal Safety and Health district office.

Explosive material. Explosives, blasting agents, and detonators.

Flash point. The minimum temperature at which sufficient vapor is released by a liquid to form a flammable vapor-air mixture near the surface of the liquid.

Igniter cord. A fuse that burns progressively along its length with an external flame at the zone of burning, used for lighting a series of safety fuses in a desired sequence.

Magazine. A bullet-resistant, theft-resistant, fire-resistant, weather-resistant, ventilated facility for the storage of explosives and detonators (BATF Type 1 or Type 2 facility).

Misfire. The complete or partial failure of explosive material to detonate as planned. The term also is used to describe the explosive material itself that has failed to detonate.

Primer. A unit, package, or cartridge of explosives which contains a detonator and is used to initiate other explosives or blasting agents.

Safety switch. A switch that provides shunt protection in blasting circuits between the blast site and the switch used to connect a power source to the blasting circuit.

Slurry. An explosive material containing substantial portions of a liquid, oxidizers, and fuel, plus a thickener.

Water gel. An explosive material containing substantial portions of water, oxidizers, and fuel, plus a cross-linking agent.

[61 FR 36801, July 12, 1996, as amended at 67 FR 38385, June 4, 2002; 68 FR 32361, May 30, 2003; 69 FR 38842, June 29, 2004; 85 FR 2027, Jan. 14, 2020]

Storage - Surface and Underground

§ 57.6100 Separation of stored explosive material

(a) Detonators shall not be stored in the same magazine with other explosive material.

(b) When stored in the same magazine, blasting agents shall be separated from explosives, safety fuse, and detonating cord to prevent contamination.

§ 57.6101 Areas around explosive material storage facilities

(a) Areas surrounding storage facilities for explosive material shall be clear of rubbish, brush, dry grass, and trees for 25 feet in all directions, except that live trees 10 feet or taller need not be removed.

(b) Other combustibles shall not be stored or allowed to accumulate within 50 feet of explosive material. Combustible liquids shall be stored in a manner that ensures drainage will occur away from the explosive material storage facility in case of tank rupture.

§ 57.6102 Explosive material storage practices

(a) Explosive material shall be -

(1) Stored in a manner to facilitate use of oldest stocks first;

(2) Stored according to brand and grade in such a manner as to facilitate identification; and

(3) Stacked in a stable manner but not more than 8 feet high.

(b) Explosives and detonators shall be stored in closed nonconductive containers except that nonelectric detonating devices may be stored on nonconductive racks provided the case-insert instructions and the date-plant-shift code are maintained with the product.

Storage - Surface Only

§ 57.6130 Explosive material storage facilities

(a) Detonators and explosives shall be stored in magazines.

(b) Packaged blasting agents shall be stored in a magazine or other facility which is ventilated to prevent dampness and excessive heating, weather-resistant, and locked or attended. Drop trailers do not have to be ventilated if they are currently licensed by the Federal, State, or local authorities for over-the-road use. Facilities other than magazines used to store blasting agents shall contain only blasting agents.

(c) Bulk blasting agents shall be stored in weather-resistant bins or tanks which are locked, attended, or otherwise inaccessible to unauthorized entry.

(d) Facilities, bins, or tanks shall be posted with the appropriate United States Department of Transportation placards or other appropriate warning signs that indicate the contents and are visible from each approach.

§ 57.6131 Location of explosive material storage facilities

(a) Storage facilities for any explosive material shall be -

(1) Located so that the forces generated by a storage facility explosion will not create a hazard to occupants in mine buildings and will not damage dams or electric substations; and

(2) Detached structures located outside the blast area and a sufficient distance from powerlines so that the powerlines, if damaged, would not contact the magazines.

(b) Operators should also be aware of regulations affecting storage facilities in 27 CFR part 55, in particular, 27 CFR 55.218 and 55.220. This document is available at any MSHA Metal and Nonmetal Safety and Health district office.

§ 57.6132 Magazine requirements

(a) Magazines shall be -

(1) Structurally sound;

(2) Noncombustible or the exterior covered with fire-resistant material;

(3) Bullet resistant;

(4) Made of nonsparking material on the inside;

(5) Ventilated to control dampness and excessive heating within the magazine;

(6) Posted with the appropriate United States Department of Transportation placards or other appropriate warning signs that indicate the contents and are visible from each approach, so located that a bullet passing through any of the signs will not strike the magazine;

(7) Kept clean and dry inside;

(8) Unlighted or lighted by devices that are specifically designed for use in magazines and which do not create a fire or explosion hazard;

(9) Unheated or heated only with devices that do not create a fire or explosion hazard;

(10) Locked when unattended; and

(11) Used exclusively for the storage of explosive material except for essential nonsparking equipment used for the operation of the magazine.

(b) Metal magazines shall be equipped with electrical bonding connections between all conductive portions, so the entire structure is at the same electrical potential. Suitable electrical bonding methods include welding, riveting, or the use of securely tightened bolts where individual metal portions are joined. Conductive portions of nonmetal magazines shall be grounded.

(c) Electrical switches and outlets shall be located on the outside of the magazine.

§ 57.6133 Powder chests

(a) Powder chests (day boxes) shall be -

(1) Structurally sound, weather-resistant, equipped with a lid or cover, and with only nonsparking material on the inside;

(2) Posted with the appropriate United States Department of Transportation placards or other appropriate warning signs that indicate the contents and are visible from each approach;

(3) Located out of the blast area once loading has been completed;

(4) Locked or attended when containing explosive material; and

(5) Emptied at the end of each shift with the contents returned to a magazine or other storage facility, or attended.

(b) Detonators shall be kept in chests separate from explosives or blasting agents, unless separated by 4 inches of hardwood or equivalent, or a laminated partition. When a laminated partition is used, operators must follow the provisions of the Institute of Makers of Explosives (IME) Safety Library Publication No. 22, "Recommendations for the Safe Transportation of Detonators in a Vehicle with Other Explosive Materials" (May 1993), and the "Generic Loading Guide for the IME-22 Container" (October 1993). The IME is located at 1120 19th Street NW., Suite 310, Washington, DC 20036-3605; 202-429-9280; *https://www.ime.org*. This incorporation by reference has been approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies are available at MSHA's Office of Standards, Regulations, and Variances, 201 12th Street South, Arlington, VA 22202-5452; 202-693-9440; and at all Metal and Nonmetal Mine Safety and Health District Offices, or available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*.

[61 FR 36801, July 12, 1996, as amended at 67 FR 38385, June 4, 2002; 80 FR 52988, Sept. 2, 2015]

Storage - Underground Only

§ 57.6160 Main facilities

(a) Main facilities used to store explosive material underground shall be located -

(1) In stable or supported ground;

(2) So that a fire or explosion in the storage facilities will not prevent escape from the mine, or cause detonation of the contents of another storage facility;

(3) Out of the line of blasts, and protected from vehicular traffic, except that accessing the facility;

(4) At least 200 feet from work places or shafts;

(5) At least 50 feet from electric substations;

(6) A safe distance from trolley wires; and

(7) At least 25 feet from detonator storage facilities.

(b) Main facilities used to store explosive material underground shall be -

(1) Posted with warning signs that indicate the contents and are visible from any approach;

(2) Used exclusively for the storage of explosive material and necessary equipment associated with explosive material storage and delivery:

(i) Portions of the facility used for the storage of explosives shall only contain nonsparking material or equipment.

(ii) The blasting agent portion of the facility may be used for the storage of other necessary equipment;

(3) Kept clean, suitably dry, and orderly;

(4) Provided with unobstructed ventilation openings;

(5) Kept securely locked unless all access to the mine is either locked or attended; and

(6) Unlighted or lighted only with devices that do not create a fire or explosion hazard, and which are specifically designed for use in magazines.

(c) Electrical switches and outlets shall be located outside the facility.

§ 57.6161 Auxiliary facilities

(a) Auxiliary facilities used to store explosive material near work places shall be wooden, box-type containers equipped with covers or doors, or facilities constructed or mined-out to provide equivalent impact resistance and confinement.

(b) The auxiliary facilities shall be -

(1) Constructed of nonsparking material on the inside when used for the storage of explosives;

(2) Kept clean, suitably dry, and orderly;

(3) Kept in repair;

(4) Located out of the line of blasts so they will not be subjected to damaging shock or flyrock;

(5) Identified with warning signs or coded to indicate the contents with markings visible from any approach;

(6) Located at least 15 feet from all haulageways and electrical equipment, or placed entirely within a mined-out recess in the rib used exclusively for explosive material;

(7) Filled with no more than a one-week supply of explosive material;

(8) Separated by at least 25 feet from other facilities used to store detonators; and

(9) Kept securely locked unless all access to the mine is either locked or attended.

Transportation - Surface and Underground

§ 57.6200 Delivery to storage or blast site areas

Explosive material shall be transported without undue delay to the storage area or blast site.

§ 57.6201 Separation of transported explosive material

Detonators shall not be transported on the same vehicle or conveyance with other explosives except as follows:

(a) Detonators in quantities of more than 1,000 may be transported in a vehicle or conveyance with explosives or blasting agents provided the detonators are -

(1) Maintained in the original packaging as shipped from the manufacturer; and

(2) Separated from explosives or blasting agents by 4 inches of hardwood or equivalent, or a laminated partition. The hardwood or equivalent shall be fastened to the vehicle or conveyance. When a laminated partition is used, operators must follow the provisions of the Institute of Makers of Explosives (IME) Safety Library Publication No. 22, "Recommendations for the Safe Transportation of Detonators in a Vehicle with Other Explosive Materials" (May 1993), and the "Generic Loading Guide for the IME-22 Container" (October 1993). The IME is located at 1120 19th Street NW., Suite 310, Washington, DC 20036-3605; 202-429-9280; *https://www.ime.org*. This incorporation by reference has been approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies are available at MSHA's Office of Standards, Regulations, and Variances, 201 12th Street South, Arlington, VA 22202-5452; 202-693-9440; and at all Metal and Nonmetal Mine Safety and Health District Offices, or available for

examination at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*.

(b) Detonators in quantities of 1,000 or fewer may be transported with explosives or blasting agents provided the detonators are -

(1) Kept in closed containers; and

(2) Separated from explosives or blasting agents by 4 inches of hardwood or equivalent, or a laminated partition. The hardwood or equivalent shall be fastened to the vehicle or conveyance. When a laminated partition is used, operators must follow the provisions of IME Safety Library Publication No. 22, "Recommendations for the Safe Transportation of Detonators in a Vehicle with Other Explosive Materials" (May 1993), and the "Generic Loading Guide for the IME-22 Container" (October 1993). The IME is located at 1120 19th Street NW., Suite 310, Washington, DC 20036-3605; 202-429-9280; *https://www.ime.org*. This incorporation by reference has been approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies are available at MSHA's Office of Standards, Regulations, and Variances, 201 12th Street South, Arlington, VA 22202-5452; 202-693-9440; and at all Metal and Nonmetal Mine Safety and Health District Offices, or available for examination at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*.

[61 FR 36801, July 12, 1996, as amended at 67 FR 38385, June 4, 2002; 80 FR 52988, Sept. 2, 2015]

§ 57.6202 Vehicles

(a) Vehicles containing explosive material shall be -

(1) Maintained in good condition and shall comply with the requirements of subpart M of this part;

(2) Equipped with sides and enclosures higher than the explosive material being transported or have the explosive material secured to a nonconductive pallet;

(3) Equipped with a cargo space that shall contain the explosive material (passenger areas shall not be considered cargo space);

(4) Equipped with at least two multipurpose dry-chemical fire extinguishers or one such extinguisher and an automatic fire suppression system;

(5) Posted with warning signs that indicate the contents and are visible from each approach;

(6) Occupied only by persons necessary for handling the explosive material;

(7) Attended or the cargo compartment locked at surface areas of underground mines, except when parked at the blast site and loading is in progress; and

(8) Secured while parked by having -

(i) The brakes set;

(ii) The wheels chocked if movement could occur; and

(iii) The engine shut off unless powering a device being used in the loading operation.

(b) Vehicles containing explosives shall have -

(1) No sparking material exposed in the cargo space; and

(2) Only properly secured nonsparking equipment in the cargo space with the explosives.

(c) Vehicles used for dispensing bulk explosive material shall -

(1) Have no zinc or copper exposed in the cargo space; and

(2) Provide any enclosed screw-type conveyors with protection against internal pressure and frictional heat.

§ 57.6203 Locomotives

Explosive material shall not be transported on a locomotive. When explosive material is hauled by trolley locomotive, covered, electrically insulated cars shall be used.

§ 57.6204 Hoists

(a) Before explosive material is transported in hoist conveyances -

(1) The hoist operator shall be notified; and

(2) Hoisting in adjacent shaft compartments, except for empty conveyances or counterweights, shall be stopped until transportation of the explosive material is completed.

(b) Explosive material transported in hoist conveyances shall be placed within a container which prevents shifting of the cargo that could cause detonation of the container by impact or by sparks. The manufacturer's container may be used if

secured to a nonconductive pallet. When explosives are transported, they shall be secured so as not to contact any sparking material.

(c) No explosive material shall be transported during a mantrip.

§ 57.6205 Conveying explosives by hand

Closed, nonconductive containers shall be used to carry explosives and detonators to and from blast sites. Separate containers shall be used for explosives and detonators.

Use - Surface and Underground

§ 57.6300 Control of blasting operations

(a) Only persons trained and experienced in the handling and use of explosive material shall direct blasting operations and related activities.

(b) Trainees and inexperienced persons shall work only in the immediate presence of persons trained and experienced in the handling and use of explosive material.

§ 57.6301 Blasthole obstruction check

Before loading, blastholes shall be checked and, wherever possible, cleared of obstructions.

§ 57.6302 Separation of explosive material

Explosives and blasting agents shall be kept separated from detonators until loading begins.

§ 57.6303 Initiation preparation

(a) Primers shall be made up only at the time of use and as close to the blast site as conditions allow.

(b) Primers shall be prepared with the detonator contained securely and completely within the explosive or contained securely and appropriately for its design in the tunnel or cap well.

(c) When using detonating cord to initiate another explosive, a connection shall be prepared with the detonating cord threaded through, attached securely to, or otherwise in contact with the explosive.

§ 57.6304 Primer protection

(a) Tamping shall not be done directly on a primer.

(b) Rigid cartridges of explosives or blasting agents that are 4 inches (100 millimeters) in diameter or larger shall not be dropped on the primer except

where the blasthole contains sufficient depth of water to protect the primer from impact. Slit packages of prill, water gel, or emulsions are not considered rigid cartridges and may be drop loaded.

§ 57.6305 Unused explosive material

Unused explosive material shall be moved to a protected location as soon as practical after loading operations are completed.

§ 57.6306 Loading, blasting, and security

(a) When explosive materials or initiating systems are brought to the blast site, the blast site shall be attended; barricaded and posted with warning signs, such as "Danger," "Explosives," or "Keep Out;" or flagged against unauthorized entry.

(b) Vehicles and equipment shall not be driven over explosive material or initiating systems in a manner which could contact the material or system, or create other hazards.

(c) Once loading begins, the only activities permitted within the blast site shall be those activities directly related to the blasting operation and the activities of surveying, stemming, sampling of geology, and reopening of holes, provided that reasonable care is exercised. Haulage activity is permitted near the base of bench faces being loaded or awaiting firing, provided no other haulage access exists.

(d) Loading and blasting shall be conducted in a manner designed to facilitate a continuous process, with the blast fired as soon as possible following the completion of loading. If blasting a loaded round may be delayed for more than 72 hours, the operator shall notify the appropriate MSHA district office.

(e) In electric blasting prior to connecting to the power source, and in nonelectric blasting prior to attaching an initiating device, all persons shall leave the blast area except persons in a blasting shelter or other location that protects them from concussion (shock wave), flying material, and gases.

(f) Before firing a blast -

(1) Ample warning shall be given to allow all persons to be evacuated;

(2) Clear exit routes shall be provided for persons firing the round; and

(3) All access routes to the blast area shall be guarded or barricaded to prevent the passage of persons or vehicles.

(g) Work shall not be resumed in the blast area until a post-blast examination addressing potential blast-related hazards has been conducted by a person with the ability and experience to perform the examination.

§ 57.6307 Drill stem loading

Explosive material shall not be loaded into blastholes with drill stem equipment or other devices that could be extracted while containing explosive material. The use of loading hose, collar sleeves, or collar pipes is permitted.

§ 57.6308 Initiation systems

Initiation systems shall be used in accordance with the manufacturer's instructions.

§ 57.6309 Fuel oil requirements for ANFO

(a) Liquid hydrocarbon fuels with flash points lower than that of No. 2 diesel oil (125 °F) shall not be used to prepare ammonium nitrate-fuel oil, except that diesel fuels with flash points no lower than 100 °F may be used at ambient air temperatures below 45 °F.

(b) Waste oil, including crankcase oil, shall not be used to prepare ammonium nitrate-fuel oil.

§ 57.6310 Misfire waiting period

When a misfire is suspected, persons shall not enter the blast area -

(a) For 30 minutes if safety fuse and blasting caps are used;

(b) For 15 minutes if any other type detonators are used; or

(c) For 30 minutes if electronic detonators are used, or for the manufacturer-recommended time, whichever is longer.

[61 FR 36801, July 12, 1996, as amended at 85 FR 2027, Jan. 14, 2020]

§ 57.6311 Handling of misfires

(a) Faces and muck piles shall be examined for misfires after each blasting operation.

(b) Only work necessary to remove a misfire and protect the safety of miners engaged in the removal shall be permitted in the affected area until the misfire is disposed of in a safe manner.

(c) When a misfire cannot be disposed of safely, each approach to the area affected by the misfire shall be posted with a warning sign at a conspicuous location to prohibit entry, and the condition shall be reported immediately to mine management.

(d) Misfires occurring during the shift shall be reported to mine management not later than the end of the shift.

§ 57.6312 Secondary blasting

Secondary blasts fired at the same time in the same work area shall be initiated from one source.

Electric Blasting - Surface and Underground

§ 57.6400 Compatibility of electric detonators

All electric detonators to be fired in a round shall be from the same manufacturer and shall have similar electrical firing characteristics.

§ 57.6401 Shunting

Except during testing -

(a) Electric detonators shall be kept shunted until connected to the blasting line or wired into a blasting round;

(b) Wired rounds shall be kept shunted until connected to the blasting line; and

(c) Blasting lines shall be kept shunted until immediately before blasting.

§ 57.6402 Deenergized circuits near detonators

Electrical distribution circuits within 50 feet of electric detonators at the blast site shall be deenergized. Such circuits need not be deenergized between 25 to 50 feet of the electric detonators if stray current tests, conducted as frequently as necessary, indicate a maximum stray current of less than 0.05 ampere through a 1-ohm resistor as measured at the blast site.

§ 57.6403 Branch circuits

(a) If electric blasting includes the use of branch circuits, each branch shall be equipped with a safety switch or equivalent method to isolate the circuits to be used.

(b) At least one safety switch or equivalent method of protection shall be located outside the blast area and shall be in the open position until persons are withdrawn.

§ 57.6404 Separation of blasting circuits from power source

(a) Switches used to connect the power source to a blasting circuit shall be locked in the open position except when closed to fire the blast.

(b) Lead wires shall not be connected to the blasting switch until the shot is ready to be fired.

§ 57.6405 Firing devices

(a) Power sources shall be capable of delivering sufficient current to energize all electric detonators to be fired with the type of circuits used. Storage or dry cell batteries are not permitted as power sources.

(b) Blasting machines shall be tested, repaired, and maintained in accordance with manufacturer's instructions.

(c) Only the blaster shall have the key or other control to an electrical firing device.

§ 57.6406 Duration of current flow

If any part of a blast is connected in parallel and is to be initiated from powerlines or lighting circuits, the time of current flow shall be limited to a maximum of 25 milliseconds. This can be accomplished by incorporating an arcing control device in the blasting circuit or by interrupting the circuit with an explosive device attached to one or both lead lines and initiated by a 25-millisecond delay electric detonator.

§ 57.6407 Circuit testing

A blasting galvanometer or other instrument designed for testing blasting circuits shall be used to test the following:

(a) In surface operations -

(1) Continuity of each electric detonator in the blasthole prior to stemming and connection to 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 or electronic detonator series; and

(4) Total blasting circuit resistance prior to connection to the power source.

(b) In underground operations -

(1) Continuity of each electric detonator series; and

(2) Continuity of blasting lines prior to the connection of electric or electronic detonators.

[61 FR 36801, July 12, 1996, as amended at 85 FR 2027, Jan. 14, 2020]

§ 57.6500 Damaged initiating material

A visual check of the completed circuit shall be made to ensure that the components are properly aligned and connected. Safety fuse, igniter cord, detonating cord, shock or gas tubing, and similar material which is kinked, bent sharply, or damaged shall not be used.

§ 57.6501 Nonelectric initiation systems

(a) When the nonelectric initiation system uses shock tube -

(1) Connections with other initiation devices shall be secured in a manner which provides for uninterrupted propagation;

(2) Factory-made units shall be used as assembled and shall not be cut except that a single splice is permitted on the lead-in trunkline during dry conditions; and

(3) Connections between blastholes shall not be made until immediately prior to clearing the blast site when surface delay detonators are used.

(b) When the nonelectric initiation system uses detonating cord -

(1) The line of detonating cord extending out of a blasthole shall be cut from the supply spool immediately after the attached explosive is correctly positioned in the hole;

(2) In multiple row blasts, the trunkline layout shall be designed so that the detonation can reach each blasthole from at least two directions;

(3) Connections shall be tight and kept at right angles to the trunkline;

(4) Detonators shall be attached securely to the side of the detonating cord and pointed in the direction in which detonation is to proceed;

(5) Connections between blastholes shall not be made until immediately prior to clearing the blast site when surface delay detonators are used; and

(6) Lead-in lines shall be manually unreeled if connected to the trunklines at the blast site.

(c) When nonelectric initiation systems use gas tube, continuity of the circuit shall be tested prior to blasting.

§ 57.6502 Safety fuse

(a) The burning rate of each spool of safety fuse to be used shall be measured, posted in locations which will be conspicuous to safety fuse users, and brought to the attention of all persons involved with the blasting operation.

(b) When firing with safety fuse ignited individually using handheld lighters, the safety fuse shall be of lengths which provide at least the minimum burning time for a particular size round, as specified in the following table:

Table E-1 - Safety Fuse - Minimum Burning Time

Number of holes in a round	Minimum burning time
1	2 min.[1]
2 to 5	2 min. 40 sec.
6 to 10	3 min. 20 sec.
11 to 15	5 min.

[1] For example, at least a 36-inch length of 40-second-per-foot safety fuse or at least a 48-inch length of 30-second-per-foot safety fuse would have to be used to allow sufficient time to evacuate the area.

(c) Where flyrock might damage exposed safety fuse, the blast shall be timed so that all safety fuses are burning within the blastholes before any blasthole detonates.

(d) Fuse shall be cut and capped in dry locations.

(e) Blasting caps shall be crimped to fuse only with implements designed for that purpose.

(f) Safety fuse shall be ignited only after the primer and the explosive material are securely in place.

(g) Safety fuse shall be ignited only with devices designed for that purpose. Carbide lights, liquefied petroleum gas torches, and cigarette lighters shall not be used to light safety fuse.

(h) At least two persons shall be present when lighting safety fuse, and no one shall light more than 15 individual fuses. If more than 15 holes per person are to be fired, electric initiation systems, igniter cord and connectors, or other nonelectric initiation systems shall be used.

Extraneous Electricity - Surface and Underground

§ 57.6600 Loading practices

If extraneous electricity is suspected in an area where electric detonators are used, loading shall be suspended until tests determine that stray current does not exceed 0.05 amperes through a 1-ohm resister when measured at the location of the electric detonators. If greater levels of extraneous electricity are found, the source shall be determined, and no loading shall take place until the condition is corrected.

§ 57.6601 Grounding

Electric blasting circuits, including powerline sources when used, shall not be grounded.

§ 57.6602 Static electricity dissipation during loading

When explosive material is loaded pneumatically into a blasthole in a manner that generates a static electricity hazard -

(a) An evaluation of the potential static electricity hazard shall be made, and any hazard shall be eliminated before loading begins;

(b) The loading hose shall be of a semiconductive type, have a total of not more than 2 megohms of resistance over its entire length and not less than 1000 ohms of resistance per foot;

(c) Wire-countered hoses shall not be used;

(d) Conductive parts of the loading equipment shall be bonded and grounded and grounds shall not be made to other potential sources of extraneous electricity; and

(e) Plastic tubes shall not be used as hole liners if the hole contains an electric detonator.

§ 57.6603 Air gap

At least a 15-foot air gap shall be provided between the blasting circuit and the electric power source.

§ 57.6604 Precautions during storms

During the approach and progress of an electrical storm -

(a) Surface blasting operations shall be suspended, and persons withdrawn from the blast area or to a safe location; or

(b) Underground electronic or electrical blasting operations that are capable of being initiated by lightning shall be suspended and all persons withdrawn from the blast area or to a safe location.

[61 FR 36801, July 12, 1996, as amended at 85 FR 2027, Jan. 14, 2020]

§ 57.6605 Isolation of blasting circuits

Lead wires and blasting lines shall be isolated and insulated from power conductors, pipelines, and railroad tracks, and shall be protected from sources of stray or static electricity. Blasting circuits shall be protected from any contact between firing lines and overhead powerlines which could result from the force of a blast.

Equipment/Tools - Surface and Underground

§ 57.6700 Nonsparking tools

Only nonsparking tools shall be used to open containers of explosive material or to punch holes in explosive cartridges.

§ 57.6701 Tamping and loading pole requirements

Tamping and loading poles shall be of wood or other nonconductive, nonsparking material. Couplings for poles shall be nonsparking.

Maintenance - Surface and Underground

§ 57.6800 Storage facilities

When repair work which could produce a spark or flame is to be performed on a storage facility -

(a) The explosive material shall be moved to another facility, or moved at least 50 feet from the repair activity and monitored; and

(b) The facility shall be cleaned to prevent accidental detonation.

§ 57.6801 Vehicle repair

Vehicles containing explosive material and oxidizers shall not be taken into a repair garage or shop.

§ 57.6802 Bulk delivery vehicles

No welding or cutting shall be performed on a bulk delivery vehicle until the vehicle has been washed down and all explosive material has been removed. Before welding or cutting on a hollow shaft, the shaft shall be thoroughly cleaned inside and out and vented with a minimum ½-inch diameter opening to allow for sufficient ventilation.

§ 57.6803 Blasting lines

Permanent blasting lines shall be properly supported. All blasting lines shall be insulated and kept in good repair.

§ 57.6900 Damaged or deteriorated explosive material

Damaged or deteriorated explosive material shall be disposed of in a safe manner in accordance with the instructions of the manufacturer.

§ 57.6901 Black powder

(a) Black powder shall be used for blasting only when a desired result cannot be obtained with another type of explosive, such as in quarrying certain types of dimension stone.

(b) Containers of black powder shall be -

(1) Nonsparking;

(2) Kept in a totally enclosed cargo space while being transported by a vehicle;

(3) Securely closed at all times when -

(i) Within 50 feet of any magazine or open flame;

(ii) Within any building in which a fuel-fired or exposed-element electric heater is operating; or

(iii) In an area where electrical or incandescent-particle sparks could result in powder ignition; and

(4) Opened only when the powder is being transferred to a blasthole or another container and only in locations not listed in paragraph (b)(3) of this section.

(c) Black powder shall be transferred from containers only by pouring.

(d) Spills shall be cleaned up promptly with nonsparking equipment. Contaminated powder shall be put into a container of water and shall be disposed of promptly after the granules have disintegrated, or the spill area shall be flushed promptly with water until the granules have disintegrated completely.

(e) Misfires shall be disposed of by washing the stemming and powder charge from the blasthole and removing and disposing of the initiator in accordance with the requirement for damaged explosives.

(f) Holes shall not be reloaded for at least 12 hours when the blastholes have failed to break as planned.

§ 57.6902 Excessive temperatures

(a) Where heat could cause premature detonation, explosive material shall not be loaded into hot areas, such as kilns or sprung holes.

(b) When blasting sulfide ores where hot holes occur that may react with explosive material in blastholes, operators shall -

(1) Measure an appropriate number of blasthole temperatures in order to assess the specific mine conditions prior to the introduction of explosive material;

(2) Limit the time between the completion of loading and the initiation of the blast to no more than 12 hours; and

(3) Take other special precautions to address the specific conditions at the mine to prevent premature detonation.

§ 57.6903 Burning explosive material

If explosive material is suspected of burning at the blast site, persons shall be evacuated from the endangered area and shall not return for at least one hour after the burning or suspected burning has stopped.

§ 57.6904 Smoking and open flames

Smoking and use of open flames shall not be permitted within 50 feet of explosive material except when separated by permanent noncombustible barriers. This standard does not apply to devices designed to ignite safety fuse or to heating devices which do not create a fire or explosion hazard.

§ 57.6905 Protection of explosive material

(a) Explosive material shall be protected from temperatures in excess of 150 degrees Fahrenheit.

(b) Explosive material shall be protected from impact, except for tamping and dropping during loading.

General Requirements - Underground Only

§ 57.6960 Mixing of explosive material

(a) The mixing of ingredients to produce explosive material shall not be conducted underground unless prior approval of the MSHA district manager is obtained. In granting or withholding approval, the district manager shall consider the potential hazards created by -

(1) The location of the stored material and the storage practices used;

(2) The transportation and use of the explosive material;

(3) The nature of the explosive material, including its sensitivity;

(4) Any other factor deemed relevant to the safety of miners potentially exposed to the hazards associated with the mixing of the bulk explosive material underground.

(b) Storage facilities for the ingredients to be mixed shall provide drainage away from the facilities for leaks and spills.

Subpart F - DRILLING AND ROTARY JET PIERCING

Drilling - Surface Only

§ 57.7002 Equipment defects

Equipment defects affecting safety shall be corrected before the equipment is used.

§ 57.7003 Drill area inspection

The drilling area shall be inspected for hazards before starting the drilling operations.

§ 57.7004 Drill mast

Persons shall not be on a mast while the drill-bit is in operation unless they are provided with a safe platform from which to work and they are required to use safety belts to avoid falling.

§ 57.7005 Augers and drill stems

Drill crews and others shall stay clear of augers or drill stems that are in motion. Persons shall not pass under or step over a moving stem or auger.

§ 57.7008 Moving the drill

When a drill is being moved from one drilling area to another, drill steel, tools, and other equipment shall be secured, and the mast placed in a safe position.

§ 57.7009 Drill helpers

If a drill helper assists the drill operator during movement of a drill to a new location, the helper shall be in sight of, or in communication with, the operator at all times.

§ 57.7010 Power failures

In the event of power failure, drill controls shall be placed in the neutral position until power is restored.

§ 57.7011 Straightening crossed cables

The drill stem shall be resting on the bottom of the hole or on the platform with the stem secured to the mast before attempts are made to straighten a crossed cable on a reel.

§ 57.7012 Tending drills in operation

While in operation, drills shall be attended at all times.

§ 57.7013 Covering or guarding drill holes

Drill holes large enough to constitute a hazard shall be covered or guarded.

§ 57.7018 Hand clearance

Persons shall not hold the drill steel while collaring holes, or rest their hands on the chuck or centralizer while drilling.

Drilling - Underground Only

§ 57.7028 Hand clearance

Persons shall not rest their hands on the chuck or centralizer while drilling.

§ 57.7032 Anchoring

Columns and the drills mounted on them shall be anchored firmly before and during drilling.

Drilling - Surface and Underground

§ 57.7050 Tool and drill steel racks

Receptacles or racks shall be provided for drill steel and tools stored or carried on drills.

§ 57.7051 Loose objects on the mast or drill platform

To prevent injury to personnel, tools and other objects shall not be left loose on the mast or drill platform.

§ 57.7052 Drilling positions

Persons shall not drill from -

(a) Positions which hinder their access to the control levers;

(b) Insecure footing or insecure staging; or

(c) Atop equipment not suitable for drilling.

§ 57.7053 Moving hand-held drills

Before hand-held drills are moved from one working area to another, air shall be turned off and bled from the hose.

§ 57.7054 Starting or moving drill equipment

Drill operators shall not start or move drilling equipment unless all miners are in the clear.

§ 57.7055 Intersecting holes

Holes shall not be drilled where there is a danger of intersecting a misfired hole or a hole containing explosives, blasting agents, or detonators.

[56 FR 46517, Sept. 12, 1991; 56 FR 52193, Oct. 18, 1991]

§ 57.7056 Collaring in bootlegs

Holes shall not be collared in bootlegs.

[56 FR 46517, Sept. 12, 1991]

Rotary Jet Piercing - Surface Only

§ 57.7801 Jet drills

Jet piercing drills shall be provided with:

(a) A system to pressurize the equipment operator's cab, when a cab is provided; and

(b) A protective cover over the oxygen flow indicator.

§ 57.7802 Oxygen hose lines

Safety chains or other suitable locking devices shall be provided across connections to and between high pressure oxygen hose lines of 1-inch inside diameter or larger.

§ 57.7803 Lighting the burner

A suitable means of protection shall be provided for the employee when lighting the burner.

§ 57.7804 Refueling

When rotary jet piercing equipment requires refueling at locations other than fueling stations, a system for fueling without spillage shall be provided.

§ 57.7805 Smoking and open flames

Persons shall not smoke, and open flames shall not be used in the vicinity of the oxygen storage and supply lines. Signs warning against smoking and open flames shall be posted in these areas.

§ 57.7806 Oxygen intake coupling

The oxygen intake coupling on jet piercing drills shall be constructed so that only the oxygen hose can be coupled to it.

§ 57.7807 Flushing the combustion chamber

The combustion chamber of a jet drill stem which has been sitting unoperated in a drill hole shall be flushed with a suitable solvent after the stem is pulled up.

Subpart G - VENTILATION

Surface and Underground

§ 57.8518 Main and booster fans

(a) All mine main and booster fans installed and used to ventilate the active workings of the mine shall be operated continuously while persons are underground in the active workings. However, this provision is not applicable during scheduled production-cycle shutdowns or planned or scheduled fan maintenance or fan adjustments where air quality is maintained in compliance with the applicable standards of subpart D of this part and all persons underground in the affected areas are advised in advance of such scheduled or planned fan shutdowns, maintenance, or adjustments.

(b) In the event of main or booster fan failure due to a malfunction, accident, power failure, or other such unplanned or unscheduled event:

(1) The air quality in the affected active workings shall be tested at least within 2-hours of the discovery of the fan failure, and at least every 4-hours thereafter by a competent person for compliance with the requirements of the applicable standards of subpart D of this part until normal ventilation is restored, or

(2) All persons, except those working on the fan, shall be withdrawn, the ventilation shall be restored to normal and the air quality in the affected active workings shall be tested by a competent person to assure that the air quality meets the requirements of the standards in subpart D of this part, before any other persons are permitted to enter the affected active workings.

§ 57.8519 Underground main fan controls

All underground main fans shall have controls placed at a suitable protected location remote from the fan and preferably on the surface.

Underground Only

§ 57.8520 Ventilation plan

A plan of the mine ventilation system shall be set out by the operator in written form. Revisions of the system shall be noted and updated at least annually. The ventilation plan or revisions thereto shall be submitted to the District Manager for review and comments upon his written request. The plan shall, where applicable, contain the following:

(a) The mine name.

(b) The current mine map or schematic or series of mine maps or schematics of an appropriate scale, not greater than five hundred feet to the inch, showing:

(1) Direction and quantity of principal air flows;

(2) Locations of seals used to isolate abandoned workings;

(3) Locations of areas withdrawn from the ventilation system;

(4) Locations of all main, booster and auxiliary fans not shown in paragraph (d) of this standard.

(5) Locations of air regulators and stoppings and ventilation doors not shown in paragraph (d) of this standard;

(6) Locations of overcasts, undercasts and other airway crossover devices not shown in paragraph (d) of this standard;

(7) Locations of known oil or gas wells;

(8) Locations of known underground mine openings adjacent to the mine;

(9) Locations of permanent underground shops, diesel fuel storage depots, oil fuel storage depots, hoist rooms, compressors, battery charging stations and explosive storage facilities. Permanent facilities are those intended to exist for one year or more; and

(10) Significant changes in the ventilation system projected for one year.

(c) Mine fan data for all active main and booster fans including manufacturer's name, type, size, fan speed, blade setting, approximate pressure at present operating point, and motor brake horsepower rating.

(d) Diagrams, descriptions, or sketches showing how ventilation is accomplished in each typical type of working place including the approximate quantity of air provided, and typical size and type of auxiliary fans used.

(e) The number and type of internal combustion engine units used underground, including make and model of unit, type of engine, make and model of engine, brake horsepower rating of engine, and approval number.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33723, June 29, 1995]

§ 57.8525 Main fan maintenance

Main fans shall be maintained according to either the manufacturer's recommendations or a written periodic schedule adopted by the operator which shall be available at the operation on request of the Secretary or his authorized representative.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33723, June 29, 1995]

§ 57.8527 Oxygen-deficiency testing

Flame safety lamps or other suitable devices shall be used to test for acute oxygen deficiency.

§ 57.8528 Unventilated areas

Unventilated areas shall be sealed or barricaded and posted against entry.

§ 57.8529 Auxiliary fan systems

When auxiliary fan systems are used, such systems shall minimize recirculation and be maintained to provide ventilation air that effectively sweeps the working places.

§ 57.8531 Construction and maintenance of ventilation doors

Ventilation doors shall be -

(a) Substantially constructed;

(b) Covered with fire-retardant material, if constructed of wood;

(c) Maintained in good condition;

(d) Self-closing, if manually operated; and

(e) Equipped with audible or visual warning devices, if mechanically operated.

§ 57.8532 Opening and closing ventilation doors

When ventilation control doors are opened as a part of the normal mining cycle, they shall be closed as soon as possible to re-establish normal ventilation to working places.

§ 57.8534 Shutdown or failure of auxiliary fans

(a) Auxiliary fans installed and used to ventilate the active workings of the mine shall be operated continuously while persons are underground in the active workings, except for scheduled production-cycle shutdowns or planned or scheduled fan maintenance or fan adjustments where air quality is maintained in compliance with the applicable standards of subpart D of this part, and all persons underground in the affected areas are advised in advance of such scheduled or planned fan shutdowns, maintenance, or adjustments.

(b) In the event of auxiliary fan failure due to malfunction, accident, power failure, or other such unplanned or unscheduled event:

(1) The air quality in the affected active workings shall be tested at least within 2 hours of the discovery of the fan failure, and at least every 4 hours thereafter by a competent person for compliance with the requirements of the applicable standards of subpart D of this part until normal ventilation is restored, or

(2) All persons, except those working on the fan, shall be withdrawn, the ventilation shall be restored to normal and the air quality in the affected active workings shall be tested by a competent person to assure that the air quality meets the requirements of the standards in subpart D of this part, before any other persons are permitted to enter the affected active workings.

§ 57.8535 Seals

Seals shall be provided with a means for checking the quality of air behind the seal and a means to prevent a water head from developing unless the seal is designed to impound water.

Subpart H - LOADING, HAULING, AND DUMPING

Source: 53 FR 32526, Aug. 25, 1988, unless otherwise noted.

Traffic Safety

§ 57.9100 Traffic control

To provide for the safe movement of self-propelled mobile equipment -

(a) Rules governing speed, right-of-way, direction of movement, and the use of headlights to assure appropriate visibility, shall be established and followed at each mine; and

(b) Signs or signals that warn of hazardous conditions shall be placed at appropriate locations at each mine.

§ 57.9101 Operating speeds and control of equipment

Operators of self-propelled mobile equipment shall maintain control of the equipment while it is in motion. Operating speeds shall be consistent with conditions of roadways, tracks, grades, clearance, visibility, and traffic, and the type of equipment used.

§ 57.9102 Movement of independently operating rail equipment

Movement of two or more pieces of rail equipment operating independently on the same track shall be controlled for safe operation.

§ 57.9103 Clearance on adjacent tracks

Railcars shall not be left on sidetracks unless clearance is provided for traffic on adjacent tracks.

§ 57.9104 Railroad crossings

Designated railroad crossings shall be posted with warning signs or signals, or shall be guarded when trains are passing. These crossings shall also be planked or filled between the rails.

§ 57.9160 Train movement during shift changes

During shift changes, the movement of underground trains carrying rock or material shall be limited to areas where the trains do not present a hazard to persons changing shifts.

Transportation of Persons and Materials

§ 57.9200 Transporting persons

Persons shall not be transported -

(a) In or on dippers, forks, clamshells, or buckets except shaft buckets during shaft-sinking operations or during inspection, maintenance, and repair of shafts.

(b) In beds of mobile equipment or railcars, unless -

(1) Provisions are made for secure travel, and

(2) Means are taken to prevent accidental unloading if the equipment is provided with unloading devices;

(c) On top of loads in mobile equipment;

(d) Outside cabs, equipment operators' stations, and beds of mobile equipment, except when necessary for maintenance, testing, or training purposes, and provisions are made for secure travel. This provision does not apply to rail equipment.

(e) Between cars of trains, on the leading end of trains, on the leading end of a single railcar, or in other locations on trains that expose persons to hazards from train movement.

(1) This paragraph does not apply to car droppers if they are secured with safety belts and lines which prevent them from falling off the work platform.

(2) Brakemen and trainmen are prohibited from riding between cars of moving trains but may ride on the leading end of trains or other locations when necessary to perform their duties;

(f) To and from work areas in overcrowded mobile equipment;

(g) In mobile equipment with materials or equipment unless the items are secured or are small and can be carried safely by hand without creating a hazard to persons; or

(h) On conveyors unless the conveyors are designed to provide for their safe transportation.

§ 57.9201 Loading, hauling, and unloading of equipment or supplies

Equipment and supplies shall be loaded, transported, and unloaded in a manner which does not create a hazard to persons from falling or shifting equipment or supplies.

§ 57.9202 Loading and hauling large rocks

Large rocks shall be broken before loading if they could endanger persons or affect the stability of mobile equipment. Mobile equipment used for haulage of mined material shall be loaded to minimize spillage where a hazard to persons could be created.

§ 57.9260 Supplies, materials, and tools on mantrips

Supplies, materials, and tools, other than small items that can be carried by hand, shall not be transported underground with persons in mantrips. Mantrips shall be operated independently of ore or supply trips.

§ 57.9261 Transporting tools and materials on locomotives

Tools or materials shall not be carried on top of locomotives underground except for secured rerailing devices located in a manner which does not create a hazard to persons.

Safety Devices, Provisions, and Procedures for Roadways, Railroads, and Loading and Dumping Sites

§ 57.9300 Berms or guardrails

(a) Berms or guardrails shall be provided and maintained on the banks of roadways where a drop-off exists of sufficient grade or depth to cause a vehicle to overturn or endanger persons in equipment.

(b) Berms or guardrails shall be at least mid-axle height of the largest self-propelled mobile equipment which usually travels the roadway.

(c) Berms may have openings to the extent necessary for roadway drainage.

(d) Where elevated roadways are infrequently traveled and used only by service or maintenance vehicles, berms or guardrails are not required when all of the following are met:

(1) Locked gates are installed at the entrance points to the roadway.

(2) Signs are posted warning that the roadway is not bermed.

(3) Delineators are installed along the perimeter of the elevated roadway so that, for both directions of travel, the reflective surfaces of at least three delineators along each elevated shoulder are always visible to the driver and spaced at intervals sufficient to indicate the edges and attitude of the roadway.

(4) A maximum speed limit is posted and observed for the elevated unbermed portions of the roadway. Factors to consider when establishing the maximum speed limit shall include the width, slope and alignment of the road, the type of equipment using the road, the road material, and any hazardous conditions which may exist.

(5) Road surface traction is not impaired by weather conditions, such as sleet and snow, unless corrective measures, such as the use of tire chains, plowing, or sanding, are taken to improve traction.

(e) This standard is not applicable to rail beds.

[53 FR 32526, Aug. 25, 1988, as amended at 55 FR 37218, Sept. 7, 1990]

§ 57.9301 Dump site restraints

Berms, bumper blocks, safety hooks, or similar impeding devices shall be provided at dumping locations where there is a hazard of overtravel or overturning.

§ 57.9302 Protection against moving or runaway railroad equipment

Stopblocks, derail devices, or other devices that protect against moving or runaway rail equipment shall be installed wherever necessary to protect persons.

§ 57.9303 Construction of ramps and dumping facilities

Ramps and dumping facilities shall be designed and constructed of materials capable of supporting the loads to which they will be subjected. The ramps and dumping facilities shall provide width, clearance, and headroom to safely accommodate the mobile equipment using the facilities.

§ 57.9304 Unstable ground

(a) Dumping locations shall be visually inspected prior to work commencing and as ground conditions warrant.

(b) Where there is evidence that the ground at a dumping location may fail to support the mobile equipment, loads shall be dumped a safe distance back from the edge of the unstable area of the bank.

§ 57.9305 Truck spotters

(a) If truck spotters are used, they shall be in the clear while trucks are backing into dumping position or dumping.

(b) Spotters shall use signal lights to direct trucks where visibility is limited.

(c) When a truck operator cannot clearly recognize the spotter's signals, the truck shall be stopped.

§ 57.9306 Warning devices for restricted clearances

Where restricted clearance creates a hazard to persons on mobile equipment, warning devices shall be installed in advance of the restricted area and the restricted area shall be conspicuously marked.

§ 57.9307 Design, installation, and maintenance of railroads

Roadbeds and all elements of the railroad tracks shall be designed, installed, and maintained to provide safe operation consistent with the speed and type of haulage used.

§ 57.9308 Switch throws

Switch throws shall be installed to provide clearance to protect switchmen from contact with moving trains.

§ 57.9309 Chute design

Chute-loading installations shall be designed to provide a safe location for persons pulling chutes.

§ 57.9310 Chute hazards

(a) Prior to chute-pulling, persons who could be affected by the draw or otherwise exposed to danger shall be warned and given time to clear the hazardous area.

(b) Persons attempting to free chute hangups shall be experienced and familiar with the task, know the hazards involved, and use the proper tools to free material.

(c) When broken rock or material is dumped into an empty chute, the chute shall be equipped with a guard or all persons shall be isolated from the hazard of flying rock or material.

§ 57.9311 Anchoring stationary sizing devices

Grizzlies and other stationary sizing devices shall be securely anchored.

§ 57.9312 Working around drawholes

Unless platforms or safety lines are used, persons shall not position themselves over drawholes if there is danger that broken rock or material may be withdrawn or bridged.

§ 57.9313 Roadway maintenance

Water, debris, or spilled material on roadways which creates hazards to the operation of mobile equipment shall be removed.

§ 57.9314 Trimming stockpile and muckpile faces

Stockpile and muckpile faces shall be trimmed to prevent hazards to persons.

§ 57.9315 Dust control

Dust shall be controlled at muck piles, material transfer points, crushers, and on haulage roads where hazards to persons would be created as a result of impaired visibility.

§ 57.9316 Notifying the equipment operator

When an operator of self-propelled mobile equipment is present, persons shall notify the equipment operator before getting on or off that equipment.

§ 57.9317 Suspended loads

Persons shall not work or pass under the buckets or booms of loaders in operation.

§ 57.9318 Getting on or off moving equipment

Persons shall not get on or off moving mobile equipment. This provision does not apply to trainmen, brakemen, and car droppers who are required to get on or off slowly moving trains in the performance of their work duties.

§ 57.9319 Going over, under, or between railcars

Persons shall not go over, under, or between railcars unless -

(a) The train is stopped; and

(b) The train operator, when present, is notified and the notice acknowledged.

§ 57.9330 Clearance for surface equipment

Continuous clearance of at least 30 inches from the farthest projection of moving railroad equipment shall be provided on at least one side of the tracks at all locations where possible or the area shall be marked conspicuously.

§ 57.9360 Shelter holes

(a) Shelter holes shall be -

(1) Provided at intervals adequate to assure the safety of persons along underground haulageways where continuous clearance of at least 30 inches cannot be maintained from the farthest projection of moving equipment on at least one side of the haulageway; and

(2) At least four feet wide, marked conspicuously, and provide a minimum 40-inch clearance from the farthest projection of moving equipment.

(b) Shelter holes shall not be used for storage unless a 40-inch clearance is maintained.

§ 57.9361 Drawholes

To prevent hazards to persons underground, collars of open drawholes shall be free of muck or materials except during transfer of the muck or material through the drawhole.

§ 57.9362 Protection of signalmen

Signalmen used during slushing operations underground shall be located away from possible contact with cables, sheaves, and slusher buckets.

Subpart I - AERIAL TRAMWAYS

§ 57.10001 Filling buckets

Buckets shall not be overloaded, and feed shall be regulated to prevent spillage.

§ 57.10002 Inspection and maintenance

Inspection and maintenance of carriers (including loading and unloading mechanisms), ropes and supports, and brakes shall be performed by competent persons according to the recommendations of the manufacturer.

§ 57.10003 Correction of defects

Any hazardous defects shall be corrected before the equipment is used.

§ 57.10004 Brakes

Positive-action-type brakes and devices which apply the brakes automatically in the event of a power failure shall be provided on aerial tramways.

§ 57.10005 Track cable connections

Track cable connections shall not obstruct the passage of carriage wheels.

§ 57.10006 Tower guards

Towers shall be suitably protected from swaying buckets.

§ 57.10007 Falling object protection

Guard nets or other suitable protection shall be provided where tramways pass over roadways, walkways, or buildings.

§ 57.10008 Riding tramways

Persons other than maintenance persons shall not ride aerial tramways unless the following features are provided.

(a) Two independent brakes, each capable of holding the maximum load;

(b) Direct communication between terminals;

(c) Power drives with emergency power available in case of primary power failure; and

(d) Buckets equipped with positive locks to prevent accidental tripping or dumping.

§ 57.10009 Riding loaded buckets

Persons shall not ride loaded buckets.

§ 57.10010 Starting precautions

Where possible, aerial tramways shall not be started until the operator has ascertained that everyone is in the clear.

Subpart J - TRAVELWAYS AND ESCAPEWAYS

Travelways - Surface and Underground

§ 57.11001 Safe access

Safe means of access shall be provided and maintained to all working places.

§ 57.11002 Handrails and toeboards

Crossovers, elevated walkways, elevated ramps, and stairways shall be of substantial construction, provided with handrails, and maintained in good condition. Where necessary, toeboards shall be provided.

§ 57.11003 Construction and maintenance of ladders

Ladders shall be of substantial construction and maintained in good condition.

§ 57.11004 Portable rigid ladders

Portable rigid ladders shall be provided with suitable bases and placed securely when used.

§ 57.11005 Fixed ladder anchorage and toe clearance

Fixed ladders shall be anchored securely and installed to provide at least 3 inches of toe clearance.

§ 57.11006 Fixed ladder landings

Fixed ladders shall project at least 3 feet above landings, or substantial handholds shall be provided above the landings.

§ 57.11007 Wooden components of ladders

Wooden components of ladders shall not be painted except with a transparent finish.

§ 57.11008 Restricted clearance

Where restricted clearance creates a hazard to persons, the restricted clearance shall be conspicuously marked.

[53 FR 32528, Aug. 25, 1988]

§ 57.11009 Walkways along conveyors

Walkways with outboard railings shall be provided wherever persons are required to walk alongside elevated conveyor belts. Inclined railed walkways shall be nonskid or provided with cleats.

§ 57.11010 Stairstep clearance

Vertical clearance above stair steps shall be a minimum of seven feet, or suitable warning signs or similar devices shall be provided to indicate an impaired clearance.

§ 57.11011 Use of ladders

Persons using ladders shall face the ladders and have both hands free for climbing and descending.

§ 57.11012 Protection for openings around travelways

Openings above, below, or near travelways through which persons or materials may fall shall be protected by railings, barriers, or covers. Where it is impractical to install such protective devices, adequate warning signals shall be installed.

§ 57.11013 Conveyor crossovers

Crossovers shall be provided where it is necessary to cross conveyors.

§ 57.11014 Crossing moving conveyors

Moving conveyors shall be crossed only at designated crossover points.

§ 57.11016 Snow and ice on walkways and travelways

Regularly used walkways and travelways shall be sanded, salted, or cleared of snow and ice as soon as practicable.

§ 57.11017 Inclined fixed ladders

Fixed ladders shall not incline backwards.

Travelways - Surface Only

§ 57.11025 Railed landings, backguards, and other protection for fixed ladders

Fixed ladders, except on mobile equipment, shall be offset and have substantial railed landings at least every 30 feet unless backguards or equivalent protection such as safety belts and safety lines, are provided.

§ 57.11026 Protection for inclined fixed ladders

Fixed ladders 70 degrees to 90 degrees from the horizontal and 30 feet or more in length shall have backguards, cages or equivalent protection, starting at a point not more than seven feet from the bottom of the ladders.

§ 57.11027 Scaffolds and working platforms

Scaffolds and working platforms shall be of substantial construction and provided with handrails and maintained in good condition. Floorboards shall be laid properly and the scaffolds and working platform shall not be overloaded. Working platforms shall be provided with toeboards when necessary.

Travelways - Underground Only

§ 57.11036 Ladderway trap doors and guards

Trap doors or adequate guarding shall be provided in ladderways at each level. Doors shall be kept operable.

§ 57.11037 Ladderway openings

Ladderways constructed after November 15, 1979, shall have a minimum unobstructed cross-sectional opening of 24 inches by 24 inches measured from the face of the ladder.

§ 57.11038 Entering a manway

Before entering a manway where persons may be working or traveling, a warning shall be given by the person entering the manway and acknowledged by any person present in the manway.

§ 57.11040 Inclined travelways

Travelways steeper than 35 degrees from the horizontal shall be provided with ladders or stairways.

§ 57.11041 Landings for inclined ladderways

Fixed ladders with an inclination of more than 70 degrees from the horizontal shall be offset with substantial landings at least every 30 feet or have landing gates at least every 30 feet.

Escapeways - Underground Only

§ 57.11050 Escapeways and refuges

(a) Every mine shall have two or more separate, properly maintained escapeways to the surface from the lowest levels which are so positioned that damage to one shall not lessen the effectiveness of the others. A method of refuge shall be provided while a second opening to the surface is being developed. A second escapeway is recommended, but not required, during the exploration or development of an ore body.

(b) In addition to separate escapeways, a method of refuge shall be provided for every employee who cannot reach the surface from his working place through at least two separate escapeways within a time limit of one hour when using the normal exit method. These refuges must be positioned so that the employee can reach one of them within 30 minutes from the time he leaves his workplace.

§ 57.11051 Escape routes

Escape routes shall be -

(a) Inspected at regular intervals and maintained in safe, travelable condition; and

(b) Marked with conspicuous and easily read direction signs that clearly indicate the ways of escape.

§ 57.11052 Refuge areas

Refuge areas shall be -

(a) Of fire-resistant construction, preferably in untimbered areas of the mine;

(b) Large enough to accommodate readily the normal number of persons in the particular area of the mine;

(c) Constructed so they can be made gastight; and

(d) Provided with compressed air lines, waterlines, suitable handtools, and stopping materials.

§ 57.11053 Escape and evacuation plans

A specific escape and evacuation plan and revisions thereof suitable to the conditions and mining system of the mine and showing assigned responsibilities of all key personnel in the event of an emergency shall be developed by the operator and set out in written form. Within 45 calendar days after promulgation of this standard a copy of the plan and revisions thereof shall be available to the Secretary or his authorized representative. Also, copies of the plan and revisions thereof shall be posted at locations convenient to

all persons on the surface and underground. Such a plan shall be updated as necessary and shall be reviewed jointly by the operator and the Secretary or his authorized representative at least once every six months from the date of the last review. The plan shall include:

(a) Mine maps or diagrams showing directions of principal air flow, location of escape routes and locations of existing telephones, primary fans, primary fan controls, fire doors, ventilation doors, and refuge chambers. Appropriate portions of such maps or diagrams shall be posted at all shaft stations and in underground shops, lunchrooms, and elsewhere in working areas where persons congregate;

(b) Procedures to show how the miners will be notified of emergency;

(c) An escape plan for each working area in the mine to include instructions showing how each working area should be evacuated. Each such plan shall be posted at appropriate shaft stations and elsewhere in working areas where persons congregate;

(d) A firefighting plan;

(e) Surface procedure to follow in an emergency, including the notification of proper authorities, preparing rescue equipment, and other equipment which may be used in rescue and recovery operations; and

(f) A statement of the availability of emergency communication and transportation facilities, emergency power and ventilation and location of rescue personnel and equipment.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33722, June 29, 1995]

§ 57.11054 Communication with refuge chambers

Telephone or other voice communication shall be provided between the surface and refuge chambers and such systems shall be independent of the mine power supply.

§ 57.11055 Inclined escapeways

Any portion of a designated escapeway which is inclined more than 30 degrees from the horizontal and that is more than 300 feet in vertical extent shall be provided with an emergency hoisting facility.

§ 57.11056 Emergency hoists

The procedure for inspection, testing and maintenance required by standard 57.19120 shall be utilized at least every 30 days for hoists designated as emergency hoists in any evacuation plan.

§ 57.11058 Check-in, check-out system

Each operator of an underground mine shall establish a check-in and check-out system which shall provide an accurate record of persons in the mine. These records shall be kept on the surface in a place chosen to minimize the danger of destruction by fire or other hazards. Every person underground shall carry a positive means of being identified.

§ 57.11059 Respirable atmosphere for hoist operators underground

For the protection of operators of hoists located underground which are part of the mine escape and evacuation plan required under standard 57.11053, the hoist operator shall be provided with a respirable atmosphere completely independent of the mine atmosphere. This independent ventilation system shall convert, without contamination, to an approved and properly maintained 2-hour self-contained breathing apparatus to provide a safe means of escape for the hoist operator after the hoisting duties have been completed as prescribed in the mine escape and evacuation plan for that hoist. The hoist operator's independent ventilation system shall be provided by one of the following methods:

(a) A suitable enclosure equipped with a positive pressure ventilation system which may be operated continuously or be capable of immediate activation from within the enclosure during an emergency evacuation. Air for the enclosure's ventilation system shall be provided in one of the following ways:

(1) Air coursed from the surface through a borehole into the hoist enclosure directly or through a metal pipeline from such borehole; or

(2) Air coursed from the surface through metal duct work into the hoist enclosure, although this duct work shall not be located in timber-supported active workings; or

(3) Air supplied by air compressors located on the surface and coursed through metal pipe into the hoist enclosure.

A back-up system shall be provided for a hoist enclosure ventilation system provided by either of the methods set forth in paragraphs (a)(2) and (3) of this section. This back-up system shall consist of compressed air stored in containers connected to the enclosure. This back-up system shall provide and maintain a respirable atmosphere in the enclosure for a period of time equal to at least twice the time necessary to complete the evacuation of all persons designated to use that hoist as prescribed in the mine escape and evacuation plan required under standard 57.11053; or

(b) An approved and properly maintained self-contained breathing apparatus system which shall consist of a mask connected to compressed air stored in containers adjacent to the hoist controls. The self-contained breathing system shall provide a minimum of 24 hours of respirable atmosphere to the hoist operator. In addition,

the self-contained breathing system shall be capable of a quick connect with the approved 2-hour self-contained breathing apparatus above.

Subpart K - ELECTRICITY

Surface and Underground

§ 57.12001 Circuit overload protection

Circuits shall be protected against excessive overloads by fuses or circuit breakers of the correct type and capacity.

§ 57.12002 Controls and switches

Electric equipment and circuits shall be provided with switches or other controls. Such switches or controls shall be of approved design and construction and shall be properly installed.

§ 57.12003 Trailing cable overload protection

Individual overload protection or short circuit protection shall be provided for the trailing cables of mobile equipment.

§ 57.12004 Electrical conductors

Electrical conductors shall be of a sufficient size and current-carrying capacity to ensure that a rise in temperature resulting from normal operations will not damage the insulating materials. Electrical conductors exposed to mechanical damage shall be protected.

§ 57.12005 Protection of power conductors from mobile equipment

Mobile equipment shall not run over power conductors, nor shall loads be dragged over power conductors, unless the conductors are properly bridged or protected.

§ 57.12006 Distribution boxes

Distribution boxes shall be provided with a disconnecting device for each branch circuit. Such disconnecting devices shall be equipped or designed in such a manner that it can be determined by visual observation when such a device is open and that the circuit is deenergized, and the distribution box shall be labeled to show which circuit each device controls.

§ 57.12007 Junction box connection procedures

Trailing cable and power-cable connections to junction boxes shall not be made or broken under load.

§ 57.12008 Insulation and fittings for power wires and cables

Power wires and cables shall be insulated adequately where they pass into or out of electrical compartments. Cables shall enter metal frames of motors, splice boxes, and electrical compartments only through proper fittings. When insulated wires, other than cables, pass through metal frames, the holes shall be substantially bushed with insulated bushings.

§ 57.12010 Isolation or insulation of communication conductors

Telephone and low-potential signal wire shall be protected, by isolation or suitable insulation, or both, from contacting energized power conductors or any other power source.

§ 57.12011 High-potential electrical conductors

High-potential electrical conductors shall be covered, insulated, or placed to prevent contact with low potential conductors.

§ 57.12012 Bare signal wires

The potential on bare signal wires accessible to contact by persons shall not exceed 48 volts.

§ 57.12013 Splices and repairs of power cables

Permanent splices and repairs made in power cables, including the ground conductor where provided, shall be -

(a) Mechanically strong with electrical conductivity as near as possible to that of the original;

(b) Insulated to a degree at least equal to that of the original, and sealed to exclude moisture; and,

(c) Provided with damage protection as near as possible to that of the original, including good bonding to the outer jacket.

§ 57.12014 Handling energized power cables

Power cables energized to potentials in excess of 150 volts, phase-to-ground, shall not be moved with equipment unless sleds or slings, insulated from such equipment, are used. When such energized cables are moved manually, insulated hooks, tongs, ropes, or slings shall be used unless suitable protection for persons is provided by other means. This does not prohibit pulling or dragging of cable by the equipment it powers when the cable is physically attached to the equipment by suitable mechanical devices, and the cable is insulated from the equipment in conformance with other standards in this part.

§ 57.12016 Work on electrically-powered equipment

Electrically powered equipment shall be deenergized before mechanical work is done on such equipment. Power switches shall be locked out or other measures taken which shall prevent the equipment from being energized without the knowledge of the individuals working on it. Suitable warning notices shall be posted at the power switch and signed by the individuals who are to do the work. Such locks or preventive devices shall be removed only by the persons who installed them or by authorized personnel.

§ 57.12017 Work on power circuits

Power circuits shall be deenergized before work is done on such circuits unless hot-line tools are used. Suitable warning signs shall be posted by the individuals who are to do the work. Switches shall be locked out or other measures taken which shall prevent the power circuits from being energized without the knowledge of the individuals working on them. Such locks, signs, or preventive devices shall be removed only by the person who installed them or by authorized personnel.

§ 57.12018 Identification of power switches

Principal power switches shall be labeled to show which units they control unless identification can be made readily by location.

§ 57.12019 Access to stationary electrical equipment or switchgear

Where access is necessary, suitable clearance shall be provided at stationary electrical equipment or switchgear.

§ 57.12020 Protection of persons at switchgear

Dry wooden platforms, insulating mats, or other electrically-nonconductive material shall be kept in place at all switchboards and power-control switches where shock hazards exist. However, metal plates on which a person normally would stand and which are kept at the same potential as the grounded, metal, non-current-carrying parts of the power switches to be operated may be used.

§ 57.12021 Danger signs

Suitable danger signs shall be posted at all major electrical installations.

§ 57.12022 Authorized persons at major electrical installations

Areas containing major electrical installations shall be entered only by authorized persons.

§ 57.12023 Guarding electrical connections and resistor grids

Electrical connections and resistor grids that are difficult or impractical to insulate shall be guarded unless protection is provided by location.

§ 57.12025 Grounding circuit enclosures

All metal enclosing or encasing electrical circuits shall be grounded or provided with equivalent protection. This requirement does not apply to battery-operated equipment.

§ 57.12026 Grounding transformer and switchgear enclosures

Metal fencing and metal buildings enclosing transformers and switchgear shall be grounded.

§ 57.12027 Grounding mobile equipment

Frame grounding or equivalent protection shall be provided for mobile equipment powered through trailing cables.

§ 57.12028 Testing grounding systems

Continuity and resistance of grounding systems shall be tested immediately after installation, repair, and modification; and annually thereafter. A record of the resistance measured during the most recent test shall be made available on a request by the Secretary or his duly authorized representative.

§ 57.12030 Correction of dangerous conditions

When a potentially dangerous condition is found it shall be corrected before equipment or wiring is energized.

§ 57.12032 Inspection and cover plates

Inspection and cover plates on electrical equipment and junction boxes shall be kept in place at all times except during testing or repairs.

§ 57.12033 Hand-held electric tools

Hand-held electric tools shall not be operated at high potential voltages.

§ 57.12034 Guarding around lights

Portable extension lights, and other lights that by their location present a shock or burn hazard, shall be guarded.

§ 57.12035 Weatherproof lamp sockets

Lamp sockets shall be of a weatherproof type where they are exposed to weather or wet conditions that may interfere with illumination or create a shock hazard.

§ 57.12036 Fuse removal or replacement

Fuses shall not be removed or replaced by hand in an energized circuit, and they shall not otherwise be removed or replaced in an energized circuit unless equipment and techniques especially designed to prevent electrical shock are provided and used for such purpose.

§ 57.12037 Fuses in high-potential circuits

Fuse tongs or hotline tools shall be used when fuses are removed or replaced in high-potential circuits.

§ 57.12038 Attachment of trailing cables

Trailing cables shall be attached to machines in a suitable manner to protect the cable from damage and to prevent strain on the electrical connections.

§ 57.12039 Protection of surplus trailing cables

Surplus trailing cables to shovels, cranes and similar equipment shall be -

(a) Stored in cable boats;

(b) Stored on reels mounted on the equipment; or

(c) Otherwise protected from mechanical damage.

§ 57.12040 Installation of operating controls

Operating controls shall be installed so that they can be operated without danger of contact with energized conductors.

§ 57.12041 Design of switches and starting boxes

Switches and starting boxes shall be of safe design and capacity.

§ 57.12042 Track bonding

Both rails shall be bonded or welded at every joint and rails shall be crossbonded at least every 200 feet if the track serves as the return trolley circuit. When rails are moved, replaced, or broken bonds are discovered, they shall be rebonded within three working shifts.

§ 57.12045 Overhead powerlines

Overhead high-potential powerlines shall be installed as specified by the National Electrical Code.

§ 57.12047 Guy wires

Guy wires of poles supporting high-voltage transmission lines shall meet the requirements for grounding or insulator protection of the National Electrical Safety Code, part 2, entitled "Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines" (also referred to as National Bureau of Standards Handbook 81, Nov. 1, 1961), and Supplement 2 thereof issued March 1968, which are hereby incorporated by reference and made a part hereof. These publications and documents may be obtained from the National Institute of Science and Technology, 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899-3460. Telephone: 301-975-6478 (not a toll free number); *http://ts.nist.gov/nvl*; or from the Government Printing Office, Information Dissemination (Superintendent of Documents), P.O. Box 371954, Pittsburgh, PA 15250-7954; Telephone: 866-512-1800 (toll free) or 202-512-1800; *http://bookstore.gpo.gov*, or may be examined in any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration.

[53 FR 32526, Aug. 25, 1988, as amended at 60 FR 35695, July 11, 1995; 71 FR 16667, Apr. 3, 2006]

§ 57.12048 Communication conductors on power poles

Telegraph, telephone, or signal wires shall not be installed on the same crossarm with power conductors. When carried on poles supporting powerlines, they shall be installed as specified by the National Electrical Code.

§ 57.12050 Installation of trolley wires

Trolley wires shall be installed at least seven feet above rails where height permits, and aligned and supported to suitably control sway and sag.

§ 57.12053 Circuits powered from trolley wires

Ground wires for lighting circuits powered from trolley wires shall be connected securely to the ground return circuit.

Surface Only

§ 57.12065 Short circuit and lightning protection

Powerlines, including trolley wires, and telephone circuits shall be protected against short circuits and lightning.

§ 57.12066 Guarding trolley wires and bare powerlines

Where metallic tools or equipment can come in contact with trolley wires or bare powerlines, the lines shall be guarded or deenergized.

§ 57.12067 Installation of transformers

Transformers shall be totally enclosed, or shall be placed at least 8 feet above the ground, or installed in a transformer house, or surrounded by a substantial fence at least 6 feet high and at least 3 feet from any energized parts, casings, or wiring.

§ 57.12068 Locking transformer enclosures

Transformer enclosures shall be kept locked against unauthorized entry.

§ 57.12069 Lightning protection for telephone wires and ungrounded conductors

Each ungrounded conductor or telephone wire that leads underground and is directly exposed to lightning shall be equipped with suitable lightning arrestors of approved type within 100 feet of the point where the circuit enters the mine. Lightning arrestors shall be connected to a low resistance grounding medium on the surface and shall be separated from neutral grounds by a distance of not less than 25 feet.

§ 57.12071 Movement or operation of equipment near high-voltage powerlines

When equipment must be moved or operated near energized high-voltage powerlines (other than trolley lines) and the clearance is less than 10 feet, the lines shall be deenergized or other precautionary measures shall be taken.

Underground Only

§ 57.12080 Bare conductor guards

Trolley wires and bare power conductors shall be guarded at mantrip loading and unloading points, and at shaft stations. Where such trolley wires and bare power conductors are less than 7 feet above the rail, they shall be guarded at all points where persons work or pass regularly beneath.

§ 57.12081 Bonding metal pipelines to ground return circuits

All metal pipelines, 1,000 feet or more in length running parallel to trolley tracks, that are used as a ground return circuit shall be bonded to the return circuit rail at the ends of the pipeline and at intervals not to exceed 500 feet.

§ 57.12082 Isolation of powerlines

Powerlines shall be well separated or insulated from waterlines, telephone lines and air lines.

§ 57.12083 Support of power cables in shafts and boreholes

Power cables in shafts and boreholes shall be fastened securely in such a manner as to prevent undue strain on the sheath, insulation, or conductors.

§ 57.12084 Branch circuit disconnecting devices

Disconnecting switches that can be opened safely under load shall be provided underground at all branch circuits extending from primary power circuits near shafts, adits, levels and boreholes.

§ 57.12085 Transformer stations

Transformer stations shall be enclosed to prevent persons from unintentionally or inadvertently contacting energized parts.

§ 57.12086 Location of trolley wire

Trolley and trolley feeder wire shall be installed opposite the clearance side of haulageways. However, this standard does not apply where physical limitations would prevent the safe installation or use of such trolley and trolley feeder wire.

§ 57.12088 Splicing trailing cables

No splice, except a vulcanized splice or its equivalent, shall be made in a trailing cable within 25 feet of the machine unless the machine is equipped with a cable reel or other power feed cable payout-retrieval system. However, a temporary splice may be made to move the equipment for repair.

Subpart L - COMPRESSED AIR AND BOILERS

§ 57.13001 General requirements for boilers and pressure vessels

All boilers and pressure vessels shall be constructed, installed, and maintained in accordance with the standards and specifications of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code.

§ 57.13010 Reciprocating-type air compressors

(a) Reciprocating-type air compressors rated over 10 horsepower shall be equipped with automatic temperature-actuated shutoff mechanisms which shall be set or adjusted to the compressor when the normal operating temperature is exceeded by more than 25 percent.

(b) However, this standard does not apply to reciprocating-type air compressors rated over 10 horsepower if equipped with fusible plugs that were installed in the compressor discharge lines before November 15, 1979, and designed to melt at

temperatures at least 50 degrees below the flash point of the compressors' lubricating oil.

§ 57.13011 Air receiver tanks

Air receiver tanks shall be equipped with one or more automatic pressure-relief valves. The total relieving capacity of the relief valves shall prevent pressure from exceeding the maximum allowable working pressure in a receiver tank by not more than 10 percent. Air receiver tanks also shall be equipped with indicating pressure gages which accurately measure the pressure within the air receiver tanks.

§ 57.13012 Compressor air intakes

Compressor air intakes shall be installed to ensure that only clean, uncontaminated air enters the compressors.

§ 57.13015 Inspection of compressed-air receivers and other unfired pressure vessels

(a) Compressed-air receivers and other unfired pressure vessels shall be inspected by inspectors holding a valid National Board Commission and in accordance with the applicable chapters of the National Board Inspection Code, a Manual for Boiler and Pressure Vessel Inspectors, 1979. This code is incorporated by reference and made a part of this standard. It may be examined at any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration, and may be obtained from the publisher, the National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229.

(b) Records of inspections shall be kept in accordance with requirements of the National Board Inspection Code, and the records shall be made available to the Secretary or his authorized representative.

§ 57.13017 Compressor discharge pipes

Compressor discharge pipes where carbon build-up may occur shall be cleaned periodically as recommended by the manufacturer, but no less frequently than once every two years.

§ 57.13019 Pressure system repairs

Repairs involving the pressure system of compressors, receivers, or compressed-air-powered equipment shall not be attempted until the pressure has been bled off.

§ 57.13020 Use of compressed air

At no time shall compressed air be directed toward a person. When compressed air is used, all necessary precautions shall be taken to protect persons from injury.

§ 57.13021 High-pressure hose connections

Except where automatic shutoff valves are used, safety chains or other suitable locking devices shall be used at connections to machines of high-pressure hose lines of ¾-inch inside diameter or larger, and between high-pressure hose lines of ¾-inch inside diameter or larger, where a connection failure would create a hazard.

§ 57.13030 Boilers

(a) Fired pressure vessels (boilers) shall be equipped with water level gauges, pressure gauges, automatic pressure-relief valves, blowdown piping, and other safety devices approved by the American Society of Mechanical Engineers to protect against hazards from overpressure, flameouts, fuel interruptions and low water level, all as required by the appropriate sections, chapters and appendices listed in paragraphs (b)(1) and (2) of this section.

(b) These gauges, devices and piping shall be designed, installed, operated, maintained, repaired, altered, inspected, and tested by inspectors holding a valid National Board Commission and in accordance with the following listed sections, chapters, and appendices:

(1) The ASME Boiler and Pressure Vessel Code, 1977, published by the American Society of Mechanical Engineers.

SECTION AND TITLE

I Power Boilers

II Material Specifications - Part A - Ferrous

II Material Specifications - Part B - Non-ferrous

II Material Specifications - Part C - Welding Rods, Electrodes, and Filler Metals

IV Heating Boilers

V Nondestructive Examination

VI Recommended Rules for Care and Operation of Heating Boilers

VII Recommended Rules for Care of Power Boilers

(2) The National Board Inspection Code, a Manual for Boiler and Pressure Vessel Inspectors, 1979, published by the National Board of Boiler and Pressure Vessel Inspectors.

CHAPTER AND TITLE

I Glossary of Terms

II Inspection of Boilers and Pressure Vessels

III Repairs and Alterations to Boiler and Pressure Vessels by Welding

IV Shop Inspection of Boilers and Pressure Vessels

V Inservice Inspection of Pressure Vessels by Authorized Owner-User Inspection Agencies

APPENDIX AND TITLE

A Safety and Safety Relief Valves

B Non-ASME Code Boilers and Pressure Vessels

C Storage of Mild Steel Covered Arc Welding Electrodes

D-R National Board "R" (Repair) Symbol Stamp

D-VR National Board "VR" (Repair of Safety and Safety Relief Valve) Symbol Stamp

D-VR1 Certificate of Authorization for Repair Symbol Stamp for Safety and Safety Relief Valves

D-VR2 Outline of Basic Elements of Written Quality Control System for Repairers of ASME Safety and Safety Relief Valves

D-VR3 Nameplate Stamping for "VR"

E Owner-User Inspection Agencies

F Inspection Forms

(c) Records of inspections and repairs shall be kept in accordance with the requirements of the ASME Boiler and Pressure Vessel Code and the National Board Inspection Code. The records shall be made available to the Secretary or his authorized representative.

(d) Sections of the ASME Boiler and Pressure Vessel Code, 1977, listed in paragraph (b)(1) of this section, and chapters and appendices of the National

Board Inspection Code, 1979, listed in paragraph (b)(2) of this section, are incorporated by reference and made a part of this standard. These publications may be obtained from the publishers, the American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, New Jersey 07007, Phone: 800-843-2763 (toll free); *http://www.asme.org*, and the National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229. The publication may be examined at any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration.

[50 FR 4082, Jan. 29, 1985, as amended at 71 FR 16667, Apr. 3, 2006]

Subpart M - MACHINERY AND EQUIPMENT

Source: 53 FR 32528, Aug. 25, 1988, unless otherwise noted.

§ 57.14000 Definitions

The following definitions apply in this subpart.

Travelway. A passage, walk, or way regularly used or designated for persons to go from one place to another.

[53 FR 32528, Aug. 25, 1988, as amended at 69 FR 38842, June 29, 2004]

Safety Devices and Maintenance Requirements

§ 57.14100 Safety defects; examination, correction, and records

(a) Self-propelled mobile equipment to be used during a shift shall be inspected by the equipment operator before being placed in operation on that shift.

(b) Defects on any equipment, machinery, and tools that affect safety shall be corrected in a timely manner to prevent the creation of a hazard to persons.

(c) When defects make continued operation hazardous to persons, the defective items including self-propelled mobile equipment shall be taken out of service and placed in a designated area posted for that purpose, or a tag or other effective method of marking the defective items shall be used to prohibit further use until the defects are corrected.

(d) Defects on self-propelled mobile equipment affecting safety, which are not corrected immediately, shall be reported to, and recorded by, the mine operator. The records shall be kept at the mine or nearest mine office from the date the defects are recorded, until the defects are corrected. Such records shall be made available for inspection by an authorized representative of the Secretary.

§ 57.14101 Brakes

(a) **Minimum requirements**.

(1) Self-propelled mobile equipment shall be equipped with a service brake system capable of stopping and holding the equipment with its typical load on the maximum grade it travels. This standard does not apply to equipment which is not originally equipped with brakes unless the manner in which the equipment is being operated requires the use of brakes for safe operation. This standard does not apply to rail equipment.

(2) If equipped on self-propelled mobile equipment, parking brakes shall be capable of holding the equipment with its typical load on the maximum grade it travels.

(3) All braking systems installed on the equipment shall be maintained in functional condition.

(b) **Testing**.

(1) Service brake tests shall be conducted on surface-operated equipment at underground mines when an MSHA inspector has reasonable cause to believe that the service brake system does not function as required, unless the mine operator removes the equipment from service for the appropriate repair;

(2) The performance of the service brakes shall be evaluated according to Table M-1.

Table M-1

Gross vehicle weight lbs.	**Equipment Speed, MPH**										
	10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Service Brake Maximum Stopping Distance - Feet											
0-36,000	34	38	43	48	53	59	64	70	76	83	89
36,000-70,000	41	46	52	58	62	70	76	83	90	97	104
70,000-140,000	48	54	61	67	74	81	88	95	103	111	119
140,000-250,000	56	62	69	77	84	92	100	108	116	125	133
250,000-400,000	59	66	74	81	89	97	105	114	123	132	141
Over 400,000	63	71	78	86	94	103	111	120	129	139	148

Stopping distances are computed using a constant deceleration of 9.66 FPS^2 and system response times of .5.1, 1.5, 2, 2.25 and 2.5 seconds for each of increasing weight category respectively. Stopping distance values include a one-second operator response time.

Table M-2 - The Speed of a Vehicle Can Be Determined by Clocking It Through a 100-Foot Measured Course at Constant Velocity Using Table M-2. When the Service Brakes Are Applied at the End of the Course, Stopping Distance Can Be Measured and Compared to Table M-1.

Miles per hour	10	11	12	13	14	15	16	17	18	19	20
Seconds required to travel 100 feet	6.8	6.2	5.7	5.2	4.9	4.5	4.3	4.0	3.8	3.6	3.4

(3) Service brake tests shall be conducted under the direction of the mine operator in cooperation with and according to the instructions provided by the MSHA inspector as follows:

(i) Equipment capable of traveling at least 10 miles per hour shall be tested with a typical load for that particular piece of equipment. Front-end loaders shall be tested with the loader bucket empty. Equipment shall not be tested when carrying hazardous loads, such as explosives.

(ii) The approach shall be of sufficient length to allow the equipment operator to reach and maintain a constant speed between 10 and 20 miles per hour prior to entering the 100-foot measured area. The constant speed shall be maintained up to the point when the equipment operator receives the signal to apply the brakes. The roadway shall be wide enough to accommodate the size of the equipment being tested. The ground shall be generally level, packed, and dry in the braking portion of the test course. Ground moisture may be present to the extent that it does not adversely affect the braking surface.

(iii) Braking is to be performed using only those braking systems, including auxiliary retarders, which are designed to bring the equipment to a stop under normal operating conditions. Parking or emergency (secondary) brakes are not to be actuated during the test.

(iv) The tests shall be conducted with the transmission in the gear appropriate for the speed the equipment is traveling except for equipment which is designed for the power train to be disengaged during braking.

(v) Testing speeds shall be a minimum of 10 miles per hour and a maximum of 20 miles per hour.

(vi) Stopping distances shall be measured from the point at which the equipment operator receives the signal to apply the service brakes to the final stopped position.

(4) Test results shall be evaluated as follows:

(i) If the initial test run is valid and the stopping distance does not exceed the corresponding stopping distance listed in Table 1, the performance of the service brakes shall be considered acceptable. For tests to be considered valid, the equipment shall not slide sideways or exhibit other lateral motion during the braking portion of the test.

(ii) If the equipment exceeds the maximum stopping distance in the initial test run, the mine operator may request from the inspector up to four additional test runs with two runs to be conducted in each direction. The performance of the service brakes shall be considered acceptable if the equipment does not exceed the maximum stopping distance on at least three of the additional tests.

(5) Where there is not an appropriate test site at the mine or the equipment is not capable of traveling at least 10 miles per hour, service brake tests will not be conducted. In such cases, the inspector will rely upon other available evidence to determine whether the service brake system meets the performance requirements of this standard.

[53 FR 32528, Aug. 25, 1988; 53 FR 44588, Nov. 4, 1988]

§ 57.14102 Brakes for rail equipment

Braking systems on railroad cars and locomotives shall be maintained in functional condition.

§ 57.14103 Operators' stations

(a) If windows are provided on operators' stations of self-propelled mobile equipment, the windows shall be made of safety glass or material with equivalent safety characteristics. The windows shall be maintained to provide visibility for safe operation.

(b) If damaged windows obscure visibility necessary for safe operation, or create a hazard to the equipment operator, the windows shall be replaced or removed. Damaged windows shall be replaced if absence of a window would expose the equipment operator to hazardous environmental conditions which would affect the ability of the equipment operator to safely operate the equipment.

(c) The operators' stations of self-propelled mobile equipment shall -

(1) Be free of materials that may create a hazard to persons by impairing the safe operation of the equipment; and

(2) Not be modified, in a manner that obscures visibility necessary for safe operation.

§ 57.14104 Tire repairs

(a) Before a tire is removed from a vehicle for tire repair, the valve core shall be partially removed to allow for gradual deflation and then removed. During deflation, to the extent possible, persons shall stand outside of the potential trajectory of the lock ring of a multi-piece wheel rim.

(b) To prevent injury from wheel rims during tire inflation, one of the following shall be used:

(1) A wheel cage or other restraining device that will constrain all wheel rim components during an explosive separation of a multi-piece wheel rim, or during the sudden release of contained air in a single piece rim wheel; or

(2) A stand-off inflation device which permits persons to stand outside of the potential trajectory of wheel components.

§ 57.14105 Procedures during repairs or maintenance

Repairs or maintenance on machinery or equipment shall be performed only after the power is off, and the machinery or equipment blocked against hazardous motion. Machinery or equipment motion or activation is permitted to the extent that adjustments or testing cannot be performed without motion or activation, provided that persons are effectively protected from hazardous motion.

§ 57.14106 Falling object protection

(a) Fork-lift trucks, front-end loaders, and bulldozers shall be provided with falling object protective structures if used in an area where falling objects could create a hazard to the operator.

(b) The protective structure shall be capable of withstanding the falling object loads to which it could be subjected.

§ 57.14107 Moving machine parts

(a) Moving machine parts shall be guarded to protect persons from contacting gears, sprockets, chains, drive, head, tail, and takeup pulleys, flywheels, coupling, shafts, fan blades; and similar moving parts that can cause injury.

(b) Guards shall not be required where the exposed moving parts are at least seven feet away from walking or working surfaces.

§ 57.14108 Overhead drive belts

Overhead drive belts shall be guarded to contain the whipping action of a broken belt if that action could be hazardous to persons.

§ 57.14109 Unguarded conveyors with adjacent travelways

Unguarded conveyors next to travelways shall be equipped with -

(a) Emergency stop devices which are located so that a person falling on or against the conveyor can readily deactivate the conveyor drive motor; or

(b) Railings which -

(1) Are positioned to prevent persons from falling on or against the conveyor;

(2) Will be able to withstand the vibration, shock, and wear to which they will be subjected during normal operation; and

(3) Are constructed and maintained so that they will not create a hazard.

§ 57.14110 Flying or falling materials

In areas where flying or falling materials generated from the operation of screens, crushers, or conveyors present a hazard, guards, shields, or other devices that provide protection against such flying or falling materials shall be provided to protect persons.

§ 57.14111 Slusher, backlash guards and securing

(a) When persons are exposed to slushing operations, the slushers shall be equipped with rollers and drum covers and anchored securely before slushing operations are started to protect against hazardous movement before slushing operations are started.

(b) Slushers rated over 10 horsepower shall be equipped with backlash guards unless the equipment operator is otherwise protected.

(c) This standard does not apply to air tuggers of 10 horsepower or less that have only one cable and one drum.

§ 57.14112 Construction and maintenance of guards

(a) Guards shall be constructed and maintained to -

(1) Withstand the vibration, shock, and wear to which they will be subjected during normal operation; and

(2) Not create a hazard by their use.

(b) Guards shall be securely in place while machinery is being operated, except when testing or making adjustments which cannot be performed without removal of the guard.

§ 57.14113 Inclined conveyors: backstops or brakes

Backstops or brakes shall be installed on drive units of inclined conveyors to prevent the conveyors from running in reverse, creating a hazard to persons.

§ 57.14114 Air valves for pneumatic equipment

A manual master quick-close type air valve shall be installed on all pneumatic-powered equipment if there is a hazard of uncontrolled movement when the air supply is activated. The valve shall be closed except when the equipment is being operated.

[53 FR 32528, Aug. 25, 1988; 53 FR 44588, Nov. 4, 1988]

§ 57.14115 Stationary grinding machines

Stationary grinding machines, other than special bit grinders, shall be equipped with -

(a) Peripheral hoods capable of withstanding the force of a bursting wheel and enclosing not less than 270° - of the periphery of the wheel;

(b) Adjustable tool rests set so that the distance between the grinding surface of the wheel and the tool rest is not greater than ⅛ inch; and

(c) A safety washer on each side of the wheel.

[53 FR 32528, Aug. 25, 1988; 53 FR 44588, Nov. 4, 1988]

§ 57.14116 Hand-held power tools

(a) Power drills, disc sanders, grinders, and circular and chain saws, when used in the hand-held mode shall be operated with controls which require constant hand or finger pressure.

(b) Circular saws and chain saws shall not be equipped with devices which lock-on the operating controls.

§ 57.14130 Roll-over protective structures (ROPS) and seat belts for surface equipment

(a) **Equipment included**. Roll-over protective structures (ROPS) and seat belts shall be installed on -

(1) Crawler tractors and crawler loaders;

(2) Graders;

(3) Wheel loaders and wheel tractors;

(4) The tractor portion of semi-mounted scrapers, dumpers, water wagons, bottom-dump wagons, rear-dump wagons, and towed fifth wheel attachments;

(5) Skid-steer loaders; and

(6) Agricultural tractors.

(b) **ROPS construction**. ROPS shall meet the requirements of the following Society of Automotive Engineers (SAE) publications, as applicable, which are incorporated by reference:

(1) SAE J1040, "Performance Criteria for Roll-Over Protective Structures (ROPS) for Construction, Earthmoving, Forestry, and Mining Machines,", 1986; or

(2) SAE J1194, "Roll-Over Protective Structures (ROPS) for Wheeled Agricultural Tractors", 1983.

(c) **ROPS labeling**. ROPS shall have a label permanently affixed to the structure identifying -

(1) The manufacturer's name and address;

(2) The ROPS model number; and

(3) The make and model number of the equipment for which the ROPS is designed.

(d) **ROPS installation**. ROPS shall be installed on the equipment in accordance with the recommendations of the ROPS manufacturer.

(e) **ROPS maintenance**.

(1) ROPS shall be maintained in a condition that meets the performance requirements applicable to the equipment. If the ROPS is subjected to a roll-over or abnormal structural loading, the equipment manufacturer or a registered professional engineer with knowledge and experience in ROPS design shall recertify that the ROPS meets the applicable performance requirements before it is returned to service.

(2) Alterations or repairs on ROPS shall be performed only with approval from the ROPS manufacturer or under the instructions of a registered professional engineer with knowledge and experience in ROPS design.

The manufacturer or engineer shall certify that the ROPS meets the applicable performance requirements.

(f) **Exemptions**.

(1) This standard does not apply to -

(i) Self-propelled mobile equipment manufactured prior to July 1, 1969;

(ii) Over-the-road type tractors that pull trailers or vans on highways;

(iii) Equipment that is only operated by remote control; and

(2) Self-propelled mobile equipment manufactured prior to October 24, 1988, that is equipped with ROPS and seat belts that meet the installation and performance requirements of 30 CFR 57.9088 (1986 edition) shall be considered in compliance with paragraphs (b) and (h) of this section.

(g) **Wearing seat belts**. Seat belts shall be worn by the equipment operator except that when operating graders from a standing position, the grader operator shall wear safety lines and a harness in place of a seat belt.

(h) **Seat belts construction**. Seat belts required under this section shall meet the requirement of SAE J386, "Operator Restraint System for Off-Road Work Machines" (1985, 1993, or 1997), or SAE J1194, "Roll-Over Protective Structures (ROPS) for Wheeled Agricultural Tractors" (1983, 1989, 1994, or 1999), as applicable, which are incorporated by reference.

(i) **Seat belt maintenance**. Seat belts shall be maintained in functional condition and replaced when necessary to assure proper performance.

(j) **Publications**. The incorporation by reference of these publications is approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of these publications may be examined at any Metal and Nonmetal Mine Safety and Health District Office; at MSHA's Office of Standards, Regulations, and Variances, 201 12th Street South, Arlington, VA 22202-5452; 202-693-9440; or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*. Copies may be purchased from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001; 724-776-4841; *http://www.sae.org*.

[53 FR 32528, Aug. 25, 1988; 53 FR 44588, Nov. 4, 1988, as amended at 60 FR 33722, June 29, 1995; 67 FR 38385, June 4, 2002; 68 FR 19347, Apr. 21, 2003; 80 FR 52988, Sept. 2, 2015]

§ 57.14131 Seat belts for surface haulage trucks

(a) Seat belts shall be provided and worn in haulage trucks.

(b) Seat belts shall be maintained in functional condition and replaced when necessary to assure proper performance.

(c) Seat belts required under this section shall meet the requirements of SAE J386, "Operator Restraint System for Off-Road Work Machines" (1985, 1993, or 1997), which are incorporated by reference.

(d) The incorporation by reference of these publications is approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of these publications may be examined at any Metal and Nonmetal Mine Safety and Health District Office; at MSHA's Office of Standards, Regulations, and Variances, 201 12th Street South, Arlington, VA 22202-5452; 202-693-9440; or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*. Copies may be purchased from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001; 724-776-4841; *http://www.sae.org*.

[53 FR 32528, Aug. 25, 1988, as amended at 67 FR 38385, June 4, 2002; 68 FR 19347, Apr. 21, 2003; 80 FR 52988, Sept. 2, 2015]

§ 57.14132 Horns and backup alarms for surface equipment

(a) Manually operated horns or other audible warning devices provided on self-propelled mobile equipment as a safety device shall be maintained in a functional condition.

(b) (1) When the operator has an obstructed view to the rear, self-propelled mobile equipment shall have -

(i) An automatic reverse-activated signal alarm;

(ii) A wheel-mounted bell alarm which sounds at least once for each three feet of reverse movement;

(iii) A discriminating backup alarm that covers the area of obstructed view; or

(iv) An observer to signal when it is safe to back up.

(2) Alarms shall be audible above the surrounding noise level.

(3) An automatic reverse-activated strobe light may be used at night in lieu of an audible reverse alarm.

(c) This standard does not apply to rail equipment.

§ 57.14160 Mantrip trolley wire hazards underground

Mantrips shall be covered if there is danger of persons contacting the trolley wire.

§ 57.14161 Makeshift couplings

Couplings used on underground rail equipment shall be designed for that equipment, except that makeshift couplings may be used to move disabled rail equipment for repairs if no hazard to persons is created.

§ 57.14162 Trip lights

On underground rail haulage, trip lights shall be used on the rear of pulled trips and on the front of pushed trips.

Safety Practices and Operational Procedures

§ 57.14200 Warnings prior to starting or moving equipment

Before starting crushers or moving self-propelled mobile equipment, equipment operators shall sound a warning that is audible above the surrounding noise level or use other effective means to warn all persons who could be exposed to a hazard from the equipment.

§ 57.14201 Conveyor start-up warnings

(a) When the entire length of a conveyor is visible from the starting switch, the conveyor operator shall visually check to make certain that all persons are in the clear before starting the conveyor.

(b) When the entire length of the conveyor is not visible from the starting switch, a system which provides visible or audible warning shall be installed and operated to warn persons that the conveyor will be started. Within 30 seconds after the warning is given, the conveyor shall be started, or a second warning shall be given.

§ 57.14202 Manual cleaning of conveyor pulleys

Pulleys of conveyors shall not be cleaned manually while the conveyor is in motion.

§ 57.14203 Application of belt dressing

Belt dressings shall not be applied manually while belts are in motion unless a pressurized-type applicator is used that allows the dressing to be applied from outside the guards.

§ 57.14204 Machinery lubrication

Machinery or equipment shall not be lubricated manually while it is in motion where application of the lubricant may expose persons to injury.

§ 57.14205 Machinery, equipment, and tools

Machinery, equipment, and tools shall not be used beyond the design capacity intended by the manufacturer, where such use may create a hazard to persons.

§ 57.14206 Securing movable parts

(a) When moving mobile equipment between workplaces, booms, forks, buckets, beds, and similar movable parts of the equipment shall be positioned in the travel mode and, if required for safe travel, mechanically secured.

(b) When mobile equipment is unattended or not in use, dippers, buckets, and scraper blades shall be lowered to the ground. Other movable parts, such as booms, shall be mechanically secured or positioned to prevent movement which would create a hazard to persons.

§ 57.14207 Parking procedures for unattended equipment

Mobile equipment shall not be left unattended unless the controls are placed in the park position and the parking brake, if provided, is set. When parked on a grade, the wheels or tracks of mobile equipment shall be either chocked or turned into a bank or rib.

§ 57.14208 Warning devices

(a) Visible warning devices shall be used when parked mobile equipment creates a hazard to persons in other mobile equipment.

(b) Mobile equipment, other than forklifts, carrying loads that project beyond the sides or more than four feet beyond the rear of the equipment shall have a warning flag at the end of the projection. Under conditions of limited visibility these loads shall have a warning light at the end of the projection. Such flags or lights shall be attached to the end of the projection or be carried by persons walking beside or behind the projection.

§ 57.14209 Safety procedures for towing

(a) A properly sized tow bar or other effective means of control shall be used to tow mobile equipment.

(b) Unless steering and braking are under the control of the equipment operator on the towed equipment, a safety chain or wire rope capable of withstanding the loads to which it could be subjected shall be used in conjunction with any primary rigging.

(c) This provision does not apply to rail equipment.

§ 57.14210 Movement of dippers, buckets, loading booms, or suspended loads

(a) Dippers, buckets, loading booms, or suspended loads shall not be swung over the operators' stations of self-propelled mobile equipment until the equipment operator is out of the operator's station and in a safe location.

(b) This section does not apply when the equipment is specifically designed to protect the equipment operator from falling objects.

§ 57.14211 Blocking equipment in a raised position

(a) Persons shall not work on top of, under, or work from mobile equipment in a raised position until the equipment has been blocked or mechanically secured to prevent it from rolling or falling accidentally.

(b) Persons shall not work on top of, under, or work from a raised component of mobile equipment until the component has been blocked or mechanically secured to prevent accidental lowering. The equipment must also be blocked or secured to prevent rolling.

(c) A raised component must be secured to prevent accidental lowering when persons are working on or around mobile equipment and are exposed to the hazard of accidental lowering of the component.

(d) Under this section, a raised component of mobile equipment is considered to be blocked or mechanically secured if provided with a functional load-locking device or devices which prevent free and uncontrolled descent.

(e) Blocking or mechanical securing of the raised component is required during repair or maintenance of elevated mobile work platforms.

§ 57.14212 Chains, ropes, and drive belts

Chains, ropes, and drive belts shall be guided mechanically onto moving pulleys, sprockets, or drums except where equipment is designed specifically for hand feeding.

§ 57.14213 Ventilation and shielding for welding

(a) Welding operations shall be shielded when performed at locations where arc flash could be hazardous to persons.

(b) All welding operations shall be well-ventilated.

§ 57.14214 Train warnings

A warning that is audible above the surrounding noise level shall be sounded -

(a) Immediately prior to moving trains;

(b) When trains approach persons, crossing, other trains on adjacent tracks; and

(c) Any place where the train operator's vision is obscured.

§ 57.14215 Coupling or uncoupling cars

Prior to coupling or uncoupling cars manually, trains shall be brought to a complete stop, and then moved at minimum tram speed until the coupling or uncoupling activity is completed. Coupling or uncoupling shall not be attempted from the inside of curves unless the railroad and cars are designed to eliminate hazards to persons.

§ 57.14216 Backpoling

Backpoling of trolleys is prohibited except where there is inadequate clearance to reverse the trolley pole. Where backpoling is required, it shall be done only at the minimum tram speed of the trolley.

§ 57.14217 Securing parked railcars

Parked railcars shall be blocked securely unless held effectively by brakes.

§ 57.14218 Movement of equipment on adjacent tracks

When a locomotive on one track is used to move rail equipment on adjacent tracks, a chain, cable, or drawbar shall be used which is capable of withstanding the loads to which it could be subjected.

§ 57.14219 Brakeman signals

When a train is under the direction of a brakeman and the train operator cannot clearly recognize the brakeman's signals, the train operator shall bring the train to a stop.

Appendix I to Subpart M of Part 57 - NATIONAL CONSENSUS STANDARDS

Mine operators seeking further information regarding the construction and installation of falling object protective structures (FOPS) may consult the following national consensus standards, as applicable.

MSHA Standard 57.14106, Falling Object Protection

Equipment	National consensus standard
Front-end loaders and bulldozers	Society of Automotive Engineers (SAE) minimum performance criteria for falling object protective structures (FOPS) SAE J231 - January 1981.
Fork-lift trucks	American National Standards Institute (ANSI) safety standard for low lift and high lift trucks, B 56.1, section 7.27 - 1983; or
	American National Standards Institute (ANSI) standard, rough terrain forklift trucks, B 56.6 - 1987.

Subpart N - PERSONAL PROTECTION

Surface and Underground

§ 57.15001 First aid materials

Adequate first-aid materials, including stretchers and blankets shall be provided at places convenient to all working areas. Water or neutralizing agents shall be available where corrosive chemicals or other harmful substances are stored, handled, or used.

§ 57.15002 Hard hats

All persons shall wear suitable hard hats when in or around a mine or plant where falling objects may create a hazard.

§ 57.15003 Protective footwear

All persons shall wear suitable protective footwear when in or around an area of a mine or plant where a hazard exists which could cause an injury to the feet.

§ 57.15004 Eye protection

All persons shall wear safety glasses, goggles, or face shields or other suitable protective devices when in or around an area of a mine or plant where a hazard exists which could cause injury to unprotected eyes.

§ 57.15005 Safety belts and lines

Safety belts and lines shall be worn when persons work where there is danger of falling; a second person shall tend the lifeline when bins, tanks, or other dangerous areas are entered.

§ 57.15006 Protective equipment and clothing for hazards and irritants

Special protective equipment and special protective clothing shall be provided, maintained in a sanitary and reliable condition, and used whenever hazards of process or environment, chemical hazards, radiological hazards, or mechanical irritants are encountered in a manner capable of causing injury or impairment.

§ 57.15007 Protective equipment or clothing for welding, cutting, or working with molten metal

Protective clothing or equipment and face shields or goggles shall be worn when welding, cutting, or working with molten metal.

§ 57.15014 Eye protection when operating grinding wheels

Face shields or goggles in good condition shall be worn when operating a grinding wheel.

[53 FR 32533, Aug. 25, 1988]

Surface Only

§ 57.15020 Life jackets and belts

Life jackets or belts shall be worn where there is danger from falling into water.

Underground Only

§ 57.15030 Provision and maintenance of self-rescue devices

A 1-hour self-rescue device approved by MSHA and NIOSH under 42 CFR part 84 shall be made available by the operator to all personnel underground. Each operator shall maintain self-rescue devices in good condition.

[60 FR 30401, June 8, 1995]

§ 57.15031 Location of self-rescue devices

(a) Except as provided in paragraph (b) and (c) of this section, self-rescue devices meeting the requirements of standard 57.15030 shall be worn or carried by all persons underground.

(b) Where the wearing or carrying of self-rescue devices meeting the requirements of standard 57.15030 is hazardous to a person, such self-rescue devices shall be located at a distance no greater than 25 feet from such person.

(c) Where a person works on or around mobile equipment, self-rescue devices may be placed in a readily accessible location on such equipment.

Subpart O - MATERIALS STORAGE AND HANDLING

§ 57.16001 Stacking and storage of materials

Supplies shall not be stacked or stored in a manner which creates tripping or fall-of-material hazards.

§ 57.16002 Bins, hoppers, silos, tanks, and surge piles

(a) Bins, hoppers, silos, tanks, and surge piles, where loose unconsolidated materials are stored, handled, or transferred shall be -

(1) Equipped with mechanical devices or other effective means of handling materials so that during normal operations persons are not required to enter or work where they are exposed to entrapment by the caving or sliding of materials; and

(2) Equipped with supply and discharge operating controls. The controls shall be located so that spills or overruns will not endanger persons.

(b) Where persons are required to move around or over any facility listed in this standard, suitable walkways or passageways shall be provided.

(c) Where persons are required to enter any facility listed in this standard for maintenance or inspection purposes, ladders, platforms, or staging shall be provided. No person shall enter the facility until the supply and discharge of materials have ceased and the supply and discharge equipment is locked out. Persons entering the facility shall wear a safety belt or harness equipped with a lifeline suitably fastened. A second person, similarly equipped, shall be stationed near where the lifeline is fastened and shall constantly adjust it or keep it tight as needed, with minimum slack.

§ 57.16003 Storage of hazardous materials

Materials that can create hazards if accidentally liberated from their containers shall be stored in a manner that minimizes the dangers.

§ 57.16004 Containers for hazardous materials

Containers holding hazardous materials must be of a type approved for such use by recognized agencies.

[67 FR 42389, June 21, 2002]

§ 57.16005 Securing gas cylinders

Compressed and liquid gas cylinders shall be secured in a safe manner.

§ 57.16006 Protection of gas cylinder valves

Valves on compressed gas cylinders shall be protected by covers when being transported or stored, and by a safe location when the cylinders are in use.

§ 57.16007 Taglines, hitches, and slings

(a) Taglines shall be attached to loads that may require steadying or guidance while suspended.

(b) Hitches and slings used to hoist materials shall be suitable for the particular material handled.

§ 57.16009 Suspended loads

Persons shall stay clear of suspended loads.

§ 57.16010 Dropping materials from overhead

To protect personnel, material shall not be dropped from an overhead elevation until the drop area is first cleared of personnel and the area is then either guarded or a suitable warning is given.

§ 57.16011 Riding hoisted loads or on the hoist hook

Persons shall not ride on loads being moved by cranes or derricks, nor shall they ride the hoisting hooks unless such method eliminates a greater hazard.

§ 57.16012 Storage of incompatible substances

Chemical substances, including concentrated acids and alkalies, shall be stored to prevent inadvertent contact with each other or with other substances, where such contact could cause a violent reaction or the liberation of harmful fumes or gases.

§ 57.16013 Working with molten metal

Suitable warning shall be given before molten metal is poured and before a container of molten metal is moved.

§ 57.16014 Operator-carrying overhead cranes

Operator-carrying overhead cranes shall be provided with -

(a) Bumpers at each end of each rail;

(b) Automatic switches to halt uptravel of the blocks before they strike the hoist;

(c) Effective audible warning signals within easy reach of the operator; and

(d) A means to lock out the disconnect switch.

§ 57.16015 Work or travel on overhead crane bridges

No person shall work from or travel on the bridge of an overhead crane unless the bridge is provided with substantial footwalks with toeboards and railings the length of the bridge.

§ 57.16016 Lift trucks

Fork and other similar types of lift trucks shall be operated with the:

(a) Upright tilted back to steady and secure the load;

(b) Load in the upgrade position when ascending or descending grades in excess of 10 percent;

(c) Load not raised or lowered en route except for minor adjustments; and

(d) Load-engaging device downgrade when traveling unloaded on all grades.

§ 57.16017 Hoisting heavy equipment or material

Where the stretching or contraction of a hoist rope could create a hazard, chairs or other suitable blocking shall be used to support conveyances at shaft landings before heavy equipment or material is loaded or unloaded.

Subpart P - ILLUMINATION

§ 57.17001 Illumination of surface working areas

Illumination sufficient to provide safe working conditions shall be provided in and on all surface structures, paths, walkways, stairways, switch panels, loading and dumping sites, and working areas.

§ 57.17010 Electric lamps

Individual electric lamps shall be carried for illumination by all persons underground.

Subpart Q - SAFETY PROGRAMS

Surface and Underground

§ 57.18002 Examination of working places

(a) A competent person designated by the operator shall examine each working place at least once each shift before miners begin work in that place, for conditions that may adversely affect safety or health.

(1) The operator shall promptly notify miners in any affected areas of any conditions found that may adversely affect safety or health and promptly initiate appropriate action to correct such conditions.

(2) Conditions noted by the person conducting the examination that may present an imminent danger shall be brought to the immediate attention of the operator who shall withdraw all persons from the area affected (except persons referred to in section 104(c) of the Federal Mine Safety and Health Act of 1977) until the danger is abated.

(b) A record of each examination shall be made before the end of the shift for which the examination was conducted. The record shall contain the name of the person conducting the examination; date of the examination; location of all areas examined; and description of each condition found that may adversely affect the safety or health of miners.

(c) When a condition that may adversely affect safety or health is corrected, the examination record shall include, or be supplemented to include, the date of the corrective action.

(d) The operator shall maintain the examination records for at least one year, make the records available for inspection by authorized representatives of the Secretary and the representatives of miners, and provide these representatives a copy on request.

[84 FR 51401, Sept. 30, 2019]

§ 57.18006 New employees

New employees shall be indoctrinated in safety rules and safe work procedures.

§ 57.18009 Designation of person in charge

When persons are working at the mine, a competent person designated by the mine operator shall be in attendance to take charge in case of an emergency.

§ 57.18010 First aid

An individual capable of providing first aid shall be available on all shifts. The individual shall be currently trained and have the skills to perform patient assessment and artificial respiration; control bleeding; and treat shock, wounds, burns, and musculoskeletal injuries. First aid training shall be made available to all interested miners.

[61 FR 50436, Sept. 26, 1996]

§ 57.18012 Emergency telephone numbers

Emergency telephone numbers shall be posted at appropriate telephones.

§ 57.18013 Emergency communications system

A suitable communication system shall be provided at the mine to obtain assistance in the event of an emergency.

§ 57.18014 Emergency medical assistance and transportation

Arrangements shall be made in advance for obtaining emergency medical assistance and transportation for injured persons.

Surface Only

§ 57.18020 Working alone

No employee shall be assigned, or allowed, or be required to perform work alone in any area where hazardous conditions exist that would endanger his safety unless he can communicate with others, can be heard, or can be seen.

Underground Only

§ 57.18025 Working alone

No employee shall be assigned, or allowed, or be required to perform work alone in any area where hazardous conditions exist that would endanger his safety unless his cries for help can be heard or he can be seen.

§ 57.18028 Mine emergency and self-rescuer training

(a) On an annual basis, all persons who are required to go underground shall be instructed in the Mine Safety and Health Administration approved course contained in Bureau of Mines Instruction Guide 19, “Mine Emergency Training” (September 1972). The instruction shall be given by MSHA personnel or by persons who are certified by the District Manager of the area in which the mine is located.

(b) On an annual basis, all persons who go underground shall be instructed in the Mine Safety and Health Administration course contained in Bureau of Mines Instruction Guide 2, "MSA W-65 Self-Rescuer" (March 1972) or Bureau of Mines Instruction Guide 3, "Permissible Drager 810 Respirator for Self-Rescue" (March 1972). The instruction shall be given by MSHA personnel or by persons who are certified by the District Manager of the area in which the mine is located: *Provided*, *however*, That if a Mine Safety and Health Administration instructor or a certified instructor is not immediately available such instruction of new employees in self-rescuers may be conducted by qualified company personnel who are not certified, but who have obtained provisional approval from the District Manager. Any person who has not had self-rescuer instruction within 12 months immediately preceding going underground shall be instructed in the use of self-rescuers before going underground.

(c) All instructional material, handouts, visual aids, and other such teaching accessories used by the operator in the courses prescribed in paragraphs (a) and (b) of this section shall be available for inspection by the Secretary or his authorized representative.

(d) Records of all instruction shall be kept at the mine site or nearest mine office at least 2 years from the date of instruction. Upon completion of such instruction, copies of the record shall be submitted to the District Manager.

(e) The Bureau of Mines instruction guides to which reference is made in items (a) and (b) of this standard are hereby incorporated by reference and made a part hereof. The incorporated instruction guides are available and shall be provided upon request made to any Metal and Nonmetal Mine Safety and Health district office.

[50 FR 4082, Jan. 29, 1985, as amended at 71 FR 16667, Apr. 3, 2006]

Subpart R - PERSONNEL HOISTING

§ 57.19000 Application

(a) The hoisting standards in this subpart apply to those hoists and appurtenances used for hoisting persons. However, where persons may be endangered by hoists and appurtenances used solely for handling ore, rock, and materials, the appropriate standards should be applied.

(b) Standards 57.19021 through 57.19028 shall apply to wire ropes in service used to hoist -

(1) Persons in shafts and slopes underground;

(2) Persons with an incline hoist on the surface; or

(3) Loads in shaft or slope development when persons work below suspended loads.

(4) These standards do not apply to wire ropes used for elevators.

(c) Emergency hoisting facilities should conform to the extent possible to safety requirements for other hoists, and should be adequate to remove the persons from the mine with a minimum of delay.

Hoists

§ 57.19001 Rated capacities

Hoists shall have rated capacities consistent with the loads handled and the recommended safety factors of the ropes used.

§ 57.19002 Anchoring

Hoists shall be anchored securely.

§ 57.19003 Driving mechanism connections

Belt, rope, or chains shall not be used to connect driving mechanisms to man hoists.

§ 57.19004 Brakes

Any hoist used to hoist persons shall be equipped with a brake or brakes which shall be capable of holding its fully loaded cage, skip, or bucket at any point in the shaft.

§ 57.19005 Locking mechanism for clutch

The operating mechanism of the clutch of every man-hoist drum shall be provided with a locking mechanism, or interlocked electrically or mechanically with the brake to prevent accidental withdrawal of the clutch.

§ 57.19006 Automatic hoist braking devices

Automatic hoists shall be provided with devices that automatically apply the brakes in the event of power failure.

§ 57.19007 Overtravel and overspeed devices

All man hoists shall be provided with devices to prevent overtravel. When utilized in shafts exceeding 100 feet in depth, such hoists shall also be provided with overspeed devices.

§ 57.19008 Friction hoist synchronizing mechanisms

Where creep or slip may alter the effective position of safety devices, friction hoists shall be equipped with synchronizing mechanisms that recalibrate the overtravel devices and position indicators.

§ 57.19009 Position indicator

An accurate and reliable indicator of the position of the cage, skip, bucket, or cars in the shaft shall be provided.

§ 57.19010 Location of hoist controls

Hoist controls shall be placed or housed so that the noise from machinery or other sources will not prevent hoistmen from hearing signals.

§ 57.19011 Drum flanges

Flanges on drums shall extend radially a minimum of 4 inches or three rope diameters beyond the last wrap, whichever is the lesser.

§ 57.19012 Grooved drums

Where grooved drums are used, the grooves shall be of suitable size and pitch for the ropes used.

§ 57.19013 Diesel- and other fuel-injection-powered hoists

Where any diesel or similar fuel-injection engine is used to power a hoist, the engine shall be equipped with a damper or other cutoff in its air intake system. The control handle shall be clearly labeled to indicate that its intended function is for emergency stopping only.

§ 57.19014 Friction hoist overtravel protection

In a friction hoist installation, tapered guides or other approved devices shall be installed above and below the limits of regular travel of the conveyance and arranged to prevent overtravel in the event of failure of other devices.

§ 57.19017 Emergency braking for electric hoists

Each electric hoist shall be equipped with a manually operable switch that will initiate emergency braking action to bring the conveyance and the counterbalance safely to rest. This switch shall be located within reach of the hoistman in case the manual controls of the hoist fail.

§ 57.19018 Overtravel by-pass switches

When an overtravel by-pass switch is installed, the switch shall function so as to allow the conveyance to be moved through the overtravel position when the switch is held in the closed position by the hoistman. The overtravel by-pass switch shall return automatically to the open position when released by the hoistman.

Wire Ropes

Authority: Sec. 101, Federal Mine Safety and Health Act of 1977, Pub. L. 91-173 as amended by Pub. L. 95-164, 91 Stat. 1291 (30 U.S.C. 811).

§ 57.19019 Guide ropes

If guide ropes are used in shafts for personnel hoisting applications other than shaft development, the nominal strength (manufacturer's published catalog strength) of the guide rope at installation shall meet the minimum value calculated as follows:
Minimum Value = Static Load × 5.0.

§ 57.19021 Minimum rope strength

At installation, the nominal strength (manufacturer's published catalog strength) of wire ropes used for hoisting shall meet the minimum rope strength values obtained by the following formulas in which "L" equals the maximum suspended rope length in feet:

(a) **Winding drum ropes** (all constructions, including rotation resistant).

For rope lengths less than 3,000 feet:
Minimum Value = Static Load × (7.0 - 0.001L).

For rope lengths 3,000 feet or greater:
Minimum Value = Static Load × 4.0.

(b) **Friction drum ropes**.

For rope lengths less than 4,000 feet:
Minimum Value = Static Load × (7.0 - 0.0005L).

For rope lengths 4,000 feet or greater:
Minimum Value = Static Load × 5.0.

(c) **Tail ropes** (balance ropes).

Minimum Value = Weight of Rope × 7.0.

§ 57.19022 Initial measurement

After initial rope stretch but before visible wear occurs, the rope diameter of newly installed wire ropes shall be measured at least once in every third interval of active length

and the measurements averaged to establish a baseline for subsequent measurements. A record of the measurements and the date shall be made by the person taking the measurements. This record shall be retained until the rope is retired from service.

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33722, June 29, 1995]

§ 57.19023 Examinations

(a) At least once every fourteen calendar days, each wire rope in service shall be visually examined along its entire active length for visible structural damage, corrosion, and improper lubrication or dressing. In addition, visual examination for wear and broken wires shall be made at stress points, including the area near attachments, where the rope rests on sheaves, where the rope leaves the drum, at drum crossovers, and at change-of-layer regions. When any visible condition that results in a reduction of rope strength is present, the affected portion of the rope shall be examined on a daily basis.

(b) Before any person is hoisted with a newly installed wire rope or any wire rope that has not been examined in the previous fourteen calendar days, the wire rope shall be examined in accordance with paragraph (a) of this section.

(c) At least once every six months, nondestructive tests shall be conducted of the active length of the rope, or rope diameter measurements shall be made -

(1) Wherever wear is evident;

(2) Where the hoist rope rests on sheaves at regular stopping points;

(3) Where the hoist rope leaves the drum at regular stopping points; and

(4) At drum crossover and change-of-layer regions.

(d) At the completion of each examination required by paragraph (a) of this section, the person making the examination shall certify, by signature and date, that the examination has been made. If any condition listed in paragraph (a) of this section is present, the person conducting the examination shall make a record of the condition and the date. Certifications and records of examinations shall be retained for one year.

(e) The person making the measurements or nondestructive tests as required by paragraph (c) of this section shall record the measurements or test results and the date. This record shall be retained until the rope is retired from service.

§ 57.19024 Retirement criteria

Unless damage or deterioration is removed by cutoff, wire ropes shall be removed from service when any of the following conditions occurs:

(a) The number of broken wires within a rope lay length, excluding filler wires, exceeds either -

(1) Five percent of the total number of wires; or

(2) Fifteen percent of the total number of wires within any strand.

(b) On a regular lay rope, more than one broken wire in the valley between strands in one rope lay length.

(c) A loss of more than one-third of the original diameter of the outer wires.

(d) Rope deterioration from corrosion.

(e) Distortion of the rope structure.

(f) Heat damage from any source.

(g) Diameter reduction due to wear that exceeds six percent of the baseline diameter measurement.

(h) Loss of more than ten percent of rope strength as determined by nondestructive testing.

§ 57.19025 Load end attachments

(a) Wire rope shall be attached to the load by a method that develops at least 80 percent of the nominal strength of the rope.

(b) Except for terminations where use of other materials is a design feature, zinc (spelter) shall be used for socketing wire ropes. Design feature means either the manufacturer's original design or a design approved by a registered professional engineer.

(c) Load end attachment methods using splices are prohibited.

§ 57.19026 Drum end attachment

(a) For drum end attachment, wire rope shall be attached -

(1) Securely by clips after making one full turn around the drum spoke;

(2) Securely by clips after making one full turn around the shaft, if the drum is fixed to the shaft; or

(3) By properly assembled anchor bolts, clamps, or wedges, provided that the attachment is a design feature of the hoist drum. Design feature means either the manufacturer's original design or a design approved by a registered professional engineer.

(b) A minimum of three full turns of wire rope shall be on the drum when the rope is extended to its maximum working length.

§ 57.19027 End attachment retermination.

Damaged or deteriorated wire rope shall be removed by cutoff and the rope reterminated where there is -

(a) More than one broken wire at an attachment;

(b) Improper installation of an attachment;

(c) Slippage at an attachment; or

(d) Evidence of deterioration from corrosion at an attachment.

§ 57.19028 End attachment replacement

Wire rope attachments shall be replaced when cracked, deformed, or excessively worn.

§ 57.19030 Safety device attachments

Safety device attachments to hoist ropes shall be selected, installed, and maintained according to manufacturers' specifications to minimize internal corrosion and weakening of the hoist rope.

Headframes and Sheaves

§ 57.19035 Headframe design

All headframes shall be constructed with suitable design considerations to allow for all dead loads, live loads, and wind loads.

§ 57.19036 Headframe height

Headframes shall be high enough to provide clearance for overtravel and safe stopping of the conveyance.

§ 57.19037 Fleet angles

Fleet angles on hoists installed after November 15, 1979, shall not be greater than one and one-half degrees for smooth drums or two degrees for grooved drums.

§ 57.19038 Platforms around elevated head sheaves

Platforms with toeboards and handrails shall be provided around elevated head sheaves.

Conveyances

§ 57.19045 Metal bonnets

Man cages and skips used for hoisting or lowering employees or other persons in any vertical shaft or any incline shaft with an angle of inclination of forty-five degrees from the horizontal, shall be covered with a metal bonnet.

§ 57.19049 Hoisting persons in buckets

Buckets shall not be used to hoist persons except during shaft sinking operations, inspection, maintenance, and repairs.

§ 57.19050 Bucket requirements

Buckets used to hoist persons during vertical shaft sinking operations shall -

(a) Be securely attached to a crosshead when traveling in either direction between the lower and upper crosshead parking locations;

(b) Have overhead protection when the shaft depth exceeds 50 feet;

(c) Have sufficient depth or a suitably designed platform to transport persons safely in a standing position; and

(d) Have devices to prevent accidental dumping where the bucket is supported by a bail attached to its lower half.

§ 57.19054 Rope guides

Where rope guides are used in shafts other than in shaft sinking operations, the rope guides shall be a type of lock coil construction.

Hoisting Procedures

§ 57.19055 Availability of hoist operator for manual hoists

When a manually operated hoist is used, a qualified hoistman shall remain within hearing of the telephone or signal device at all times while any person is underground.

§ 57.19056 Availability of hoist operator for automatic hoists

When automatic hoisting is used, a competent operator of the hoist shall be readily available at or near the hoisting device while any person is underground.

§ 57.19057 Hoist operator's physical fitness

No person shall operate a hoist unless within the preceding 12 months he has had a medical examination by a qualified, licensed physician who shall certify his fitness to perform this duty. Such certification shall be available at the mine.

§ 57.19058 Experienced hoist operators

Only experienced hoistmen shall operate the hoist except in cases of emergency and in the training of new hoistmen.

§ 57.19061 Maximum hoisting speeds

The safe speed for hoisting persons shall be determined for each shaft, and this speed shall not be exceeded. Persons shall not be hoisted at a speed faster than 2,500 feet per minute, except in an emergency.

§ 57.19062 Maximum acceleration and deceleration

Maximum normal operating acceleration and deceleration shall not exceed 6 feet per second per second. During emergency braking, the deceleration shall not exceed 16 feet per second per second.

§ 57.19063 Persons allowed in hoist room

Only authorized persons shall be in hoist rooms.

§ 57.19065 Lowering conveyances by the brakes

Conveyances shall not be lowered by the brakes alone except during emergencies.

§ 57.19066 Maximum riders in a conveyance

In shafts inclined over 45 degrees, the operator shall determine and post in the conveyance or at each shaft station the maximum number of persons permitted to ride in a hoisting conveyance at any one time. Each person shall be provided a minimum of 1.5 square feet of floor space.

§ 57.19067 Trips during shift changes

During shift changes, an authorized person shall be in charge of each trip in which persons are hoisted.

§ 57.19068 Orderly conduct in conveyances

Persons shall enter, ride, and leave conveyances in an orderly manner.

§ 57.19069 Entering and leaving conveyances

Persons shall not enter or leave conveyances which are in motion or after a signal to move the conveyance has been given to the hoistman.

§ 57.19070 Closing cage doors or gates

Cage doors or gates shall be closed while persons are being hoisted; they shall not be opened until the cage has come to a stop.

§ 57.19071 Riding in skips or buckets

Persons shall not ride in skips or buckets with muck, supplies, materials, or tools other than small hand tools.

§ 57.19072 Skips and cages in same compartment

When combinations of cages and skips are used in the same compartment, the cages shall be enclosed to protect personnel from flying material and the hoist speed reduced to man-speed as defined in standard 57.19061, but not to exceed 1,000 feet per minute. Muck shall not be hoisted with personnel during shift changes.

§ 57.19073 Hoisting during shift changes

Rock or supplies shall not be hoisted in the same shaft as persons during shift changes, unless the compartments and dumping bins are partitioned to prevent spillage into the cage compartment.

§ 57.19074 Riding the bail, rim, bonnet, or crosshead

Persons shall not ride the bail, rim, bonnet, or crosshead of any shaft conveyance except when necessary for inspection and maintenance, and then only when suitable protection for persons is provided.

§ 57.19075 Use of open hooks

Open hooks shall not be used to hoist buckets or other conveyances.

§ 57.19076 Maximum speeds for hoisting persons in buckets

When persons are hoisted in buckets, speeds shall not exceed 500 feet per minute and shall not exceed 200 feet per minute when within 100 feet of the intended station.

§ 57.19077 Lowering buckets

Buckets shall be stopped about 15 feet from the shaft bottom to await a signal from one of the crew on the bottom for further lowering.

§ 57.19078 Hoisting buckets from the shaft bottom

All buckets shall be stopped after being raised about three feet above the shaft bottom. A bucket shall be stabilized before a hoisting signal is given to continue hoisting the bucket to the crosshead. After a hoisting signal is given, hoisting to the crosshead shall be at a minimum speed. The signaling device shall be attended constantly until a bucket reaches the guides. When persons are hoisted, the signaling devices shall be attended until the crosshead has been engaged.

§ 57.19079 Blocking mine cars

Where mine cars are hoisted by cage or skip, means for blocking cars shall be provided at all landings and also on the cage.

§ 57.19080 Hoisting tools, timbers, and other materials

When tools, timbers, or other materials are being lowered or raised in a shaft by means of a bucket, skip, or cage, they shall be secured or so placed that they will not strike the sides of the shaft.

§ 57.19081 Conveyances not in use

When conveyances controlled by a hoist operator are not in use, they shall be released, and the conveyances shall be raised or lowered a suitable distance to prevent persons from boarding or loading the conveyances.

§ 57.19083 Overtravel backout device

A manually operated device shall be installed on each electric hoist that will allow the conveyance or counterbalance to be removed from an overtravel position. Such device shall not release the brake, or brakes, holding the overtravelled conveyance or counterbalance until sufficient drive motor torque has been developed to assure movement of the conveyance or counterbalance in the correct direction only.

Signaling

§ 57.19090 Dual signaling systems

There shall be at least two effective approved methods of signaling between each of the shaft stations and the hoist room, one of which shall be a telephone or speaking tube.

§ 57.19091 Signaling instructions to hoist operator

Hoist operators shall accept hoisting instructions only by the regular signaling system unless it is out of order. In such an event, and during other emergencies, the hoist operator shall accept instructions to direct movement of the conveyances only from authorized persons.

§ 57.19092 Signaling from conveyances

A method shall be provided to signal the hoist operator from cages or other conveyances at any point in the shaft.

§ 57.19093 Standard signal code

A standard code of hoisting signals shall be adopted and used at each mine. The movement of a shaft conveyance on a "one bell" signal is prohibited.

§ 57.19094 Posting signal code

A legible signal code shall be posted prominently in the hoist house within easy view of the hoistmen, and at each place where signals are given or received.

§ 57.19095 Location of signal devices

Hoisting signal devices shall be positioned within easy reach of persons on the shaft bottom or constantly attended by a person stationed on the lower deck of the sinking platform.

§ 57.19096 Familiarity with signal code

Any person responsible for receiving or giving signals for cages, skips, and mantrips when persons or materials are being transported shall be familiar with the posted signaling code.

Shafts

§ 57.19100 Shaft landing gates

Shaft landings shall be equipped with substantial safety gates so constructed that materials will not go through or under them; gates shall be closed except when loading or unloading shaft conveyances.

§ 57.19101 Stopblocks and derail switches

Positive stopblocks or a derail switch shall be installed on all tracks leading to a shaft collar or landing.

§ 57.19102 Shaft guides

A means shall be provided to guide the movement of a shaft conveyance.

§ 57.19103 Dumping facilities and loading pockets

Dumping facilities and loading pockets shall be constructed so as to minimize spillage into the shaft.

§ 57.19104 Clearance at shaft stations

Suitable clearance at shaft stations shall be provided to allow safe movement of persons, equipment, and materials.

§ 57.19105 Landings with more than one shaft entrance

A safe means of passage around open shaft compartments shall be provided on landings with more than one entrance to the shaft.

§ 57.19106 Shaft sets

Shaft sets shall be kept in good repair and clean of hazardous material.

§ 57.19107 Precautions for work in compartment affected by hoisting operation

Hoistmen shall be informed when persons are working in a compartment affected by that hoisting operation and a "Men Working in Shaft" sign shall be posted at the hoist.

§ 57.19108 Posting warning signs during shaft work

When persons are working in a shaft "Men Working in Shaft" signs shall be posted at all devices controlling hoisting operations that may endanger such persons.

§ 57.19109 Shaft inspection and repair

Shaft inspection and repair work in vertical shafts shall be performed from substantial platforms equipped with bonnets or equivalent overhead protection.

§ 57.19110 Overhead protection for shaft deepening work

A substantial bulkhead or equivalent protection shall be provided above persons at work deepening a shaft.

§ 57.19111 Shaft-sinking ladders

Substantial fixed ladders shall be provided from the collar to as near the shaft bottom as practical during shaft-sinking operations, or an escape hoist powered by an emergency power source shall be provided. When persons are on the shaft bottom, a chain ladder, wire rope ladder, or other extension ladders shall be used from the fixed ladder or lower limit of the escape hoist to the shaft bottom.

Inspection and Maintenance

§ 57.19120 Procedures for inspection, testing, and maintenance

A systematic procedure of inspection, testing and maintenance of shaft and hoisting equipment shall be developed and followed. If it is found or suspected that any part is

not functioning properly, the hoist shall not be used until the malfunction has been located and repaired or adjustments have been made.

§ 57.19121 Recordkeeping

At the time of completion, the person performing inspections, tests, and maintenance of shafts and hoisting equipment required in standard 57.19120 shall certify, by signature and date, that they have been done. A record of any part that is not functioning properly shall be made and dated. Certifications and records shall be retained for one year.

(Sec. 101, Pub. L. 91-173 as amended by Pub. L. 95-164, 91 Stat. 1291 (30 U.S.C. 811))

[50 FR 4082, Jan. 29, 1985, as amended at 60 FR 33722, June 29, 1995]

§ 57.19122 Replacement parts

Parts used to repair hoists shall have properties that will ensure the proper and safe function of the hoist.

§ 57.19129 Examinations and tests at beginning of shift

Hoistmen shall examine their hoists and shall test overtravel, deadman controls, position indicators, and braking mechanisms at the beginning of each shift.

§ 57.19130 Conveyance shaft test

Before hoisting persons and to assure that the hoisting compartments are clear of obstructions, empty hoist conveyances shall be operated at least one round trip after -

(a) Any hoist or shaft repairs or related equipment repairs that might restrict or obstruct conveyance clearance;

(b) Any oversize or overweight material or equipment trips that might restrict or obstruct conveyance clearance;

(c) Blasting in or near the shaft that might restrict or obstruct conveyance clearance; or

(d) Remaining idle for one shift or longer.

§ 57.19131 Hoist conveyance connections

Hoist conveyance connections shall be inspected at least once during any 24-hour period that the conveyance is used for hoisting persons.

§ 57.19132 Safety catches

(a) A performance drop test of hoist conveyance safety catches shall be made at the time of installation, or prior to installation in a mockup of the actual installation.

The test shall be certified to in writing by the manufacturer or by a registered professional engineer performing the test.

(b) After installation and before use, and at the beginning of any seven day period during which the conveyance is to be used, the conveyance shall be suitably rested and the hoist rope slackened to test for the unrestricted functioning of the safety catches and their activating mechanisms.

(c) The safety catches shall be inspected by a competent person at the beginning of any 24-hour period that the conveyance is to be used.

§ 57.19133 Shaft

Shafts that have not been inspected within the past 7 days shall not be used until an inspection has been conducted by a competent person.

§ 57.19134 Sheaves

Sheaves in operating shafts shall be inspected weekly and kept properly lubricated.

§ 57.19135 Rollers in inclined shafts

Rollers used in operating inclined shafts shall be lubricated, properly aligned, and kept in good repair.

Subpart S - MISCELLANEOUS

§ 57.20001 Intoxicating beverages and narcotics

Intoxicating beverages and narcotics shall not be permitted or used in or around mines. Persons under the influence of alcohol or narcotics shall not be permitted on the job.

§ 57.20002 Potable water

(a) An adequate supply of potable drinking water shall be provided at all active working areas.

(b) The common drinking cup and containers from which drinking water must be dipped or poured are prohibited.

(c) Where single service cups are supplied, a sanitary container for unused cups and a receptacle for used cups shall be provided.

(d) When water is cooled by ice, the ice shall either be of potable water or shall not come in contact with the water.

(e) Potable water outlets shall be posted.

(f) Potable water systems shall be constructed to prevent backflow or backsiphonage of non-potable water.

§ 57.20003 Housekeeping

At all mining operations -

(a) Workplaces, passageways, storerooms, and service rooms shall be kept clean and orderly;

(b) The floor of every workplace shall be maintained in a clean and, so far as possible, dry condition. Where wet processes are used, drainage shall be maintained, and false floors, platforms, mats, or other dry standing places shall be provided where practicable; and

(c) Every floor, working place, and passageway shall be kept free from protruding nails, splinters, holes, or loose boards, as practicable.

§ 57.20005 Carbon tetrachloride

Carbon tetrachloride shall not be used.

§ 57.20008 Toilet facilities

(a) Toilet facilities shall be provided at locations that are compatible with the mine operations and that are readily accessible to mine personnel.

(b) The facilities shall be kept clean and sanitary. Separate toilet facilities shall be provided for each sex except where toilet rooms will be occupied by no more than one person at a time and can be locked from the inside.

§ 57.20009 Tests for explosive dusts

Dusts suspected of being explosive shall be tested for explosibility. If tests prove positive, appropriate control measures shall be taken.

§ 57.20010 Retaining dams

If failure of a water or silt retaining dam will create a hazard, it shall be of substantial construction and inspected at regular intervals.

§ 57.20011 Barricades and warning signs

Areas where health or safety hazards exist that are not immediately obvious to employees shall be barricaded, or warning signs shall be posted at all approaches. Warning signs shall be readily visible, legible, and display the nature of the hazard and any protective action required.

§ 57.20013 Waste receptacles

Receptacles with covers shall be provided at suitable locations and used for the disposal of waste food and associated materials. They shall be emptied frequently and shall be maintained in a clean and sanitary condition.

§ 57.20014 Prohibited areas for food and beverages

No person shall be allowed to consume or store food or beverages in a toilet room or in any area exposed to a toxic material.

§ 57.20020 Unattended mine openings

Access to unattended mine openings shall be restricted by gates or doors, or the openings shall be fenced and posted.

§ 57.20021 Abandoned mine openings

Upon abandonment of a mine, the owner or operator shall effectively close or fence off all surface openings down which persons could fall or through which persons could enter. Upon or near all such safeguards, trespass warnings and appropriate danger notices shall be posted.

§ 57.20031 Blasting underground in hazardous areas

In underground areas where dangerous accumulations of water, gas, mud, or fire atmosphere could be encountered, persons shall be removed to safe places before blasting.

§ 57.20032 Two-way communication equipment for underground operations

Telephones or other two-way communication equipment with instructions for their use shall be provided for communication from underground operations to the surface.

Subpart T - SAFETY STANDARDS FOR METHANE IN METAL AND NONMETAL MINES

Authority: 30 U.S.C. 811.

Source: 52 FR 24941, July 1, 1987, unless otherwise noted.

General

§ 57.22001 Scope

This subpart T sets forth procedures and safety standards for each metal and nonmetal underground mine subject to the Federal Mine Safety and Health Act of 1977. All metal and nonmetal mines will be placed into one of the categories or subcategories defined in this subpart. Mines shall operate in accordance with the applicable standards in this

subpart to protect persons against the hazards of methane gas and dust containing volatile matter. The standards in this subpart apply to underground mines as well as surface mills at Subcategory I-C mines. These mines are also required to be operated in accordance with the other applicable health and safety standards published in 30 CFR part 57.

§ 57.22002 Definitions

The following definitions apply in this subpart:

Competent person. A person designated by the mine operator who has sufficient experience and training to perform the assigned task.

Explosive material. Explosives, blasting agents, and detonators. Explosives are substances classified as explosives by the Department of Transportation in § § 173.53, 173.88, and 173.100 of Title 49 of the Code of Federal Regulations (1986 Edition). Blasting agents are substances classified as blasting agents by the Department of Transportation in § 173.114(a) of Title 49 of the Code of Federal Regulations (1986 Edition). Detonators are devices containing a detonating charge used to initiate explosives. Examples of detonators are blasting caps, electric or non-electric instantaneous or delay blasting caps and delay connectors. [A copy of Title 49 is available at any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration].

Substantial construction. Construction of such strength, material, and workmanship that the object will withstand air blasts, blasting shock, ground movement, pressure differentials, wear, and usage which may be expected to occur in the mining environment.

[52 FR 24941, July 1, 1987, as amended at 69 FR 38842, June 29, 2004]

Mine Categorization

§ 57.22003 Mine category or subcategory

(a) All underground mines, and the surface mills of Subcategory I-C mines (gilsonite), shall be placed into one of the following categories or subcategories to protect persons against the hazards of methane and dusts containing volatile matter. Categories and subcategories are defined as follows:

(1) **Category I** applies to mines that operate within a combustible ore body and either liberate methane or have the potential to liberate methane based on the history of the mine or the geological area in which the mine is located. Category I is divided into Subcategories I-A, I-B, and I-C as follows:

(i) **Subcategory I-A** applies to mines that operate within a combustible ore body and liberate methane and in which -

(A) A concentration of 0.25 percent or more methane has been detected in the mine atmosphere and confirmed by laboratory analysis; or

(B) An ignition of methane has occurred.

(ii) **Subcategory I-B** applies to mines that operate within a combustible ore body and have the potential to liberate methane based on the history of the mine or geological area in which the mine is located and in which -

(A) A concentration of 0.25 percent or more methane has not been detected in the mine atmosphere; and

(B) An ignition of methane has not occurred.

(iii) **Subcategory I-C** applies to mines in which the product extracted is combustible and the dust has a volatile matter content of 60 percent or more measured on a moisture free basis[1].

(2) **Category II** applies to domal salt mines where the history of the mine or geological area indicates the occurrence of or the potential for an outburst. Category II is divided into Subcategories II-A and II-B as follows:

(i) **Subcategory II-A** applies to domal salt mines where an outburst reportable under § 57.22004(c)(1) has occurred.

(ii) **Subcategory II-B** applies to domal salt mines where an outburst reportable under § 57.22004(c)(1) has not occurred, but which have the potential for an outburst based on the history of the mine or geological area in which the mine is located.

(3) **Category III** applies to mines in which noncombustible ore is extracted and which liberate a concentration of methane that is explosive, or is capable of forming explosive mixtures with air, or have the potential to do so based on the history of the mine or the geological area in which the mine is located. The concentration of methane in such mines is explosive or is capable of forming explosive mixtures if mixed with air as illustrated by Table 1 below, entitled "Relation Between Quantitative Composition and Explosibility of Mixtures of Methane and Air".

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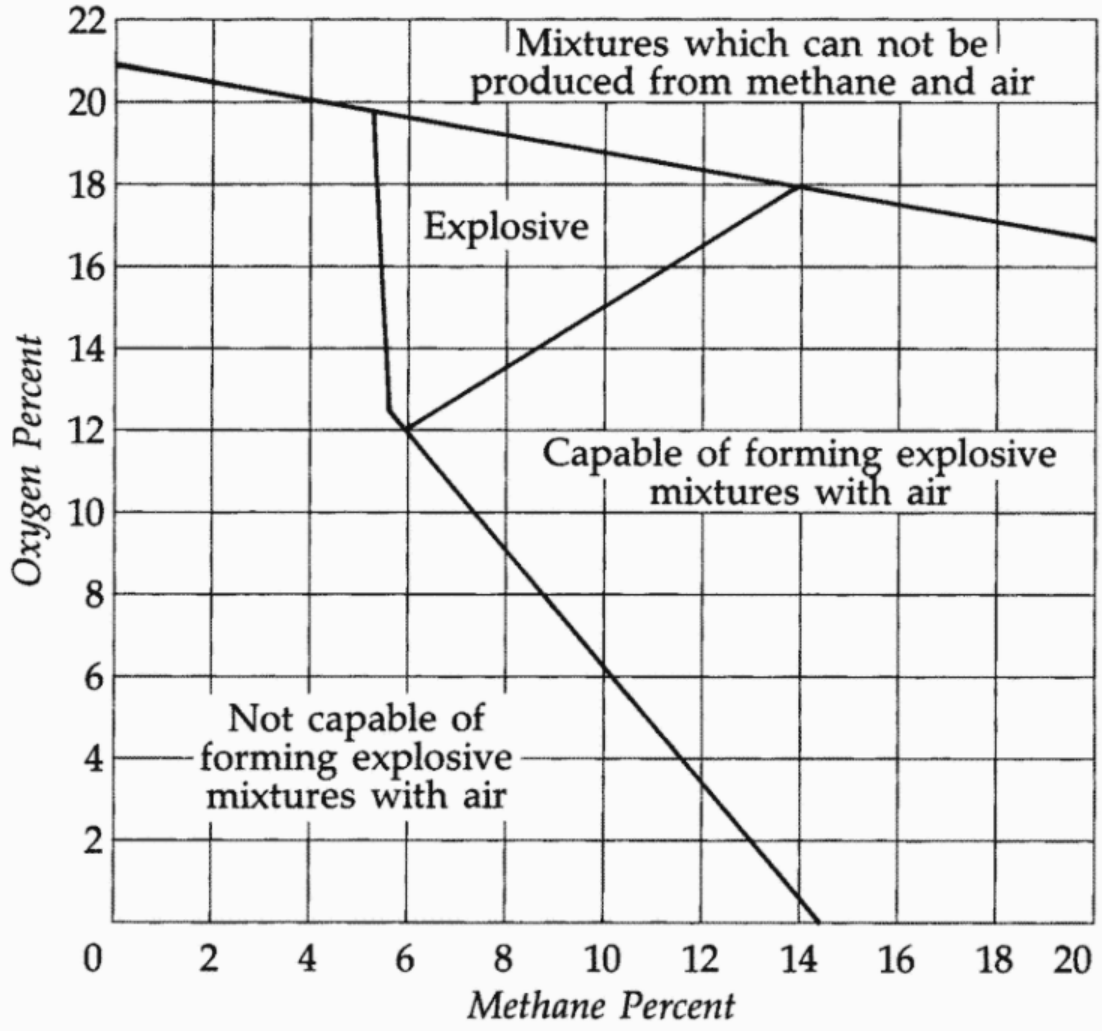
[1] Measured by the American Society for Testing and Materials, ASTM D 3175-82, Standard Test Method for Volatile Matter in the Analysis Sample of Coal and Coke. (This document is available at any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration).

Table 1



Relation Between Quantitative Composition and Explosibility of Mixtures of Methane and Air

(4) **Category IV** applies to mines in which noncombustible ore is extracted and which liberate a concentration of methane that is not explosive nor capable of forming explosive mixtures with air based on the history of the mine or the geological area in which the mine is located. The concentration of methane in such mines is not explosive nor capable of forming explosive mixtures if mixed with air as illustrated by Table 1 above, entitled "Relation Between Quantitative Composition and Explosibility of Mixtures of Methane and Air".

(5) **Category V** applies to petroleum mines. Category V is divided into Subcategories V-A and V-B as follows:

(i) **Subcategory V-A** applies to petroleum mines that operate entirely or partially within an oil reservoir; and all other petroleum mines in which -

(A) A concentration of 0.25 percent or more methane has been detected in the mine atmosphere and confirmed by laboratory analysis; or

(B) An ignition of methane has occurred.

(ii) **Subcategory V-B** applies to petroleum mines that operate outside of and drill into an oil reservoir and in which -

(A) A concentration of 0.25 percent or more methane has not been detected in the mine atmosphere; and

(B) An ignition of methane has not occurred.

(6) **Category VI** applies to mines in which the presence of methane has not been established and are not included in another category or subcategory.

(b) Category or subcategory placement or change in placement shall include consideration of the following:

(1) The history and geology of the mine or of the geological area in which the mine is located;

(2) The ore body and host rock;

(3) The character, amount, duration, origin, and nature of methane emission and the presence of explosive dust and inert gases; and

(4) Whether or not conditions encountered during primary or access development are transient or permanent.

(c) (1) Gas samples for the purpose of category or subcategory placement or change in placement, and for determining action levels, shall be taken in the mine atmosphere. Gas samples taken to determine the nature and extent of an occurrence under § 57.22004 (c) and (d) may be taken at any location, including the source, point of entry and the mine atmosphere.

(2) Tests for methane shall be made with hand-held methanometers, methane monitors, atmospheric monitoring systems, devices used to provide laboratory analysis of samples, or with other equally effective sampling devices. However, only methane samples that have been confirmed by laboratory analysis shall be used for category or subcategory placement or change in placement.

(d) Each mine and mill shall be required to operate in accordance with the safety standards applicable to its particular category or subcategory.

§ 57.22004 Category placement or change in placement

The Administrator for Metal and Nonmetal Mine Safety and Health (Administrator) shall be responsible for category and subcategory placement, change in placement, and notification of placement of mines.

(a) The Administrator's proposed notice of placement or change in placement shall be sent to the mine operator and the appropriate representative of miners and shall include -

(1) The category or subcategory;

(2) The reasons for placement or change in placement;

(3) The data considered;

(4) The applicable standards and a time schedule for the mine operator to achieve compliance;

(5) Whether or not conditions encountered during primary or access development are transient or permanent; and

(6) Notification of the right to appeal the Administrator's determination under § 57.22005.

(b) The operator or the representative of the miners shall have the right to request of the Administrator reassignment of the mine to a more appropriate category or subcategory if, based on operating experience, the conditions set forth in § 57.22003(b) indicate that the hazards of methane exist under circumstances more appropriately governed by a different category or subcategory. In response to such a request, the procedures set forth in paragraph (d) of this section shall apply. While the request for category or subcategory reassignment is pending, the mine shall continue to operate under the standards for the category or subcategory to which originally assigned.

(c) MSHA shall be notified as soon as possible if any of the following events occur:

(1) An outburst that results in 0.25 percent or more methane in the mine atmosphere;

(2) A blowout that results in 0.25 percent or more methane in the mine atmosphere;

(3) An ignition of methane; or

(4) Air sample results that indicate 0.25 percent or more methane in the mine atmosphere of a Subcategory I-B, I-C, II-B, V-B or Category VI mine.

(d) The Administrator shall promptly appoint an MSHA committee to investigate occurrences reported in accordance with paragraph (c) of this section or requests filed in accordance with paragraph (b) of this section. Upon completion of an investigation, the committee shall make a written report of the findings. These investigations may include an evaluation of the following:

(1) Source, nature, and extent of occurrences;

(2) Conditions under which the incident occurred;

(3) Samples and tests;

(4) Physical conditions at the time of the occurrence;

(5) Charts, logs, and records related to the occurrence;

(6) Whether the occurrence is isolated, continuous, or could recur;

(7) Conditions indicating that the hazards of methane no longer exist or exist under circumstances more appropriately governed by a different category or subcategory;

(8) The geology of the mine and the geological area in which the mine is located; and

(9) Statements by witnesses, company officials, employees, and other persons having knowledge of the mine or the occurrence. Representatives of the mine operator, the miners and the appropriate State agency may participate in the investigation.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987; 60 FR 33722, June 29, 1995]

§ 57.22005 Notice and appeal of placement or change in placement

(a) The Administrator's determination of category or subcategory placement or change in placement shall become final upon the 30th day after it is served on the mine operator and representative of miners unless a request for a hearing has been filed. Service of the Administrator's determination is complete upon mailing by registered or certified mail, return receipt requested.

(b) The mine operator or representative of miners may obtain review of the Administrator's determination by filing a request for a hearing with the Assistant Secretary of Labor for Mine Safety and Health, Mine Safety and Health Administration, 201 12th Street South, Arlington, VA 22202-5452 within 30 days

of the Administrator's determination. Service of a request for hearing is completed upon mailing by registered or certified mail, return receipt requested. Requests for a hearing shall be in writing and contain the following information:

(1) Name, address, and mine identification number;

(2) A concise statement of the reason why the Administrator's determination is inappropriate; and

(3) A copy of the Administrator's determination.

(c) The mine operator shall post a copy of the Administrator's determination and the request for a hearing on the mine bulletin board and shall maintain the posting until the placement becomes final.

(d) Promptly after receipt of the request for a hearing, the Assistant Secretary shall refer to the Chief Administrative Law Judge, United States Department of Labor, the following:

(1) The request for a hearing;

(2) The Administrator's determination; and

(3) All information upon which the Administrator's determination was based.

(e) The hearing shall be regulated and conducted by an Administrative Law Judge in accordance with 29 CFR part 18, entitled, "Rules of Practice and Procedure for Administrative Hearings Before the Office of Administrative Law Judges." Once the Administrative Law Judge has made an initial decision and served each party, the decision shall be final on the 30th day after service, unless discretionary review is undertaken by the Assistant Secretary or an appeal is filed by the mine operator or representative of the miners under paragraph (f) of this section.

(f) Within 30 days after service of an initial decision of an Administrative Law Judge, the Assistant Secretary for Mine Safety and Health may undertake a discretionary review of the initial decision, or the mine operator, or representative of the miners may appeal the initial decision of the Administrative Law Judge to the Assistant Secretary.

(1) The Assistant Secretary shall give notice of discretionary review to the mine operator and representative of the miners. The mine operator or representative of the miners shall give notice of an appeal to the other party. The notice shall specify the suggested changes and refer to the specific findings of fact, conclusions of law, and terms of the initial decision to be reviewed or appealed. The Assistant Secretary shall fix a time for filing any objections to the suggested changes and supporting reasons.

(2) The Assistant Secretary shall promptly notify the Administrative Law Judge of a discretionary review or an appeal. The entire record of the proceedings shall be transmitted to the Assistant Secretary for review.

(3) The Assistant Secretary shall make the final decision based upon consideration of the record of the proceedings. The final decision may affirm, modify, or set aside in whole or in part, the findings and conclusions contained in the initial decision. A statement of reasons for the action taken shall be included in the final decision. The final decision shall be served upon the mine operator and representative of the miners.

(g) Unless a decision by the Administrator for Metal and Nonmetal Mine Safety and Health, or the initial decision of the Administrative Law Judge, is appealed within 30 days, it becomes final, and is not subject to judicial review for the purposes of 5 U.S.C. 704. Only a decision by the Assistant Secretary shall be considered final Agency action for purposes of judicial review. Any such appeal must be filed in the appropriate circuit of the United States Court of Appeal.

(h) While a final decision of category placement is pending the following procedures shall apply:

(1) Where a mine has been classified as gassy prior to the effective date of these standards, existing gassy mines standards 30 CFR 57.21001 through 57.21101 (1986 Edition) shall continue to be applicable until placement is final.

(2) Where a mine has not been classified as gassy prior to the effective date of these standards and it is placed in Categories I through V, the mine shall comply with Category VI standards (§ § 57.22231, 57.22232, 57.22236, and 57.22238) until placement is final.

(3) Where a mine has been classified in Categories I through V after the effective date of these standards and category reassignment is being considered, the mine shall comply with the standards applicable to the category to which presently assigned until category placement is final.

[52 FR 24941, July 1, 1987; 52 FR 27903, July 24, 1987, as amended at 67 FR 38385, June 4, 2002; 80 FR 52988, Sept. 2, 2015]

Fire Prevention and Control

Note:

The Category or Subcategory applicability of each standard appears in the parentheses of each standard's title line.

§ 57.22101 Smoking (I-A, II-A, III, and V-A mines)

Persons shall not smoke or carry smoking materials, matches, or lighters underground. The operator shall institute a reasonable program to assure that persons entering the mine do not carry such items.

§ 57.22102 Smoking (I-C mines)

(a) Persons shall not smoke or carry smoking materials, matches, or lighters underground or within 50 feet of a mine opening. The operator shall institute a reasonable program to assure that persons entering the mine do not carry such items.

(b) Smoking is prohibited in surface milling facilities except in designated, dust-free smoking areas.

§ 57.22103 Open flames (I-A, II-A, III, and V-A mines)

Open flames shall not be permitted underground except for welding, cutting, and other maintenance operations, and for igniting underground retorts in a Subcategory I-A mine. When using open flames in other than fresh air, or in places where methane may enter the air current, tests for methane shall be conducted by a competent person before work is started and every 10 minutes until the job is completed. Continuous methane monitors with audible alarms may be used after the initial test has been conducted as an alternative to the ten-minute interval testing requirement. Open flames shall not be used in atmospheres containing 0.5 percent or more methane.

§ 57.22104 Open flames (I-C mines)

(a) Open flames, including cutting and welding, shall not be used underground.

(b) Welding and cutting shall not be done within 50 feet of a mine opening unless all persons are out of the mine and the mine opening is covered. The cover shall be a substantial material, such as metal or wood, topped with a layer of wetted material to prevent sparks and flames from entering the mine opening.

§ 57.22105 Smoking and open flames (IV mines)

Smoking or open flames shall not be permitted in a face or raise, or during release of gas from a borehole until tests have been conducted in accordance with § 57.22226 and the methane level has been determined to be below 0.5 percent.

§ 57.22106 Dust containing volatile matter (I-C mines)

Dust containing volatile matter shall not be allowed to accumulate on the surfaces of enclosures, facilities, or equipment used in surface milling in amounts that, if suspended in air, would become an explosive mixture. An explosive mixture of dust containing volatile matter is 0.02 ounce or more per cubic foot of air.

Ventilation

§ 57.22201 Mechanical ventilation (I-A, I-B, I-C, II-A, II-B, III, IV, V-A, and V-B mines)

All mines shall be ventilated mechanically.

§ 57.22202 Main fans (I-A, I-B, I-C, II-A, III, V-A, and V-B mines)

(a) Main fans shall be -

(1) Installed on the surface in noncombustible housings provided with noncombustible air ducts;

(2) Except in Subcategory I-A mines, provided with an automatic signal device to give an alarm when the fan stops. The signal device shall be located so that it can be seen or heard by a person designated by the mine operator.

(b) Fan installations shall be -

(1) Offset so that the fan and its associated components are not in direct line with possible explosive forces;

(2) Equipped with explosion-doors, a weak-wall, or other equivalent devices located to relieve the pressure that would be created by an explosion underground. The area of the doors or weak-wall shall be at least equivalent to the average cross-sectional area of the airway.

(c) (1) All main fan-related electrical equipment and cables located within or exposed to the forward or reverse airstream shall be approved by MSHA under the appliable requirements of 30 CFR part 18;

(2) Drive belts and nonmetallic fan blades shall be constructed of static-conducting material; and

(3) Aluminum alloy fan blades shall not contain more than 0.5 percent magnesium. [Paragraph (c)(3) of this section does not apply to Subcategory I-C mines].

(d) When an internal combustion engine is used to power a main fan or as standby power, the engine shall be -

(1) Installed in a noncombustible housing;

(2) Protected from a possible fuel supply fire or explosion; and

(3) Located out of direct line with the forward and reverse airstream provided by the fan. Engine exhaust gases shall be vented to the atmosphere so that exhaust cannot contaminate mine intake air.

(e) For Subcategory I-A mines only: Main exhaust fans shall be equipped with methane monitors to give an alarm when methane in the return air reaches 0.5 percent. The alarm shall be located so that it can be seen or heard by a person designated by the mine operator.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987]

§ 57.22203 Main fan operation (I-C mines)

Main fans shall be operated continuously while ore production is in progress.

§ 57.22204 Main fan operation and inspection (I-A, II-A, III, and V-A mines)

Main fans shall be -

(a) Provided with a pressure-recording system; and

(b) Inspected daily while operating if persons are underground. Certification of inspections shall be made by signature and date. Certifications and pressure recordings shall be retained for at least one year and made available to an authorized representative of the Secretary.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987; 60 FR 33722, June 29, 1995]

§ 57.22205 Doors on main fans (I-A, II-A, III, and V-A mines)

In mines ventilated by multiple main fans, each main fan installation shall be equipped with noncombustible doors. Such doors shall automatically close to prevent air reversal through the fan. The doors shall be located so that they are not in direct line with explosive forces which could come out of the mine.

§ 57.22206 Main ventilation failure (I-A, II-A, III, and V-A mines)

(a) When there has been a main ventilation failure, such as stoppage of main fans or failure of other components of the main ventilation system, tests for methane shall be conducted in affected active workings until normal air flow has resumed.

(b) If a total failure of ventilation occurs while all persons are out of the mine and the failure lasts for more than 30 minutes, only competent persons shall be allowed underground to examine the mine or to make necessary ventilation changes. Other persons may reenter the mine after the main fans have been operational for at least 30 minutes, or after the mine atmosphere has been tested and contains less

than 1.0 percent methane. Persons other than examiners shall not reenter a Subcategory II-A mine until the methane level is less than 0.5 percent.

§ 57.22207 Booster fans (I-A, II-A, III, and V-A mines)

(a) Booster fans shall be approved by MSHA under the applicable requirements of 30 CFR part 18, and be -

(1) Provided with an automatic signal device located so that it can be seen or heard by a person designated by the mine operator to give an alarm when the fan stops or when methane reaches the following levels:

(i) 1.0 percent at the fan in Subcategory I-A, Category III, and Subcategory V-A mines; and

(ii) 0.5 percent at the fan in Subcategory II-A mines.

(2) Equipped with a device that automatically deenergizes power in affected workings should the fan stop; and

(3) Equipped with starting and stopping controls located at the fan and at another accessible remote location.

(b) Booster fan installations, except for booster fans installed in ducts, shall be -

(1) Provided with doors which open automatically when all fans in the installation stop; and

(2) Provided with an air lock when passage through the fan bulkhead is necessary.

§ 57.22208 Auxiliary fans (I-A, II-A, III, and V-A mines)

(a) Auxiliary fans, except fans used in shops and other areas which have been so designed that methane cannot enter the airway, shall be approved by MSHA under the applicable requirements of 30 CFR part 18, and be operated so that recirculation is minimized. Auxiliary fans shall not be used to ventilate work places during the interruption of normal mine ventilation.

(b) Tests for methane shall be made at auxiliary fans before they are started.

§ 57.22209 Auxiliary fans (I-C mines)

Electric auxiliary fans shall be approved by MSHA under the applicable requirements of 30 CFR part 18. Tests for methane shall be made at electric auxiliary fans before they are started. Such fans shall not be operated when air passing over or through them contains 0.5 percent or more methane.

§ 57.22210 In-line filters (I-C mines)

Filters or separators shall be installed on air-lift fan systems to prevent explosive concentrations of dust from passing through the fan.

§ 57.22211 Air flow (I-A mines)

The average air velocity in the last open crosscut in pairs or sets of developing entries, or through other ventilation openings nearest the face, shall be at least 40 feet per minute. The velocity of air ventilating each face at a work place shall be at least 20 feet per minute.

§ 57.22212 Air flow (I-C, II-A, and V-A mines)

Air flow across each working face shall be sufficient to carry away any accumulation of methane, smoke, fumes, and dust.

§ 57.22213 Air flow (III mines)

The quantity of air coursed through the last open crosscut in pairs or sets of entries, or through other ventilation openings nearest the face, shall be at least 6,000 cubic feet per minute, or 9,000 cubic feet per minute in longwall and continuous miner sections. The quantity of air across each face at a work place shall be at least 2,000 cubic feet per minute.

§ 57.22214 Changes in ventilation (I-A, II-A, III, and V-A mines)

(a) Changes in ventilation which affect the main air current or any split thereof and which adversely affect the safety of persons in the mine shall be made only when the mine is idle.

(b) Only persons engaged in making such ventilation changes shall be permitted in the mine during changes.

(c) Power shall be deenergized in affected areas prior to making ventilation changes, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18. Power shall not be restored until the results of the change have been determined and a competent person has examined affected working places for methane.

§ 57.22215 Separation of intake and return air (I-A, II-A, III, and V-A mines)

Main intake and return air currents shall be coursed through separate mine openings and shall be separated throughout the mine, except -

(a) Where multiple shafts are used for ventilation and a single shaft contains a curtain wall or partition for separation of air currents. Such wall or partition shall be

constructed of reinforced concrete or other noncombustible equivalent, and provided with pressure-relief devices.

(b) During development of openings to the surface -

(1) Ventilation tubing approved by MSHA in accordance with 30 CFR part 7 or previously issued a BC or VT acceptance number by the MSHA Approval and Certification Center may be used for separation of main air currents in the same opening. Flexible ventilation tubing shall not exceed 250 feet in length.

(2) Only development related to making a primary ventilation connection may be performed beyond 250 feet of the shaft.

[52 FR 24941, July 1, 1987, as amended at 54 FR 30508, July 20, 1989]

§ 57.22216 Separation of intake and return air (I-C mines)

The main intake and return air currents in single shafts shall be separated by ventilation tubing, curtain walls, or partitions. Ventilation tubing shall be constructed of noncombustible material. Curtain walls or partitions shall be constructed of reinforced concrete or other noncombustible equivalent, and provided with pressure-relief devices.

§ 57.22217 Seals and stoppings (I-A, I-B, and I-C mines)

All seals, and those stoppings that separate main intake from main return airways, shall be of substantial construction and constructed of noncombustible materials, except that stoppings constructed of brattice materials may be used in face areas.

§ 57.22218 Seals and stoppings (III, V-A, and V-B mines)

(a) All seals, and those stoppings that separate main intake from main return airways, shall be of substantial construction, except that stoppings constructed of brattice materials may be used in face areas.

(b) Exposed surfaces on the intake side of stoppings constructed of combustible materials or foam-type blocks shall be coated with at least one inch of construction plaster containing perlite and gypsum; at least one inch of expanded vermiculite, Portland cement and limestone; or other coatings with equivalent fire resistance. Stoppings constructed to phenolic foam blocks at least 12 inches thick need not be coated for fire resistance. All foam-type blocks used for stopping construction shall be solid.

(c) Exposed surfaces on the fresh air side of seals constructed of combustible materials shall be coated with at least one inch of construction plaster containing perlite and gypsum; at least one inch of expanded vermiculite, Portland cement and limestone; or other coatings with equivalent fire resistance. Foam-type blocks shall not be used for seals.

§ 57.22219 Seals and stoppings (II-A mines)

(a) Exposed surfaces on the intake side of stoppings constructed of combustible materials, except brattice, shall be coated with at least one inch of construction plaster containing perlite and gypsum; at least one inch of expanded vermiculite, Portland cement and limestone; or other coatings with equivalent fire resistance.

(b) Seals shall be of substantial construction. Exposed surfaces on the fresh air side of seals constructed of combustible materials shall be coated with at least one inch of construction plaster containing perlite and gypsum; at least one inch of expanded vermiculite, Portland cement and limestone; or other coatings with equivalent fire resistance. Foam-type blocks shall not be used for seals.

§ 57.22220 Air passing unsealed areas (I-A, II-A, III, and V-A mines)

Air that has passed by or through unsealed abandoned or unsealed inactive areas and contains 0.25 percent or more methane shall -

(a) Be coursed directly to a return airway;

(b) Be tested daily for methane by a competent person; and

(c) Not be used to ventilate work places.

§ 57.22221 Overcast and undercast construction (I-A, II-A, III, and V-A mines)

Overcasts and undercasts shall be -

(a) Of substantial construction;

(b) (1) Constructed of noncombustible materials; or

(2) Where constructed of combustible materials, the outside surfaces shall be coated with at least one inch of construction plaster containing perlite and gypsum; at least one inch of expanded vermiculite, Portland cement and limestone; or other coatings with equivalent fire resistance;

(c) Kept clear of obstructions.

§ 57.22222 Ventilation materials (I-A, I-B, I-C, II-A, III, V-A, and V-B mines)

Brattice cloth and ventilation tubing shall be approved by MSHA in accordance with 30 CFR part 7 or shall bear a BC or VT acceptance number issued by the MSHA Approval and Certification Center.

[54 FR 30508, July 20, 1989]

§ 57.22223 Crosscuts before abandonment (III mines)

A means of ventilating faces shall be provided before workings are abandoned in unsealed areas unless crosscuts are provided within 30 feet of the face.

§ 57.22224 Auxiliary equipment stations (I-A and III mines)

Battery charging stations, compressor stations, pump stations, and transformer stations shall be installed in intake air at locations which are sufficiently ventilated to prevent the accumulation of methane.

§ 57.22225 Auxiliary equipment stations (I-C mines)

Battery charging stations, compressor stations, and electrical substations shall not be installed underground or within 50 feet of a mine opening.

§ 57.22226 Testing for methane (IV mines)

Tests for methane shall be conducted in the mine atmosphere by a competent person -

(a) At least once each shift prior to starting work in each face and raise; and

(b) Upon initial release of gas into the mine atmosphere from boreholes.

§ 57.22227 Approved testing devices (I-A, I-B, I-C, II-A, II-B, III, IV, V-A, and V-B mines)

(a) Methane monitoring devices and portable, battery-powered, self-contained devices used for measuring methane, other gases, and contaminants in mine air shall be approved by MSHA under the applicable requirements of 30 CFR parts 18, 21, 22, 23, 27, and 29. Such devices shall be maintained in accordance with manufacturers' instructions, or an equivalent maintenance and calibration procedure.

(b) (1) Flame safety lamps shall not be used to test for methane except as supplementary devices.

(2) Flame safety lamps shall not be used in Subcategory I-C mines.

(c) (1) If electrically powered, remote sensing devices are used, that portion of the instrument located in return air or other places where combustible gases may be present shall be approved by MSHA under the applicable requirements of 30 CFR parts 18, 22, 23, 27, and 29.

(2) If air samples are delivered to remote analytical devices through sampling tubes, such tubes shall be provided with in-line flame arrestors. Pumping equipment and analytical instruments shall be located in intake air.

§ 57.22228 Preshift examination (I-A, I-C, II-A, III, and V-A mines)

(a) Preshift examinations shall be conducted within three hours prior to the start of the shift for which the examination is being made.

(b) Prior to the beginning of a shift following an idle shift, a competent person shall test the mine atmosphere for methane at all work places before persons other than examiners enter the mine.

(c) When one shift immediately follows another, a competent person shall test the mine atmosphere at each active working face for methane before work is started on that shift.

(d) A competent person shall test the mine atmosphere at each face blasted before work is started.

(e) Except in Subcategory I-C or Category III mines, vehicles used for transportation when examining the mine shall be approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36.

[52 FR 24941, July 1, 1987, as amended at 53 FR 9615, Mar. 24, 1988]

§ 57.22229 Weekly testing (I-A, III, and V-A mines)

(a) The mine atmosphere shall be tested for methane and carbon monoxide at least once every seven days by a competent person or an atmospheric monitoring system, or a combination of the two. Such testing shall be done at the following locations:

(1) The return of each split where it enters the main return;

(2) Adjacent to retreat areas, if accessible;

(3) At least one seal of each sealed area, if accessible;

(4) Main returns;

(5) At least one entry of each intake and return;

(6) Idle workings; and

(7) Return air from unsealed abandoned workings.

(b) The volume of air (velocity in Subcategory I-A mines) shall be measured at least once every seven days by a competent person. Such measurement shall be done at the following locations:

(1) Entering main intakes;

(2) Leaving main returns;

(3) Entering each main split;

(4) Returning from each main split; and

(5) In the last open crosscuts or other ventilation openings nearest the active faces where the air enters the return.

(c) Where such examinations disclose hazardous conditions, affected persons shall be informed and corrective action shall be taken.

(d) Certification of examinations shall be made by signature and date. Certifications shall be retained for at least one year and made available to authorized representatives of the Secretary.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987]

§ 57.22230 Weekly testing (II-A mines)

(a) The mine atmosphere shall be tested for methane at least once every seven days by a competent person or an atmospheric monitoring system, or a combination of the two. Such testing shall be done at the following locations:

(1) Active mining faces and benches;

(2) Main returns;

(3) Returns from idle workings;

(4) Returns from abandoned workings; and

(5) Seals.

(b) Where such examinations disclose hazardous conditions, affected persons shall be informed and corrective action shall be taken.

(c) Certification of examinations shall be made by signature and date. Certifications shall be kept for at least one year and made available to authorized representatives of the Secretary.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987; 60 FR 33723, June 29, 1995]

§ 57.22231 Actions at 0.25 percent methane (I-B, II-B, V-B, and VI mines)

If methane reaches 0.25 percent in the mine atmosphere, changes shall be made to improve ventilation, and MSHA shall be notified immediately.

§ 57.22232 Actions at 0.5 percent methane (I-B, II-A, II-B, IV, V-B, and VI mines)

If methane reaches 0.5 percent in the mine atmosphere, ventilation changes shall be made to reduce the level of methane. Until methane is reduced to less than 0.5 percent, electrical power shall be deenergized in affected areas, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18. Diesel equipment shall be shut off or immediately removed from the area and no other work shall be permitted in affected areas.

[52 FR 24941, July 1, 1987; 52 FR 27903, July 24, 1987]

§ 57.22233 Actions at 0.5 percent methane (I-C mines)

If methane reaches 0.5 percent in the mine atmosphere, ventilation changes shall be made to reduce the level of methane. Until methane is reduced to less than 0.5 percent, no other work shall be permitted in affected areas.

[52 FR 24941, July 1, 1987; 52 FR 27903, July 24, 1987]

§ 57.22234 Actions at 1.0 percent methane (I-A, I-B, III, V-A, and V-B mines)

(a) If methane reaches 1.0 percent in the mine atmosphere, ventilation changes shall be made to reduce the methane. Until such changes are achieved -

(1) All persons other than competent persons necessary to make the ventilation changes shall be withdrawn from affected areas;

(2) Electrical power shall be deenergized in affected areas, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18; and

(3) Diesel equipment shall be shut off or immediately removed from the area.

(b) If methane reaches 1.0 percent at a main exhaust fan, electrical power underground shall be deenergized, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18, and all persons shall be withdrawn from the mine.

(c) If methane reaches 1.0 percent at a work place and there has been a failure of the main ventilation system, all persons shall be withdrawn from the mine.

[52 FR 24941, July 1, 1987, as amended at 53 FR 9615, Mar. 24, 1988]

§ 57.22235 Actions at 1.0 percent methane (I-C, II-A, II-B, and IV mines)

(a) If methane reaches 1.0 percent in the mine atmosphere, all persons other than competent persons necessary to make ventilation changes shall be withdrawn from affected areas until methane is reduced to less than 0.5 percent.

(b) If methane reaches 1.0 percent at a work place and there has been a failure of the main ventilation system, all persons shall be withdrawn from the mine.

§ 57.22236 Actions at 1.0 percent methane (VI mines)

If methane reaches 1.0 percent in the mine atmosphere, all persons other than competent persons necessary to make ventilation changes shall be withdrawn from affected areas until methane is reduced to less than 0.5 percent.

§ 57.22237 Actions at 2.0 to 2.5 percent methane in bleeder systems (I-A and III mines)

If methane reaches 2.0 percent in bleeder systems at the point where a bleeder split enters a main return split, mining shall not be permitted on ventilation splits affected by the bleeder system. If methane has not been reduced to less than 2.0 percent within 30 minutes, or if methane levels reach 2.5 percent, all persons other than competent persons necessary to take corrective action shall be withdrawn from affected areas.

§ 57.22238 Actions at 2.0 percent methane (I-B, II-B, V-B, and VI mines)

If methane reaches 2.0 percent in the mine atmosphere, all persons other than competent persons necessary to make ventilation changes shall be withdrawn from the mine until methane is reduced to less than 0.5 percent.

§ 57.22239 Actions at 2.0 percent methane (IV mines)

If methane reaches 2.0 percent in the mine atmosphere, all persons other than competent persons necessary to make ventilation changes shall be withdrawn from the mine until methane is reduced to less than 0.5 percent. MSHA shall be notified immediately.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987; 60 FR 33723, June 29, 1995]

§ 57.22240 Actions at 2.0 percent methane (V-A mines)

If methane reaches 2.0 percent in the mine atmosphere, all persons other than competent persons necessary to make ventilation changes shall be withdrawn from affected areas until methane is reduced to less than 1.0 percent.

[52 FR 24941, July 1, 1987; 52 FR 27903, July 24, 1987]

§ 57.22241 Advance face boreholes (I-C mines)

(a) Boreholes shall be drilled at least 25 feet in advance of a face whenever the work place is within -

(1) 50 feet of a surveyed abandoned mine or abandoned workings which cannot be inspected; or

(2) 200 feet of an unsurveyed abandoned mine or abandoned workings which cannot be inspected.

(b) Boreholes shall be drilled in such a manner to ensure that the advancing face will not accidently break into an abandoned mine or abandoned working.

Equipment

§ 57.22301 Atmospheric monitoring systems (I-A, II-A, and V-A mines)

(a) An atmospheric monitoring system shall be installed to provide surface readings of methane concentrations in the mine atmosphere from underground locations. Components of the system shall be approved by MSHA under the applicable requirements of 30 CFR parts 18, 22, 23, and 27; or be determined by MSHA under 30 CFR part 18 to be intrinsically safe or explosion-proof.

(b) Atmospheric monitoring systems shall -

(1) Give warnings on the surface and underground when methane at any sensor reaches 0.5 percent or more, and when power to a sensor is interrupted. Warning devices shall be located so that they can be seen and heard by a person designated by the mine operator; and

(2) Automatically deenergize power in affected areas, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18, when methane at any sensor reaches -

(i) 1.0 percent in a Subcategory I-A or V-A mine; or

(ii) 0.5 percent while persons are underground and 1.0 percent during blasting in a Subcategory II-A mine. Timing devices are permitted to avoid nuisance tripping for periods not to exceed 30 seconds, except during blasting or the ventilation time following a blast in a Subcategory II-A mine.

(c) Atmospheric monitoring systems shall be checked with a known mixture of methane, and calibrated if necessary, at least once every 30 days. Certification of calibration tests shall be made by signature and date. Certifications of tests shall be retained for at least one year and made available to authorized representatives of the Secretary.

§ 57.22302 Approved equipment (I-A and V-A mines)

Equipment used in or beyond the last open crosscut shall be approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36. Equipment shall not be operated in atmospheres containing 1.0 percent or more methane.

§ 57.22303 Approved equipment (I-C mines)

Only electrical equipment that is approved by MSHA under the applicable requirements of 30 CFR parts 18 through 28 or approved under 30 CFR part 29 contained in the 30 CFR, parts 1-199, edition, revised as of July 1, 1999, shall be used underground, except for submersible sump pumps.

[64 FR 43283, Aug. 10, 1999]

§ 57.22304 Approved equipment (II-A mines)

(a) Cutting and drilling equipment used at a face or bench shall be approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36.

(b) While cutting or drilling is in progress, equipment not approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36 shall remain at least 100 feet from the face or bench being mined.

(c) Tests for methane shall be conducted immediately before nonapproved equipment is taken to a face or bench after blasting.

(d) Mine power transformers and stationary equipment not approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36 shall be installed in fresh air or downwind from an atmospheric methane monitor sensor.

§ 57.22305 Approved equipment (III mines)

Equipment used in or beyond the last open crosscut and equipment used in areas where methane may enter the air current, such as pillar recovery workings, longwall faces and shortwall faces, shall be approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36. Equipment shall not be operated in atmospheres containing 1.0 percent or more methane.

§ 57.22306 Methane monitors (I-A mines)

(a) Methane monitors shall be installed on continuous mining machines, longwall mining systems, and on loading and haulage equipment used in or beyond the last open crosscut.

(b) The monitors shall -

(1) Give warning at 1.0 percent methane;

(2) Automatically deenergize electrical equipment, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18, and prevent starting such equipment when methane levels reach 1.5 percent. Diesel equipment shall be shut off or immediately removed from the affected area; and

(3) Automatically deenergize electrical equipment when power to a sensor is interrupted. Diesel equipment shall not be operated if the monitor is inoperative.

(c) Sensing units of monitors shall be positioned at a location which provides for the most effective measurement of methane.

§ 57.22307 Methane monitors (II-A mines)

(a) Methane monitors shall be installed on continuous mining machines, longwall mining systems, bench and face drills, and undercutting machines used in or beyond the last open crosscut.

(b) The monitors shall -

(1) Give warning at 0.5 percent methane;

(2) Automatically deenergize electrical equipment, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18, and prevent starting such equipment when methane levels reach 1.0 percent; and

(3) Automatically deenergize the equipment when power to a sensor is interrupted.

(c) Sensing units of monitors shall be positioned at a location which provides for the most effective measurement of methane.

§ 57.22308 Methane monitors (III mines)

(a) Methane monitors shall be installed on continuous mining machines and longwall mining systems.

(b) The monitors shall -

(1) Give warning at 1.0 percent methane;

(2) Automatically deenergize electrical equipment, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18, and prevent starting such equipment when methane levels reach 1.5 percent; and

(3) Automatically deenergize the equipment when power to a sensor is interrupted.

(c) Sensing units of monitors shall be positioned at a location which provides for the most effective measurement of methane.

§ 57.22309 Methane monitors (V-A mines)

(a) Methane monitors shall be installed on continuous mining machines used in or beyond the last open crosscut.

(b) The monitors shall -

(1) Give warning at 1.0 percent methane.

(2) Automatically deenergize electrical equipment, except power to monitoring equipment determined by MSHA to be intrinsically safe under 30 CFR part 18, and prevent starting of such equipment when methane levels reach 1.5 percent; and

(3) Automatically deenergize the equipment when power to a sensor is interrupted.

(c) Sensing units of monitors shall be positioned at a location which provides for the most effective measurement of methane.

§ 57.22310 Electrical cables (I-C mines)

Electrical cables used to power submersible sump pumps shall be accepted or approved by MSHA as flame resistant, or be installed in continuous metal conduit or metal pipe. The ends of such conduit or pipe shall be sealed to prevent entry of explosive gas or dust.

[57 FR 61223, Dec. 23, 1992]

§ 57.22311 Electrical cables (II-A mines)

Only jacketed electrical cables accepted or approved by MSHA as flame resistant shall be used to supply power to distribution boxes and electrical equipment operating in face and bench areas.

[57 FR 61223, Dec. 23, 1992]

§ 57.22312 Distribution boxes (II-A and V-A mines)

Distribution boxes containing short circuit protection for trailing cables of approved equipment shall be approved by MSHA under 30 CFR part 18.

§ 57.22313 Explosion-protection systems (I-C mines)

Pressure-relief systems including vents, or explosion suppression systems, shall be provided on explosive dust handling and processing equipment and on facilities housing such equipment. Vents shall be installed so that forces are directed away from persons should an explosion occur. The ratio of vent size to internal size of the equipment or facility shall not be less than one square foot of vent for each 80 cubic feet of volume or space.

§ 57.22314 Flow-control devices (V-A and V-B mines)

Oil recovery drill holes that penetrate oil bearing formations shall have devices to control the release of liquid hydrocarbons and hazardous gases during the drilling process. Such devices may be recovered for reuse after the formation has been depressurized or the well or borehole has been capped or connected to a collection system.

§ 57.22315 Self-contained breathing apparatus (V-A mines)

Self-contained breathing apparatus of a duration to allow for escape from the mine and sufficient in number to equip all persons underground shall be strategically located throughout the mine. Such apparatus shall be approved by MSHA and NIOSH under 42 CFR part 84 and shall be maintained in accordance with manufacturers' specifications. This standard does not apply to double entry mining systems where crosscut intervals do not exceed 250 feet.

[52 FR 24941, July 1, 1987, as amended at 60 FR 30401, June 8, 1995]

Underground Retorts

§ 57.22401 Underground retorts (I-A and I-B mines)

(a) Retorts shall be provided with -

(1) Two independent power sources for main mine ventilation fans and those fans directly ventilating retort bulkheads, and for retort blowers, and provisions for switching promptly from one power source to the other; and

(2) An alarm system for blower malfunctions and an evacuation plan to assure safety of personnel in the event of a failure.

(b) Prior to the ignition of underground retorts, a written ignition and operation plan shall be submitted to the MSHA District Manager for the area in which the mine is located. The mine operator shall comply with all provisions of the retort plan. The retort plan shall include -

(1) Acceptable levels of combustible gases and oxygen in retort off-gases during start-up and during burning; levels at which corrective action will be initiated; levels at which personnel will be removed from the retort areas, from the mine, and from endangered surface areas; and the conditions for reentering the mine;

(2) Specification and locations of off-gas monitoring procedures and equipment;

(3) Specifications for construction of retort bulkheads and seals, and their locations;

(4) Procedures for ignition of a retort and for reignition following a shutdown; and

(5) Details of area monitoring and alarm systems for hazardous gases and actions to be taken to assure safety of personnel.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987; 60 FR 33723, June 29, 1995]

Illumination

§ 57.22501 Personal electric lamps (I-A, I-B, I-C, II-A, II-B, III, IV, V-A, and V-B mines)

Electric lamps used for personal illumination shall be approved by MSHA under the requirements of 30 CFR parts 19 or 20, as applicable.

Explosives

§ 57.22601 Blasting from the surface (I-A mines)

(a) All development, production, and bench rounds shall be initiated from the surface after all persons are out of the mine. Persons shall not enter the mine until ventilating air has passed over the blast area and through at least one atmospheric monitoring sensor.

(b) After blasting, if the monitoring system indicates that methane in the mine is less than 1.0 percent, persons may enter the mine. All places blasted shall be tested for methane by a competent person before work is started.

(c) If the monitoring system indicates the presence of 1.0 percent or more methane, persons other than examiners shall not enter the mine until the mine has been examined by a competent person and the methane content has been reduced to less than 1.0 percent.

(d) Vehicles used for transportation when examining the mine shall be approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36.

[52 FR 24941, July 1, 1987, as amended at 53 FR 9615, Mar. 24, 1988]

Effective Date Note: At 53 FR 9615, Mar. 24, 1988, § 57.22601 was stayed until further notice.

§ 57.22602 Blasting from the surface (I-C mines)

(a) All blasting shall be initiated from the surface after all persons are out of the mine and any connecting mines.

(b) Persons shall not enter the mine until a competent person has examined the blast sites and methane concentrations are less than 0.5 percent.

§ 57.22603 Blasting from the surface (II-A mines)

(a) All development, production, and bench rounds shall be initiated from the surface after all persons are out of the mine. Persons shall not enter the mine until the mine has been ventilated for at least 15 minutes and the ventilating air has passed over the blast area and through at least one atmospheric monitoring sensor.

(b) If the monitoring system indicates that methane in the mine is less than 0.5 percent, competent persons may enter the mine to test for methane in all blast areas.

(c) If the monitoring system indicates that methane in the mine is 0.5 percent or more, the mine shall be ventilated and persons shall not enter the mine until the monitoring system indicates that methane in the mine is less than 0.5 percent.

(d) If the monitoring system is inoperable or malfunctions, the mine shall be ventilated for at least 45 minutes and the mine power shall be deenergized before persons enter the mine. Only competent persons necessary to test for methane may enter the mine until the methane in the mine is less than 0.5 percent.

(e) Vehicles used for transportation when examining the mine shall be approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36. Vehicles shall not be used to examine the mine if the monitoring system is inoperable or has malfunctioned.

§ 57.22604 Blasting from the surface (II-B mines)

All development, production, and bench rounds shall be initiated from the surface after all persons are out of the mine. Persons other than those designated by the mine operator to make methane tests shall not enter the mine until all blast areas have been tested for methane.

§ 57.22605 Blasting from the surface (V-A mines)

(a) All development and production blasting shall be initiated from the surface after all persons are out of the mine. Persons shall not enter the mine until ventilating air has passed over the blast area and through at least one atmospheric monitoring sensor.

(b) If the monitoring system indicates that methane in the mine is less than 1.0 percent, persons may enter the mine, and all places blasted shall be tested for methane by a competent person before work is started.

(c) If the monitoring system indicates the presence of 1.0 percent or more methane, persons other than examiners shall not enter the mine until the mine has been examined by a competent person and the methane level is less than 1.0 percent.

(d) Vehicles used for transportation when examining the mine shall be approved by MSHA under the applicable requirements of 30 CFR parts 18 through 36.

(e) This standard applies only to mines blasting within an oil reservoir.

§ 57.22606 Explosive materials and blasting units (III mines)

(a) Mine operators shall notify the appropriate MSHA District Manager of all nonapproved explosive materials and blasting units to be used prior to their use. Explosive materials used for blasting shall be approved by MSHA under 30 CFR part 15, or nonapproved explosive materials shall be evaluated and determined by the District Manager to be safe for blasting in a potentially gassy environment. The notice shall also include the millisecond-delay interval between successive shots and between the first and last shot in a round.

(b) Faces shall be examined for proper placement of holes, possible breakthrough, and water. Ammonium nitrate blasting agents shall not be loaded into wet holes.

(c) Multiple-shot blasts shall be initiated with detonators encased in copper-based alloy shells. Aluminum and aluminum alloy-cased detonators, nonelectric detonators, detonating cord, and safety fuses shall not be used. All detonators in a round shall be made by the same manufacturer.

(d) Nonapproved explosives shall be used only as primers with ammonium nitrate-fuel oil blasting agents. Such primers shall be placed at the back or bottom of the hole.

(e) Blast holes shall be stemmed with a noncombustible material in an amount to confine the explosive charge. Breakthrough holes shall be stemmed at both ends.

(f) Mudcaps or other nonapproved unconfined shots shall not be blasted.

(g) (1) Blasting units shall be approved by MSHA under 30 CFR part 25; or

(2) Blasting units used to fire more than 20 detonators shall provide at least 2 amperes through each detonator but not more than an average of 100 amperes through one ohm for 10 milliseconds, and provide the necessary current for at least the first 5 milliseconds with a cutoff not to exceed 10 milliseconds.

[52 FR 24941, July 1, 1987, as amended at 52 FR 41397, Oct. 27, 1987]

§ 57.22607 Blasting on shift (III mines)

When blasting on shift, tests for methane shall be made in the mine atmosphere by a competent person before blasting. Blasting shall not be done when 1.0 percent or more methane is present.

§ 57.22608 Secondary blasting (I-A, II-A, and V-A mines)

Prior to secondary blasting, tests for methane shall be made in the mine atmosphere at blast sites by a competent person. Secondary blasting shall not be done when 0.5 percent or more methane is present.

Appendix I to Subpart T of Part 57 - STANDARD APPLICABILITY BY CATEGORY OR SUBCATEGORY

Subcategory I-A

57.22101
57.22103
57.22201
57.22202
57.22204
57.22205
57.22206
57.22207
57.22208
57.22211
57.22214
57.22215
57.22217
57.22220
57.22221
57.22222
57.22224
57.22227
57.22228
57.22229
57.22234
57.22237
57.22301
57.22302
57.22306
57.22401
57.22501
57.22601
57.22608

Subcategory I-B

57.22201
57.22202
57.22217
57.22222
57.22227
57.22231
57.22232
57.22234
57.22238
57.22401
57.22501

Subcategory I-C

57.22102
57.22104
57.22106
57.22201
57.22202
57.22203
57.22209
57.22210
57.22212
57.22216
57.22217
57.22222
57.22225
57.22227
57.22228
57.22233
57.22235
57.22241
57.22303
57.22310
57.22313
57.22501
57.22602

Subcategory II-A

57.22101
57.22103
57.22201
57.22202
57.22204

57.22205
57.22206
57.22207
57.22208
57.22212
57.22214
57.22215
57.22219
57.22220
57.22221
57.22222
57.22227
57.22228
57.22230
57.22232
57.22235
57.22301
57.22304
57.22307
57.22311
57.22312
57.22501
57.22603
57.22608

Subcategory II-B

57.22201
57.22227
57.22231
57.22232
57.22235
57.22238
57.22501
57.22604

Category III

57.22101
57.22103
57.22201
57.22202
57.22204
57.22205
57.22206
57.22207
57.22208

57.22213
57.22214
57.22215
57.22218
57.22220
57.22221
57.22222
57.22223
57.22224
57.22227
57.22228
57.22229
57.22234
57.22237
57.22305
57.22308
57.22501
57.22606
57.22607

Category IV

57.22105
57.22201
57.22226
57.22227
57.22232
57.22235
57.22239
57.22501

Subcategory V-A

57.22101
57.22103
57.22201
57.22202
57.22204
57.22205
57.22206
57.22207
57.22208
57.22212
57.22214
57.22215
57.22218
57.22220

57.22221
57.22222
57.22227
57.22228
57.22229
57.22234
57.22240
57.22301
57.22302
57.22309
57.22312
57.22314
57.22315
57.22501
57.22605
57.22608

Subcategory V-B

57.22201
57.22202
57.22218
57.22222
57.22227
57.22231
57.22232
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Section IX: General Definitions

Disclaimer

The definitions provided herein are solely for the purpose of general information. These definitions are not necessarily intended to conform to those set forth in any governmental regulations or guidelines, nor are they intended to describe any manufacturer's particular product configuration.

AC Alternating current.

Acceptor A charge of explosives or blasting agent receiving an impulse from an exploding donor charge.

Adobe Charge A mud-covered or unconfined explosive charge fired in contact with a rock surface without the use of a borehole-, Synonymous with "Bulldoze" and "Mudcapping."

Air Blast The airborne shock wave or acoustic transient generated by an explosion.

American Table of Distances The quantity-distance table, prepared and approved by IME, for storage of explosive materials to determine safe distances from inhabited buildings, public highways, passenger railways, and other stored explosive materials.

Ammonium Nitrate The ammonium salt of nitric acid represented by the formula NH_4NO_3.

Ampere A unit of electrical current produced by 1 volt acting through a resistance of 1 ohm.

ANFO An explosive material consisting of ammonium nitrate and fuel oil.

ANSI American National Standards Institute, a nongovernmental organization concerned with developing safety and health standards for industry.

Approved, **Approval**, or **Authorized** Terms that mean Approved, Approval, or Authorized by the authority having jurisdiction.

Artificial Barricade An artificial mound or revetted wall of earth of a minimum thickness of 3 ft.

Authorized Person An individual approved or assigned by management to perform a specific duty or duties or to be at a specific location or locations.

Authority Having Jurisdiction The governmental agency, office, or individual responsible for approving equipment, an installation, or a procedure.

Available Energy The energy from an explosive material that is capable of performing useful work.

Back Break Rock broken beyond the limits of the last row of holes in a blast.

Ballistic Mortar A laboratory instrument used for measuring the relative power or strength of an explosive material.

Barricaded The effective screening of a building containing explosives from a magazine or other building, railway, or highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosives to the eave line of any magazine or other building or to a point 12 ft above the center of a railway or highway shall pass through such barrier.

Base Charge The main explosive charge in the base of a detonator.

Bench A horizontal ledge in or at the top of a highwall from which holes are drilled vertically down into the material to be blasted; benching is a process of excavating where a highwall is worked in steps or lifts.

Bench Height The vertical distance from the top of a bench to the floor or to the top of the next lower bench.

Black Powder A deflagrating or low-explosive compound of an intimate mixture of sulfur, charcoal, and an alkali nitrate, usually potassium or sodium nitrate.

Blast, **Blasting** The firing of explosive materials for such purposes as breaking rock or other material, moving material, or generating seismic waves; the assembly of explosive materials for such purpose.

Blast Area The area of a blast within the influence of flying rock missiles, gases, and concussion.

Blast Pattern The plan of the drill holes laid out on a bench; an expression of the burden distance and the spacing distance and their relationship to each other.

Blast Site The area where explosive material is handled during loading, including the perimeter of blastholes and 50 ft in all directions from loaded holes or holes to be loaded. In underground mines, 15 ft of solid rib or pillar can be substituted for the 50-ft distance.

Blaster That qualified person in charge of, and responsible for the loading and firing of a blast (same as “Shot Firer”).

Blasting Accessories Nonexplosive devices and materials used in blasting, such as, but not limited to, cap crimpers, tamping bags, blasting machines, blasting galvanometers, and cartridge punches.

Blasting Agent An explosive material that meets prescribed criteria for insensitivity to initiation. For storage, Title 27, Code of Federal Regulations, Section 555.11 defines a blasting agent as any material or mixture, consisting of fuel and oxidizer intended for blasting, not otherwise defined as an explosive, provided that the finished product, as

mixed for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined (Bureau of Alcohol, Tobacco, and Firearms Regulation). For transportation, Title 49, Code of Federal Regulations defines a blasting agent as a material designed for blasting that has been tested in accordance with Section 173.114a and found to be so insensitive that there is very little probability of accidental initiation to explosion or transition from deflagration to detonation (U.S. Department of Transportation Regulation).

Blasting Cap A detonator that is initiated by a safety fuse (see "Fuse Cap")

Blasting Crew A group of persons who assist the blaster in loading, tying in, and firing a blast.

Blasting Galvanometer An electrical resistance instrument designed specifically for testing electric detonators and circuits containing them. Along with blasting ohmmeters and blaster's multimeters, it is used to measure resistance or to check electrical continuity.

Blasting Log A written record of information about a specific blast as may be required by law or regulation.

Blasting Machine An electrical or electromechanical device that provides electrical energy for the purpose of energizing detonators in an electric blasting circuit.

Blasting Machine-CD Type See "Capacitor-Discharge Blasting Machine."

Blasting Machine-Generator Type A hand-operated electromechanical device that provides an output current to energize electric detonators.

Blasting Machine Rheostat A graduated electrical resistance device used to simulate electric detonator resistances in the testing of blasting machines.

Blasting Mat A mat of woven steel wire, rope, scrap tires, or other suitable material or construction to cover blastholes for the purpose of preventing flying rock missiles.

Blasting Vibrations The energy from a blast that manifests itself in earthborne vibrations that are transmitted through the earth away from the immediate blast area.

Block-Holing The breaking of boulders by loading and firing small explosive charges in small-diameter drilled holes.

Booster An explosive charge, usually of high strength and high detonation velocity, used to improve the initiation of less sensitive explosive materials.

Bootleg The part of a drilled blasthole that remains when the force of the explosion does not break the rock completely to the bottom of the hole.

Borehole (**Blasthole**) A hole drilled in the material to be blasted, for the purpose of containing an explosive charge.

Breakage A term used to describe the size distribution of the rock fragments created by a blast.

Bridgewire A resistance wire connecting the ends of the legwires inside an electric detonator and which is imbedded in the ignition charge of the detonator.

Brisance The shattering power of an explosive material as distinguished from its total work capacity.

Bulk Mix A mass of explosive material prepared for use in bulk form without packaging.

Bulk Mix Delivery Equipment Equipment (usually a motor vehicle with or without a mechanical delivery device) that transports explosive materials in bulk form for mixing and/or loading directly into blastholes.

Bulk Strength The strength per unit volume of an explosive calculated from its weight strength and density.

Bulldoze A mud-covered or unconfined explosive charge fired in contact with a rock surface without the use of a borehole; Synonymous with "Adobe Charge" and "Mudcapping."

Bullet-Resistant Magazine walls or doors of construction resistant to penetration of a bullet of 150-grain M2 ball ammunition having a nominal muzzle velocity of 2,700 ft/sec fired from a .30-caliber rifle from a distance of 100 ft perpendicular to the wall or door. When a magazine ceiling or roof is required to be bullet-resistant, the ceiling or roof shall be constructed of materials comparable to the sidewalls or of other materials that will withstand penetration of the bullet described above when fired at an angle of 45 degrees from the perpendicular. Tests to determine bullet resistance should be conducted on test panels or empty magazines that will resist penetration of 5 out of 5 shots placed independently of each other in an area at least 3 ft. x 3 ft.

Bullet-Sensitive Explosive Material Explosive material that can be detonated by 150-grain M2 ball ammunition having a nominal muzzle velocity of 2,700 ft/sec when the bullet is fired from a .30-caliber rifle at a distance of not more than 100 ft and the test material, at a temperature of 70° - 75° F, is placed against a backing material of ½-in. steel plate.

Bureau of Explosives A bureau of the Association of American Railroads that the U.S. Department of Transportation may consult for recommendations on classification of explosive materials for the purpose of interstate transportation.

Burden The distance from the borehole and the nearest free face or the distance between boreholes measured perpendicular to the spacing. Also, the total amount of material to be blasted by a given hole, usually measured in cubic yards or tons.

Bureau of Alcohol, **Tobacco**, **and Firearms** (**BAFT**) A bureau of the Department of Treasury having responsibility for the promulgation and enforcement of regulations related to the unlawful use of explosive materials under 18 U.S.C. Chapter 40, Section 847.

Bureau of Mines See "U.S. Bureau of Mines."

Bus Wire Expendable heavy-gauge bare copper wire used to connect detonators or series of detonators in parallel.

Cap Crimper A mechanical device for crimping the metallic shell of a fuse detonator or igniter cord connector securely to a section of inserted safety fuse.

Cap Sensitivity The sensitivity of an explosive to initiation by a detonator. An explosive material is considered to be cap sensitive if it detonates with an IME No. 8 Test Detonator.

Capacitor-Discharge Blasting Machine A blasting machine in which electrical energy, stored on a capacitor, is discharged into a blasting circuit containing electric detonators.

Carton A lightweight inner container for explosive materials, usually encased in a substantial shipping container called a "Case."

Cartridge An individual closed shell, bag, or tube of circular cross section containing explosive material.

Cartridge Count (**Stick Count**) The number of cartridges in a standard case. A standard case typically contains about 50 lb. of explosive material.

Cartridge Punch A wooden, plastic, or nonsparking metallic device used to punch an opening in an explosive cartridge to accept a detonator or a section of detonating cord.

Cartridge Strength Same as "Bulk Strength."

Case An outer substantial shipping container meeting DOT specifications for explosive materials.

Case Liner A plastic or paper barrier used to prevent the escape of explosive materials from a case.

Cast, **Extrude**, or **Pressed Booster** A cast, extruded, or pressed solid high explosive used to detonate less sensitive explosive materials.

Certified Blaster A blaster certified by a governmental agency to prepare, execute, and supervise blasting.

Chemical Manufacturers Association (**CMA**) A nonprofit chemical trade organization of companies in the United States and Canada who manufacture chemicals for sale.

Circuit A completed path for conveying electrical current.

Class A Explosives Explosives, as defined by the U.S. Department of Transportation, that possess detonating or otherwise maximum hazard, such as, but not limited to, dynamite, nitroglycerin, lead azide, blasting caps, and detonating primers.

Class B Explosives Explosives, as defined by the U.S. Department of Transportation, that possess flammable hazard, such as, but not limited to, propellant explosives, photographic flash powders, and some special fireworks.

Class C Explosives Explosives, as defined by the U.S. Department of Transportation, that contain Class A or Class B explosives, or both, as components but in restricted quantities.

Collar The term applied to the timbering or concrete around the mouth or top of a shaft. It also refers to the mouth or top of a drill hole in blasting.

Column Charge A charge of explosives in a blasthole in the form of a long, continuous unbroken column.

Column Depth/Column Height The length of each portion of a blast hole filled with explosive materials.

Commercial Explosives Explosives designed, produced, and used for commercial or industrial applications rather than for military purposes.

Confined Detonation Velocity The detonation velocity of an explosive material in a substantial container or a borehole.

Connecting Wire Wire used to extend the firing line or legwires in an electric blasting circuit.

Core Load The explosive core of detonating cord, expressed as the number of grains of explosive per foot.

Coupling The degree to which an explosive fills the cross section of a borehole; bulk-loaded explosives are completely coupled; untamped cartridges are decoupled.

Coyote Shooting A method of blasting using a number of relatively large concentrated charges of explosives placed in one or more small tunnels driven in a rock formation.

Crimp The folded ends of paper explosive cartridges, the circumferential depression at the open end of a fuse cap or igniter cord connector that serves to secure the fuse; or the circumferential depression in the blasting cap shell that secures a sealing plug or sleeve into electric or nonelectric detonators.

Crimping The act of securing a fusecap or igniter cord connector to a section of a safety fuse by compressing the metal shell of the cap against the fuse by means of a cap crimper.

Critical Diameter The minimum diameter for propagation of a detonation wave at a stable velocity. Critical diameter is affected by conditions of confinement, temperature, and pressure on the explosive.

Crosscut A horizontal opening driven across the course of a vein or in general across the direction of the main workings; a connection from a shaft to a vein.

Current Leakage Portion of the firing current bypassing part of the blasting circuit through unintended paths.

Current-Limiting Device An electric or electromechanical device that limits:

1) current amplitude,

2) duration of current flow, or

3) total energy of the current delivered to an electric blasting circuit.

Cushion Blasting A blasting technique used to produce competent slopes. The cushion holes, fired after the main charge, have a reduced spacing and employ decoupled charges.

Cutoff A break in a path of detonation or initiation caused by extraneous interference, such as flyrock or shifting ground.

Date-Shift Code A code applied by manufacturers to the outside shipping containers, and, in many instances, to the immediate containers of explosive materials to aid in their identification and tracing.

D'Autriche Method-Detonation Velocity A method of determining the detonation velocity of an explosive material by employing detonating cord and a witness plate.

DC Direct current.

Decibel A unit of air overpressure commonly used to measure air blast.

Deck Loading (Decking) A method of loading blastholes in which the explosive charges, called decks or deck charges, in the same hole are separated by stemming or an air cushion.

Decks An explosive charge that is separated from other charges in the blasthole by stemming or an air cushion.

Deflagration An explosive reaction such as a rapid combustion that moves through an explosive material at a velocity less than the speed of sound in the material.

Delay A distinct pause of predetermined time between detonation or initiation impulses, to permit the firing of explosive charges separately.

Delay Blasting The practice of initiating individual explosive decks, boreholes, or rows of boreholes at predetermined time intervals using delay detonators, as compared to instantaneous blasting where all holes are fired essentially simultaneously.

Delay Detonator An electric or nonelectric detonator used to introduce a predetermined lapse of time between the application of a firing signal and the detonation of the base charge.

Delay Element The device in a delay detonator that produces the predetermined time lapse between the application of a firing signal and detonation.

Delay Interval The nominal time between the detonations of delay detonators of adjacent periods in a delay series; the nominal time between successive detonations in a blast.

Delay Period A designation given to a delay detonator to show its relative or absolute delay time in a given series.

Delay Series A series of delay detonators designed to satisfy specific blasting requirements. There are basically two types of delay series: millisecond (MS) with delay intervals on the order of milliseconds, and long period (LP) with delay times on the order of seconds.

Delay Tag A tag, band, or marker on a delay detonator that denotes the delay series, delay period, and/or delay time of the detonator.

Delay Time The lapse of time between the application of a firing signal and the detonation of the base charge of a delay detonator.

Density The mass of an explosive per unit of volume, usually expressed in grams per cubic centimeter or pounds per cubic foot.

Department of Transportation (**DOT**) A cabinet-level agency of the federal government. It has the responsibility for the comprehensive regulation of transportation safety and issues regulations governing interstate shipments of explosives and other hazardous materials.

Detonating Cord A flexible cord containing a center core of high explosive and used to initiate other explosives.

Detonating Cord Downline The section of detonating cord that extends within the blasthole from the ground surface down to the explosive charge.

Detonating Cord MS Connectors Nonelectric, short-interval (millisecond) delay devices for use in delaying blasts that are initiated by detonating cord.

Detonating Cord Trunkline The line of detonating cord that is used to connect and initiate other lines of detonating cord.

Detonating Primer A name applied for transportation purposes to a device consisting of a detonator and an additional charge of explosives, assembled as a unit.

Detonation An explosive reaction that moves through an explosive material at a velocity greater than the speed of sound in the material.

Detonation Pressure The pressure produced in the reaction/zone of a detonating explosive.

Detonation Velocity The velocity at which a detonation progresses through an explosive.

Detonator Any device containing any initiating or primary explosive that is used for initiating detonation. A detonator may not contain more than 10g of total explosives by weight, excluding ignition or delay charges. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord delay connectors, and nonelectric instantaneous and delay blasting caps that use detonating cord, shock tube, or any other replacement for electric legwires.

Development The work of driving openings to and in a proved ore body, to prepare it for mining and transporting the ore.

Diameter The cross-sectional width of a borehole or an explosive cartridge.

Ditch Blasting The formation of a ditch by the detonation of a series of explosive charges.

Ditching Dynamite A nitroglycerin-type explosive especially designed to propagate sympathetically from hole to hole in ditch blasting.

Donor An exploding charge producing an impulse that impinges upon an explosive acceptor charge.

Dope Individual, dry, nonexplosive ingredients that comprise a portion of an explosive formulation.

Do's and Don'ts A list of precautions (*IME Safety Library Publication No. 4*) printed by the Institute of Makers of Explosives pertaining to the transportation, storage, handling, and use of explosive materials and inserted in cases of explosive materials and cartons of detonators.

Downline A line of detonating cord or plastic tubing in blasthole that transmits the detonation from the trunkline or surface delay system down the hole to the primer.

Drift A horizontal opening in or near an ore body and parallel to the course of the vein or long dimension of the ore body.

Drill Hole A hole drilled in the material to be blasted for the purpose of containing an explosive charge, also called “Blasthole” or “Borehole.”

Drilling Pattern The location of blastholes in relationship to each other and the free face, if any.

Dynamite A high explosive used for blasting, consisting essentially of a mixture of, but not limited to, nitroglycerin, nitrocellulose, ammonium nitrate, sodium nitrate, and carbonaceous materials.

Electric Blasting Circuit An electric circuit containing electric detonators and associated wiring.

Electric Detonator A detonator designed for, and capable of, initiation by means of an electric current.

Electrical Storm An atmospheric disturbance characterized by intense electrical activity, producing lightning strokes and strong electric and magnetic fields.

Emergency Procedure Card Instructions carried on a truck transporting explosive materials and giving specific procedures in case of emergency.

Emulsion An explosive material containing substantial amounts of oxidizers dissolved in water droplets, surrounded by an immiscible fuel.

Energy A measure of the potential for the explosive to do work.

Exploration The work involved in gaining a knowledge of the size, shape, position, and value of an ore body.

Explosion A chemical reaction involving an extremely rapid expansion of gases, usually associated with the liberation of heat.

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

Explosive-Actuated Device Any tool or special mechanized device that is actuated by explosives. The term does not include propellant-actuated devices.

Explosive Charge The quantity of explosive material used in a blasthole, coyote tunnel, or explosive device.

Explosive Loading Factor The amount of explosive used per unit of rock; also called “Powder Factor.”

Explosive Materials These include explosives, blasting agents, and detonators. The term includes, but is not limited to, dynamite and other high explosives; slurries, emulsions, and water gels; black powder and pellet powder; initiating explosives; detonators

(blasting caps); safety fuse; squibs; detonating cord; igniter cord; and igniters. A list of explosive materials determined to be within the coverage of 18 U.S.C. Chapter 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials" is issued at least annually by the Director of the Bureau of Alcohol, Tobacco, and Firearms of the Department of the Treasury. The U.S. Department of Transportation classifications of explosive materials used in commercial blasting operations are not identical with the statutory definitions of the Organized Crime Control Act of 1970, Title 18 U.S.C., Section 84.1. To achieve uniformity in transportation, the U.S. Department of Transportation in Title 49, Code of Federal Regulation, Parts 1-999 subdivides these materials into:

Class A Explosives-detonating or otherwise maximum hazard

Class B Explosives-flammable hazard

Class C Explosives-minimum hazard

Blasting Agents-see definition of "Blasting Agent."

Explosive Oils Liquid sensitizers for explosives such as nitroglycerin, ethylene glycol dinitrate, and metriol trinitrate.

Explosive Strength The amount of energy released by an explosive upon detonation that is an indication of the capacity of the explosive to do work.

Extra (**Ammonia**) **Dynamite** A dynamite that derives a major portion of its energy from reaction of ammonium nitrate.

Extraneous Electricity Electrical energy, other than actual firing current or the test current from a blasting galvanometer, that is present at a blast site and that could enter an electric blasting circuit. It includes stray current, static electricity, RF (electromagnetic) waves, and time-varying electric and magnetic fields.

Fertilizer-Grade Ammonium Nitrate A grade of ammonium nitrate as defined by The Fertilizer Institute.

Fire Extinguisher Rating A rating set forth in the National Fire Code that may be identified on an extinguisher by a number (5, 20, 30, etc.) indicating the extinguisher's relative effectiveness followed by a letter (A, B, C, etc.) indicating the class or classes of fires for which the extinguisher has been found to be effective.

Fire-Resistant Construction designed to offer reasonable protection against fire.

Fireworks Combustible or explosive compositions or manufactured articles designed and prepared for the purpose of producing audible or visible effects.

Firing Current An electric current of recommended magnitude and duration to sufficiently energize an electric detonator or a circuit of electric detonators.

Firing Line The wire(s) connecting the electrical power source with the electric blasting circuit.

Flags-Danger Flags, usually red, that may or may not be imprinted with a warning and used to caution personnel around explosives operations, or displayed on trucks transporting explosives.

Flammability The ease with which an explosive material may be ignited by flame and heat.

Flare A pyrotechnic device designed to produce a single source of intense light.

Flashover The sympathetic detonation between explosive charges or between charged blastholes.

Flash Point The lowest temperature at which vapors from a volatile combustible substance ignite in air when exposed to flame, as determined in an apparatus specifically designed for such testing.

Flyrock Rocks propelled from the blast area by the force of an explosion.

Foot Wall The wall or rock under a vein. It's called the floor in bedded deposits.

Forbidden or **Not Acceptable Explosives** Explosives that are forbidden or not acceptable for transportation by common, contract, or private carriers, by rail freight, rail express, highway, air, or water in accordance with the regulations of the U.S. Department of Transportation.

Fragmentation The breaking of a solid mass into pieces by blasting.

Free Face A rock surface exposed to air or water that provides room for expansion upon fragmentation; sometimes called open face.

Freezing The semifusing and nonejection of the pulverized rock or ore in the cut portion of a blasting round; generally caused by providing insufficient void space for the initial holes blasted in the cut, little or no delay between charges, and/or excessive charge weights.

Fuel A substance that may react with oxygen to produce combustion.

Fume Classification See "IME Fume Classification."

Fumes The gaseous products of an explosion. For the purpose of fume classification, only poisonous or toxic gases, such as carbon monoxide, hydrogen sulfide, and nitrogen oxides are considered.

Fuse See "Safety Fuse."

Fuse Cap (**Fuse Detonator**) A detonator that is initiated by a safety fuse; also referred to as an ordinary blasting cap.

Fuse Cutter A mechanical device for cutting safety fuse clean and at right angles to its long axis.

Fuse Lighters Pyrotechnic devices for the rapid and certain lighting of safety fuse.

Gauge (**Wire**) A series of standard sizes such as the American Wire Gauge (AWG), used to specify the diameter of wire

Galvanometer See "Blasting Galvanometer."

Gap Sensitivity The maximum distance for propagation between standard charge sizes of explosive donor and acceptor. It is used for measuring the likelihood of sympathetic propagation.

Gelatin Dynamite A type of highly water-resistant dynamite characterized by its gelatinous consistency.

Geology A description of the types and arrangement of rock in an area; the description usually includes the dip and strike, the type and extent of preexisting breaks in the rock, and the hardness and massiveness of the rock as these affect blast design.

Grains A system of weight measurement where 7,000 grains are equivalent to one standard 16-ounce pound (0.45 kg).

Ground Fault An electrical contact between part of the blasting circuit and earth.

Ground Vibration Shaking of the ground, by elastic waves emanating from a blast, usually measured in inches per second of particle velocity.

GVW Gross vehicle weight.

Hangfire The detonation of an explosive charge at some nondetermined time after its normally designed firing time.

Hanging Wall The wall or rock on the upper side of an inclined vein. It is called the roof in bedded deposits.

Hardwood Red oak, white oak, hard maple, ash, or hickory, free from loose knots, wind shakes, or similar defects.

Heading Refers to the driving of openings of the various exploration and development passageways.

Hertz (**Hz**) A synonym for "cycles per second."

High Explosives Explosives that are characterized by a very high rate of reaction, high pressure development, and the presence of a detonation wave in the explosive.

Highwall A nearly vertical face at the edge of a bench, bluff, or ledge on a surface excavation.

Highway Any public street, public alley, or public road.

Hole Diameter The cross-sectional width of the borehole.

Igniter Cord A small-diameter pyrotechnic cord that burns at a uniform rate with an external flame and used to ignite a series of safety fuses.

IME Fume Classification A classification indicating the amount of poisonous or toxic gases produced by an explosive or blasting agent. The IME Fume Classification is expressed as follows:

Fume Class	Cubic Feet of Poisonous Gases Per (1 ¼′ x 8″) Cartridge of Explosive Material
1	Less than 0.16
2	0.16 - 0.33
3	0.33 - 0.67

Incendivity The property of an igniting agent (e.g., spark, flame, or hot solid) whereby the agent can cause ignition.

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

Initiation The act of causing an explosive material to detonate or deflagrate.

Initiator A detonator or detonating cord used to start detonation in an explosive material.

Instantaneous Detonator A detonator that has a firing time of essentially 0 sec as compared to delay detonators with firing times of from several milliseconds to several seconds.

Institute of Makers of Explosives (**IME**) A nonprofit safety-oriented trade association representing leading producers of commercial explosive materials in the United States and Canada and dedicated to safety in the manufacture, transportation, storage, handling, and use of explosive materials.

Institute of Makers of Explosives No. 8 Test Detonator IME No. 8 test detonator has 0.40 - 0.45g of PETN base charge pressed to a specific gravity of 1.4g/cc and primed with standard weights of primer, depending on manufacturer.

Inventory A listing of all explosive materials stored in a magazine.

Issuing Authority The governmental agency, office, or official vested with the authority to issue permits or licenses.

Jackleg A single rotary-percussion pneumatically actuated machine with a hinged air-assisted feedleg; primarily used in small development headings and production stopes for drilling holes up to 1¾ in. in diameter.

Jumbo Vehicle mounted, boom-fed rotary-percussion drills, actuated by either compressed air or hydraulics, primarily used in large tunnels and room-and-pillar mining applications; generally capable of drilling holes 1¾ - 3½ in. in diameter.

Kelly Bar A hollow bar attached to the top of the drill column in rotary drilling; also called grief joint, kelly joint, kelly stem.

Leading (**Lead**) **Lines** or **Wires** The wire(s) connecting the electrical power source with the circuit containing electric detonators.

Leakage Resistance The resistance between the blasting circuit (including lead wires) and the ground.

Legwires The two single wires or one duplex wire extending out from an electric detonator.

Level Mines are customarily worked from shafts through horizontal passages or drifts called levels. These are commonly spaced at regular intervals in depth and are either numbered from the surface in regular order or designated by their actual elevation below the top of a shaft.

Liquid Fuels Fuels in a liquid state. They may be used with oxidizers to form explosive materials.

Loading Placing explosive material in a blasthole or against the material to be blasted.

Loading Density The weight of explosive loaded per unit length of borehole occupied by the explosive, expressed as pounds per foot or kilograms per meter of borehole.

Loading Pole A nonmetallic pole used to assist the placing and compacting of explosive charges in boreholes.

Low Explosives Explosives that are characterized by deflagration or a low rate of reaction and the development of low pressure.

Magazine Any building, structure, or container, other than an explosives manufacturing building, approved for the storage of explosive material.

Magazine Keeper A person responsible for the inventory and safe storage of explosive materials, including the proper maintenance of explosive materials, storage magazines, and areas.

Magazine, Surface A specially designed and constructed structure for the storage of explosive materials on the surface of the ground.

Magazine, Underground A specially designed and constructed structure for the storage of explosive materials underground.

Main Explosive Charge The explosive material that performs the major work of blasting.

Manufacturing Codes Code markings stamped on explosive materials packages, indicating, among other information, the date of manufacture.

Mass Detonate (**Mass Explode**) Explosive materials mass detonate (mass explode) when a unit or any part of a larger quantity of explosive material explodes and causes all or a substantial part of the remaining material to detonate or explode simultaneously. With respect to detonators, "a substantial part" means 90% or more.

Maximum Recommended Firing Current The highest recommended electric current to ensure safe and effective performance of an electric detonator.

Millisecond One thousandth of a second.

Mine Safety and Health Administration (**MSHA**) An agency of the Department of Labor concerned with promulgation and enforcement of health and safety regulations in the mining field.

Miniaturized Detonating Cord Detonating cord with a core load of 5 or less grains of explosive per foot.

Minimum Recommended Firing Current The lowest recommended electric current to ensure reliable performance of an electric detonator.

Minimum Gap Sensitivity An air gap, measured in inches, that determines whether the explosive material is within specific tolerances for gap sensitivity.

Misfire A blast that fails to detonate completely after an attempt at initiation; also, the explosive material itself that failed to detonate as planned.

Motor Vehicle Any self-propelled vehicle, truck, tractor, semitrailer, or full trailer used for the transportation of freight over public highways.

MS Connectors Nonelectric, short-interval (millisecond) delay devices for use in delaying blasts that are initiated by detonating cord.

Muck The broken rock or ore displaced from its position in the earth by blasting or caving.

Muckpile The pile of broken material resulting from a blast.

Mudcapping A mud-covered or unconfined explosive charge fired in contact with a rock surface without the use of a borehole.

Munroe Effect The concentration of explosive action through the use of a shaped charge.

National Fire Protection Association (NFPA) Standards Standards for explosive materials and ammonium nitrate issued by the National Fire Protection Association.

National Safety Council (NSC) A non-profit organization chartered by Congress to provide a regular information service on the causes of accidents and ways to prevent them.

Natural Barricade Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine when the trees are bare of leaves.

Nitroglycerin An explosive chemical compound used as a sensitizer in dynamite and represented by the formula $C_3H_5(ONO_2)_3$.

No. 8 Test Cap See "Institute of Makers of Explosives No. 8 Test Detonator".

Nonelectric Detonator A detonator that does not require the use of electric energy or safety fuse to function.

Nonsparking Metal A metal that will not produce a spark when struck with other tools, rock, or hard surfaces.

Occupational Safety and Health Administration (OSHA) An agency of the Department of Labor active in eliminating occupational hazards and promoting employee health and safety.

Office of Surface Mining (OSM) An agency of the U.S. Department of the Interior regulating surface coal mining and the surface effects of underground coal mining.

Overburden Worthless material lying on top of a deposit of useful material.

Oxidizer or **Oxidizing Material** A substance, such as a nitrate, that readily yields oxygen or other oxidizing substances to stimulate the combustion of organic matter or other fuel.

Oxygen Balance The theoretical percentage of oxygen in an explosive material or ingredient that exceeds (+) or is less than (-) what is needed to produce ideal reaction products.

Parallel Blasting Circuit An electric blasting circuit in which the legwires of each detonator are connected across the firing line directly or through buswires.

Parallel-Series Circuit See “Series in Parallel Blasting Circuit”.

Particle Board A composition board made of small pieces of wood bonded together.

Particle Velocity A measure of the intensity of ground vibration, specifically the time rate of change of the amplitude of ground vibration.

Parting A rock mass located between two seams of coal; a joint or crack in rock.

Passenger Railway Any steam, electric, or other railroad or railway that carries passengers for hire.

Pellet Powder Black powder pressed into cylindrical pellets 2 in. in length and 1¼ in. in diameter.

Permissible Diameter (**Smallest**) The smallest diameter of a permissible explosive, as approved by the Mine Safety and Health Administration (MSHA)

Permissible Explosives Explosives that are permitted for use in gassy and dusty atmospheres and that must be approved by the Mine Safety and Health Administration. Permissible explosives must be used and stored in accordance with certain conditions specified by the Mine Safety and Health Administration (MSHA).

Person Any individual, corporation, company, association, firm, partnership, society, or joint stock company.

PETN An abbreviation for the name of the explosive, pentaerythritol tetranitrate.

Placards Signs placed on vehicles transporting hazardous materials (including explosive materials) indicating the nature of the cargo.

Plywood Exterior construction-grade plywood.

Pneumatic Loading The loading of explosive materials into a borehole using compressed air as the loading or conveying force.

Powder A common synonym for explosive materials.

Powder Factor The amount of explosive used per unit of rock.

Power Source The source of power for energizing electric blasting circuits, e.g., a blasting machine or power line.

Preblast Survey A documentation of the existing condition of structures near an area where blasting is to be conducted.

Premature Firing The detonation of an explosive charge before the intended time.

Presplitting (**Preshearing**) A smooth blasting method in which cracks for the final contour are created by firing a single row of holes prior to the initiation of the rest of the holes in the blast pattern.

Prilled Ammonium Nitrate Ammonium nitrate in a pelleted or prilled form.

Primary Blast A blast used to fragment and displace material from its original position to facilitate subsequent handling and crushing.

Primary Explosive A sensitive explosive that nearly always detonates by simple ignition from such means as spark, flame, impact, friction, or other primary heat sources of appropriate magnitude.

Primer A unit, package, or cartridge of explosives used to initiate other explosives or blasting agents, and which contains;

1) a detonator, or

2) detonating cord to which is attached a detonator designed to initiate the detonating cord.

Propagation The detonation of explosive charges by an impulse received from adjacent or nearby explosive charges.

Propellant Explosive An explosive material that normally functions by deflagration and is used for propulsion purposes. It may be a Class A or Class B explosive, depending upon its susceptibility to detonation.

Propellant-Actuated Power Device Any tool or special mechanized device or gas generator system that is actuated by a propellant or that releases and directs work through a propellant charge.

Public Conveyance Any railroad car, streetcar, ferry, cab, bus, aircraft, or other vehicle that carries passengers for hire.

Pyrotechnics Any combustible or explosive compositions or manufactured articles designed and prepared for the purpose of producing audible or visible effects. Pyrotechnics are commonly referred to as fireworks.

Quantity-Distance Table A table listing minimum recommended distances from explosive materials stores of various weights to a specific location.

Radio Frequency Energy (**RF**) The energy transferred by electromagnetic wave in the radio frequency spectrum.

Radio Frequency Transmitter An electronic device that radiates radio frequency waves; the device may be fixed (stationary) or mobile.

Railway Any steam, electric, or other railroad or railway that carries passengers for hire.

Raise A vertical or incline opening driven upward from a level to connect with the level above, or to explore the ground for a limited distance above one level. After two levels are connected, the connection may be a winze or a raise, depending upon which level is taken as the point of reference.

Receptor (**Acceptor**) A charge of explosive materials receiving an impulse from an exploding donor charge.

Regulations-Federal, **State**, **Local** Regulations promulgated by federal, state, or local regulatory agencies governing the manufacture, transportation, storage, sale, possession, handling, and use of explosive materials.

Relief The effective distance from a blasthole to the nearest free face.

Resistance The measure of opposition to the flow of electrical current, expressed in ohms.

Rotational Firing Delay blasting system used so that the detonating explosives will successively displace the burden into the void created by previously detonated explosives in holes that fired at an earlier delay period.

Round A set of holes drilled and charged with explosives in any phase of underground work, which are fired instantaneously or with delay detonators.

Safety Fuse A flexible cord containing an internal burning medium by which fire or flame is conveyed at a continuous and uniform rate from the point of ignition to the point of use, usually a fuse detonator.

Safety Standard Suggested precautions relative to the safety practices to be employed in the manufacture, transportation, storage, handling, and use of explosive materials.

Scaled Distance A factor relating similar blast effects from various size charges of the same explosive at various distances. Scaled distance referring to blasting effects is obtained by dividing the distance of concern by a fractional power of the weight of the explosive materials.

Seam A stratum or bed of coal or other mineral.

Secondary Blasting Blasting to reduce the size of boulders resulting from a primary blast.

Seismograph An instrument, useful in monitoring blasting operations, that records ground vibration. Particle velocity, displacement, or acceleration is generally measured and recorded in three mutually perpendicular directions.

Semiconductive Hose A hose used for pneumatic conveying of explosive materials having 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 requirements.

Sensitiveness A measure of an explosive's cartridge-to-cartridge propagating ability under certain test conditions. It is expressed as the distance through air at which a primed half-cartridge (donor) will detonate an unprimed half-cartridge (receptor).

Sensitivity A physical characteristic of an explosive material classifying its ability to be initiated upon receiving an external impulse such as impact, shock, flame, friction, or other influences that can cause explosive decomposition.

Separation Distances Minimum recommended distances from explosive materials accumulations to certain specific locations.

Series Blasting Circuit An electric blasting circuit that provides one continuous path for the current through all caps in the circuit.

Series in Parallel Blasting Circuit An electric blasting circuit in which the ends of two or more series of electric detonators are connected across the firing line directly or through buswire.

Shaft A vertical or inclined excavation in a mine extending downward from the surface or from some interior point as a principal opening through which the mine is exploited. A shaft is provided with a hoisting engine at the top for handling men, rock, and supplies, or it may be used only in connection with pumping or ventilating operations.

Shaped Charge An explosive with a shaped cavity, specifically designed to produce a high velocity cutting or piercing jet of product reaction; usually lined with metal to create a jet of molten liner material.

Shelf Life The length of time of storage during which an explosive material retains adequate performance characteristics.

Shock Wave A transient pressure pulse that propagates at supersonic velocity.

Short-Delay Blasting The practice of detonating blastholes in successive intervals where the time difference between any two successive detonations is measured in milliseconds.

Shot Anchor A device that anchors explosive material charges in the borehole so that the charges will not be blown out by the detonation of other charges.

Shot Firer That qualified person in charge of and responsible for the loading and firing of a blast (same as a “Blaster”).

Shunt The shorting together of the free ends of:

1) electric detonator legwires, or

2) the wire ends of an electric blasting circuit or part thereof-, the name of an electrical shorting device applied to the free ends of electric detonators by the manufacturer.

Signs-Explosive (**Placards**) Signs, called placards, placed on vehicles transporting explosives denoting the character of the cargo, or signs placed near storage areas as a warning to unauthorized personnel.

Silver Chloride Cell A special battery of relatively low current output used in a blasting galvanometer.

Slurry An explosive material containing substantial portions of a liquid, oxidizers, and fuel, plus a thickener.

Small-Arms Ammunition Any cartridge for shotgun, rifle, pistol, revolver, and cartridges for propellant-actuated power devices and industrial guns. Military-type ammunition containing explosive bursting charges or any incendiary, tracer, spotting, or pyrotechnic projectile is excluded from this definition.

Small-Arms Ammunition Primers Small percussion-sensitive explosive charges encased in a cap or capsule and used to ignite propellant powder.

Smoke The airborne suspension of solid particles from the products of detonation or deflagration.

Smokeless Propellant (**Smokeless Powder**) Solid propellant, commonly called smokeless powder in the trade, used in small-arms ammunition, cannon, rockets, propellant-actuated power devices, etc.

Snakehole A borehole drilled in a slightly downward direction from the horizontal into the floor elevation of a quarry face: also, a hole driven under a boulder.

Softwood Douglas fir or other wood of equal bullet resistance and free from loose knots, wind shakes, or similar defects.

Spacing The distance between boreholes. In bench blasting, the distance is measured parallel to the free face and perpendicular to the burden.

Specific Gravity The ratio of the weight of any volume of substance to the weight of an equal volume of pure water.

Springing The practice of enlarging the bottom of a blasthole by the use of a relatively small charge of explosive material; typically used in order that a larger charge of explosive material can be loaded in a subsequent blast in the same borehole.

Squib A firing device that burns with a flash and used for igniting black powder or pellet powder.

Stability The ability of an explosive material to retain chemical and physical properties specified by the manufacturer when exposed to specific environmental conditions over a particular period of time.

Static Electricity Electric charge at rest on a person or object. It is most often produced by the contact and separation of dissimilar insulating materials.

Steady State Velocity The characteristic velocity at which a specific explosive at a given charge diameter will detonate.

Steel General purpose (hot or cold rolled) low-carbon steel, such as specification ASTM A366 or equivalent.

Stemming Inert material placed in a borehole after the explosive; used for the purpose of containing explosive materials or to separate charges of explosive material in the same borehole.

Stope An excavation from which ore has been extracted. The term stoping is commonly applied to the extraction of ore but does not include the ore removed in sinking shafts and in driving levels, drifts, and other development openings.

Storage The safekeeping of explosive materials, usually in specially designed structures called magazines.

Stray Current A flow of electricity outside an insulated conductor system

Subdrilling The practice of drilling boreholes below floor level or working elevation to ensure breakage of rock to working elevation.

Subsonic Less than the speed of sound.

Supersonic Greater than the speed of sound.

Sympathetic Propagation The detonation of an explosive material as the result of receiving an impulse from another detonation through air, earth, or water.

Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents A quantity-distance table from National Fire Protection Association Standard No. 495.

Tachograph A recording device in a truck that indicates on a time basis the running and stopping times of a vehicle.

Tamping The action of compacting the explosive charge or the stemming in a blasthole.

Tamping Bags Cylindrical bags containing stemming material and used in boreholes to confine the explosive material charge.

Tamping Pole A wooden or plastic pole used to compact explosive charges or stemming.

Test Blasting Cap No. 8 See "Institute of Makers of Explosives No. 8 Test Detonator".

Theft-Resistant Construction designed to deter illegal entry into facilities used for the storage of explosive materials.

Toe In bench blasting, the distance from the free face to the blasthole, measured at the floor level of the bench.

Trunkline The line of detonating cord on the ground surface that connects detonating cord downlines.

Tunnel A horizontal or nearly horizontal underground passage that is open to the atmosphere at both ends. The term is loosely applied in many cases to an adit.

Unbarricaded The absence of a natural or artificial barricade around explosive storage areas of facilities.

Unconfined Detonation Velocity The detonation velocity of an explosive material without confinement, for example, a charge fired in the open.

Underwriters Laboratory, Inc. (**UL**) A nationally recognized incorporated testing laboratory qualified and equipped to conduct the necessary tests to determine compliance with appropriate standards and the satisfactory performance of materials or equipment in actual usage.

Volt The unit of electromotive force. It is the difference in potential required to make a current of 1 amp flow through a resistance of 1 ohm.

Volume Strength Same as "Cartridge Strength" or "Bulk Strength".

Warning Signal A visual or audible signal that is used for warning personnel in the vicinity of the blast area of the impending explosion.

Waste Acid Residual or spent acid from a nitration process.

Water Gel An explosive material containing substantial portions of water, oxidizers, and fuel, plus a cross-linking agent.

Water Stemming Bags Water-filled plastic bags with a self-sealing valve classified as a permissible stemming device by the Mine Safety and Health Administration (MSHA).

Watt A unit of electrical power equal to 1 joule/sec.

Weather-Resistant Construction designed to offer reasonable protection against weather.

Weight Strength The energy of an explosive material per unit of weight expressed as a percentage of the energy per unit of weight of a specified explosive standard.

Winze A vertical or inclined opening sunk from a point inside a mine for the purpose of connecting with a lower level and exploring the ground for a limited depth below a level.

Section X: Calculations

Borehole Diameter

Selection of the proper hole diameter is important to obtain maximum fragmentation at minimum cost. For best fragmentation and design control, the rule of thumb is that the borehole diameter in inches should be approximately one tenth of the face height in feet.

$$\mathbf{D} = \frac{\mathbf{H}}{\mathbf{10}}$$

Where

D = borehole diameter (inches)
H = bench height (feet)

Burden

Burden is defined as the distance from a borehole to the nearest free face at the time of detonation.

Burden is a function of charge diameter. The rule of thumb for burden calculation is dependent on the borehole diameter.

Burden Calculation:

$$\mathbf{B} = \frac{\mathbf{25 - 35 \times D_e}}{\mathbf{12}}$$

Where

B = burden (feet)
D_e = explosive column diameter (inches)

For a given rock type, explosive, and blast hole spacing, there is an optimum burden dimension. The optimum burden dimension depends upon a combination of variables, which include the borehole diameter, the borehole depth, spacing between boreholes, the millisecond delay pattern, the explosive used, the rock mass characteristics, and degree of fragmentation and muck pile shape sought.

Spacing

The distance between adjacent blastholes, measured perpendicular to the burden, is defined as the spacing. Spacing calculations are a function of the burden.

$$\mathbf{S = 1.8 \times B}$$

Where

S = spacing (feet)
B = burden (feet)

Spacings that are significantly less than the burden tend to cause early stemming ejection and premature splitting between blastholes. These effects encourage rapid release of gases to the atmosphere, and result in noise and air blast. Conversely, when the spacing is too large, the rock may be inadequately fragmented between holes, leaving an uneven floor. Consequently, burden and spacing decisions are made by careful analysis of geology, explosives, conditions at the site, and experience.

Bench Height

To maintain a successful blast design, it is important that the burden and bench height are reasonably compatible. However, the face height is often determined by other factors; the rule of thumb covers only the recommended minimum.

$$\mathbf{H = 2 \times B}$$

Where

H = bench height (feet)
B = burden (feet)

Stemming

Stemming is an inert substance, loaded on top of the explosive charge to give confinement of the explosion gases. The amount of stemming required may be calculated from the burden dimension using the following formula:

$$\mathbf{T = 0.7 - 1.3 \times B}$$

Where

T = stemming (feet)
B = burden (feet)

Explosive Column Weight

The explosive column weight per borehole is a function of the density of the explosive, its diameter, and the explosive column length. The explosive column weight can be calculated by using the following formula:

$$\mathbf{E_w = 0.34 \times D_e{}^2 \times \rho \times E_{cl}}$$

Where

E_w = explosives column weight (pounds)
D_e = diameter of explosive column (inches)
ρ = density of explosives (grams per cubic centimeter)
0.34 = coefficient of determination
E_{cl} = explosives column length (feet)

For example, given an explosive column diameter of 6.25 in. and 50 ft. in length and ANFO at a density of 0.81 g/cc, the charge weight is calculated by:

$$E_w = 0.34 \times D_e{}^2 \times \rho \times E_{cl}$$
$$E_w = (0.34)\ (6.25)^2\ (0.81)\ (50)$$
$$E_w = (0.34)\ (39.06)\ (0.81)\ (50)$$
$$E_w = 537.9 \text{ lb.}$$

Powder Factor

Powder factor is the mathematical relationship between the weight of explosives and a given quantity of rock. The explosive weight is normally expressed in pounds and the rock quantity is normally expressed in cubic yards or tons. There are four methods of expressing powder factor.

1. Pounds of explosive per cubic yard of rock.
2. Pounds of explosive per ton of rock.
3. Cubic yards of rock per pound of explosive.
4. Tons of rock per pound of explosive.

Cubic Yards

To calculate cubic yards per borehole, the following formula is used:

$$\mathbf{V} = \frac{\mathbf{B} \times \mathbf{S} \times \mathbf{H}}{\mathbf{27}}$$

Where

B = burden dimension (feet)
S = spacing dimension (feet)
H = Bench height (feet)
V = rock volume (cubic yards)

For example, given a burden of 10 ft., a spacing of 15 ft., a bench height of 50 ft., the calculated rock volume is as follows:

$$V = \frac{B \times S \times H}{27}$$

$$V = \frac{10 \times 15 \times 50}{27}$$

$$V = \frac{7{,}500}{27}$$

$$V = 277.77 \text{ cu yd per borehole}$$

Tons

To calculate the tons of rock per borehole, the following formula is used:

$$\mathbf{W = \frac{B \times S \times H}{27} \times \frac{27\rho}{2,000}}$$

Where

B = burden dimension (feet)
S = spacing dimension (feet)
H = bench height (feet)
ρ = rock density (pounds per cubic foot)
W = rock tonnage

For example, given a burden of 10 ft., a spacing of 15 ft., a bench height of 50 ft., and a rock density of 168 lb./cu ft, the calculation for the total rock weight per borehole is as follows:

$$W = \frac{B \times S \times H}{27} \times \frac{27\rho}{2{,}000}$$

$$W = \frac{B \times S \times L}{27} \times \frac{(27)(168)}{2{,}000}$$

$$W = 277.77 \times \frac{4{,}536}{2{,}000}$$

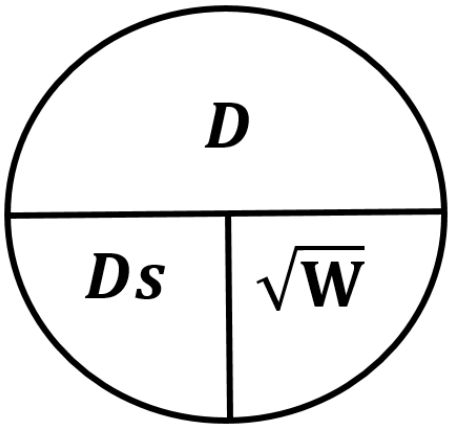
$$W = 277.77 \text{ cu yd} \times 2.268 \text{ tons per cubic yards}$$

$$W = 629.98 \text{ tons per hole}$$

Powder factor has generally been equated with the amount of explosive energy required to fragment and displace rock. A powder factor of 0.75-lb/cu yd would be expected to exhibit relatively less fragmentation and displacement than a powder factor of 1.0 lb./cu yd.

Scaled Distance

$$\mathbf{Ds} = \frac{\mathbf{D}}{\sqrt{\mathbf{W}}}$$



Where:

W = Explosives Weight Per Delay Period
D = Actual Distance
Ds = Scaled Distance

We shall designate the W, D, and Ds relationships shown in the above chart as follows:

Equation #1:

$$\mathbf{W} = \left(\frac{\mathbf{D}}{\mathbf{Ds}}\right)^{\mathbf{2}}$$

Equation #2:

$$\sqrt{\mathbf{W}} = \frac{\mathbf{D}}{\mathbf{Ds}}$$

Equation #3:

$$\mathbf{Ds} = \frac{\mathbf{D}}{\sqrt{\mathbf{W}}}$$

Equation #4:

$$\mathbf{D} = \mathbf{Ds}\sqrt{\mathbf{W}}$$

The four equations cited above are very useful, in fact necessary, tools for the licensed blaster. Here are a few examples of how they work.

(a) A blast is to be fired at a distance (D) of 1,000 feet from a residence, and it is desired that the Scaled Distance, (Ds) value be not less than 50. To find the weight (W) of explosive per delay period, which will give a Ds value of 50, substitute the values for D and Ds in Equation 1 or Equation 2. It will be found that 400 pounds of explosives may be used per delay period.

(b) Given a blast involving 400 pounds (W) of explosives per delay period to be fired at a distance (D) of 1,000 feet from an office building. Commonwealth of PA regulations require seismograph readings on any blast having a Scaled Distance value below 50. Will the Ds value be 50 or greater and so make seismograph

readings unnecessary? To arrive at the answer to this question, substitute the eight and distance values in Equation 3. A Scaled Distance of 50 will be found. Thus, seismograph readings will not be required by Regulations for this blast. Had the distance (D) been 800 feet the Ds value would have been 40 and seismograph recordings would have been required.

(c) A 52 – hole blast is planned in which each hole will contain 181 pounds of explosives, and it is to be wired four holes (724 lbs. of explosives) per delay period. This will require 13 delay periods: 0, 2-13. There is a residence 1,000 feet distant. It is desired to hold the Scaled Distance value above 50. To verify the accuracy of planning, substitute the above W and D values in Equation 3. Calculation shows a Ds value of 37, far below the desired value of 50.

Wiring the blast at two holes per delay period, that is, 362 pounds for explosives per period, should resolve the problem, although twice as many delay periods will be required. When the W value is used in Equation 3, one finds an acceptable Ds value of 53. Seismograph readings will not be required.

(d) A certain blasting operation, located 1263 feet from a residence, consists of 60 holes, each containing 242 pounds of explosives. The blast is wired two holes (484 lbs.) per delay period. Using Equation 3, it will be found that the Ds value is 58.

Desiring to maintain a Ds value of 58 in another blast only 900 feet from the same residence, what will be the maximum quantity of explosives permitted per delay period? Substituting the D and Ds values in Equation 1 or Equation 2, one finds a maxim weight of 240 pounds per delay period.

Since the Ds value above is greater than 50, what would be the closest distance to the house that blasting could be done and yet maintain a Ds value of 50, using 240 pounds (W) of explosive per delay period? To find the answer to this problem, substitute a Ds value of 50 and the W value in Equation 4. By this procedure, one finds the closest distance (D) to be 775 feet.

1. A home is 900′ away from a Blast; you have 120 lbs. per delay. What is the Scaled Distance?

$$Ds = \frac{D}{\sqrt{W}}$$

$$Ds = \frac{900'}{\sqrt{120}\text{lbs.}} \qquad \sqrt{120} = 10.95$$

$$Ds = \frac{900'}{10.95}$$

$$\mathbf{Ds = 82.19}$$

2. You have 400 lbs. per delay, and you want to have a Scaled Distance of 90. How do you do this? What is the distance to the home?

$$D = Ds\sqrt{W}$$

$$D = 90(\sqrt{400}) \qquad \sqrt{400} = 20$$

$$D = 90(20)$$

$$\mathbf{D = 1800\ ft.}$$

3. You have a home 1500 ft. away. You want a Scaled Distance of 90. What are the pounds per delay to keep a Scaled Distance of 90?

$$W = \left(\frac{D}{Ds}\right)^2$$

$$W = \left(\frac{1500'}{90}\right)^2$$

$$W = (16.66)^2$$

$$\mathbf{W = 277.56\ Maximum\ Pounds\ per\ Delay}$$

4. A home is 1100 ft. away from a Blast; you have 140 lbs. per delay. What is the Scaled Distance?

$$Ds = \frac{D}{\sqrt{W}}$$

$$Ds = \frac{1100'}{\sqrt{140}\text{lbs.}} \qquad \sqrt{140} = 11.83$$

$$Ds = \frac{1100'}{11.83}$$

$$\mathbf{Ds = 92.98}$$

5. You have a 500-pound per delay. You want a Scaled Distance of 90. What can be the closest dwelling to the Blast?

$D = Ds\sqrt{W}$

$D = 90(\sqrt{500})$ $\qquad \sqrt{500} = 222.36$

$D = 90(22.36)$

$\mathbf{D = 2012\ ft.}$

6. You have a home 1300 ft. away. You want a Scaled Distance of 95. What are the pounds per delay?

$W = \left(\frac{D}{Ds}\right)^2$

$W = \left(\frac{1300'}{95}\right)^2$

$W = (13.68)^2$

$\mathbf{W = 187.25\ Maximum\ Pounds\ per\ Delay}$

Ohms Law

Electric current initiates electric blasting caps. Too little current will not provide enough energy to initiate a cap, while too much current can cause arcing. The blaster can calculate the amount of current using OHMS LAW. OHMS LAW states: VOLTAGE (in volts) is equal to the current (in amperes) MULTIPLIED BY THE RESISTANCE (in ohms), or;

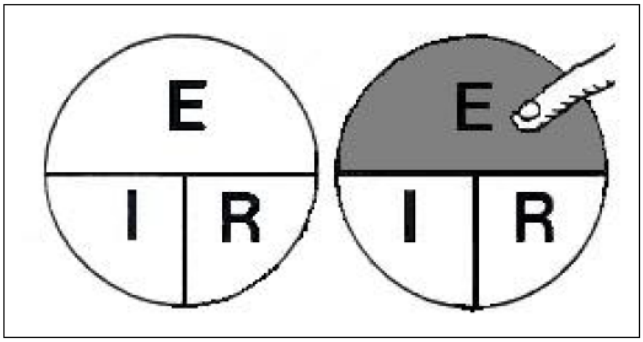
$$\mathbf{E = I \times R}$$

Where:

E is the voltage (in volts) of the power source,
I is the current (in amperes) flowing in the circuit, and
R is the resistance (in ohms) of the circuit.

Using basic algebra, OHMS LAW can be rearranged as:

$$\mathbf{I = \frac{E}{R}} \quad \text{or} \quad \mathbf{R = \frac{E}{I}}$$



NOTE: Put your finger over the unknown that you want to find. For example, cover E (voltage), and I (current) times R (resistance) remains. Similarly, cover R (resistance), and E divided by I (current) remains.

Blasting Circuitry Design and Analysis

Capacitor discharge blasting machines, when used properly, are the most dependable means of firing electric detonators. Power lines can also be used to fire electric detonators. With any power source it is essential that sufficient energy be provided to initiate all detonators in a few milliseconds.

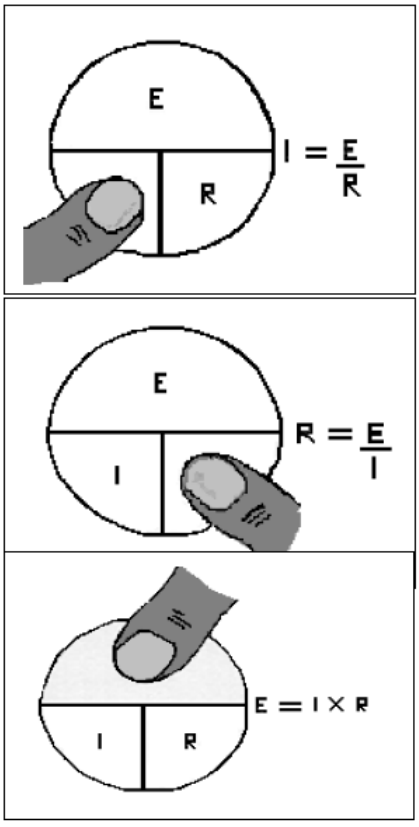
When firing from power lines, the calculations required to provide sufficient current to every detonator in the circuit are straight forward by applying the basic principles of Ohm's and Kirchhoff's Laws.

The problem is more complex with capacitor discharge machines. The discharge current from a capacity-type machine decays exponentially from a high initial value to near zero within a short period of time. The concept of steady minimum firing currents, as demanded for AC and DC power-line firing, cannot be used. Ohm's and Kirchhoff's Laws must be supplemented by transient circuit calculations to determine the effective firing current required from a capacitor discharge blasting machine must be considerably in excess of the minimum DC firing current required for a circuit because of the rapid current decay.

To have a thorough understanding of blasting circuit design, it is necessary to apply the basic principles of Ohm's and Kirchhoff's Laws.

Ohm's Law – The current flowing in an electrical circuit is equal to the applied voltage divided by the resistance.

$$\mathbf{I = \frac{E}{R}}$$



Where:

I = Current in amperes
E = Applied voltage in volts
R = Resistance in Ohms

This may also be expressed as:

$$\mathbf{R = \frac{E}{I}}$$

or:

$$\mathbf{E = I \times R}$$

Kirchhoff's Law

1. The algebraic sum of all applied voltages and potential differences in any closed circuit is equal to zero.

$$\mathbf{V_0 = I_1R_1 - I_2R_2 - I_3R_3 - \ldots I_MR_M - 0}$$

2. The algebraic sum of all currents flowing to any point in a circuit is equal to zero.

$$\mathbf{I_0 - I_1 - I_2 - \ldots I_M - 0}$$

Resistance of a Series Circuit (ohms)

$$\mathbf{R = R_1 + R_2 + R_3 + 0}$$

Resistance of a Parallel Circuit (ohms)

$$\frac{\mathbf{1}}{\boldsymbol{R}} + \frac{\mathbf{1}}{\boldsymbol{R_1}} + \frac{\mathbf{1}}{\boldsymbol{R_2}} + \frac{\mathbf{1}\boldsymbol{V}}{\boldsymbol{R_3}} \cdots \frac{\mathbf{1}}{\boldsymbol{R_M}}$$

Planning the Series Firing Circuit

Before loading a blast, you must determine how much explosive will be needed. You should also determine what type of wiring circuit will be used, and then make the calculations that show you the basting machine will supply adequate current to fire the blast. Of the three wiring circuits used in electrical blasting, the series circuit is the simplest and most commonly used. In planning the series circuit, follow these steps:

1. Determine the *TOTAL RESISTANCE* (ohms) of the circuit.
2. Calculate the *CURRENT* (amperes) that the power source will deliver the total resistance.
3. Compare the calculated current with the recommended minimum firing current requirements for a series circuit.

Finding Total Resistance (R_1)

For a series circuit, the total resistance (R_T) is simply the sum of all the individual resistances in the circuit. This will include the detonators (R_1), connecting wire (R_2), and firing line (R_3).

The formula is:

$$\mathbf{R_T = R_1 + R_2 + R_3}$$

EXAMPLE:

Consider a series circuit with 20 Millidet delay electric blasting detonators having 40 ft. long copper leg wires, 200 lineal ft. of #20 B&S copper connecting wire and a 1,200 ft. long #14 B&S copper firing line. For the resistance values, ***see Table I and II***.

Resistance of one Millidet detonator with 40 ft. copper leg wire = 2.72 ohms
Resistance of 20 Millidet detonators = 20 x 2.272 ohms = **54 ohms**

Resistance of #20 B&S connecting wire = 10.15 ohms per 1,000 ft.
Resistance of 200 lineal ft. – $\frac{200 \text{ x } 10.15 \text{ ohms}}{1{,}000} \times 2^{*} =$ **4 ohms**

Resistance of #14 B&S firing line = 2.52 ohms per 1,000 ft.
Resistance of 1,200 lineal ft. – $\frac{1{,}200 \text{ x } 2.52}{1{,}000} \times 2^{*} =$ **6 ohms**

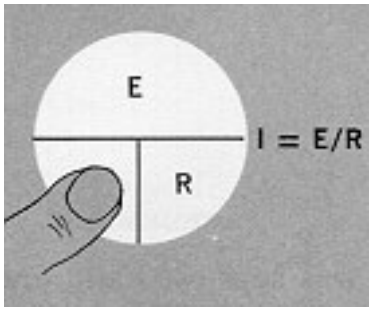
Total resistance

$$R_T = R_1 + R_2 + R_3$$
$$R_T = 54 \text{ ohms} + 4 \text{ ohms} + 6 \text{ ohms}$$
$$R_T = 64 \text{ ohms}$$

* Multiply by 2 because the firing cable and connecting wire have 2 wires.

Calculating Current (I)

Use Ohms Law to calculate the current for the circuit described under total resistance.



Example:

Consider a condenser-discharge blasting machine with a 225-volt output. Now, applying Ohms Law:

$$\text{Current (I)} = \frac{225 \text{ volts(E)}}{64 \text{ ohms (R)}}$$

I = 35 amperes

Compare:

The minimum recommended firing current (***Table III***) required for a series circuit is 1.5 amps DC or 3 amps AC. In the examples given, the answer for the calculated current is 3.5 amps DC. This is greater than 1.5, the minimum, so the amperage in this case is adequate. If the current is not adequate, here are some alternatives:

1. Use a blasting machine that will deliver the needed current, or

2. Use a different wiring circuit. A series-in-parallel circuit can reduce the total resistance without the need for reducing the number of holes (detonators).

Leg Wire Length	Instadet*	Millidet* and Superdet*	Instadet*	Millidet, Superdet, and Coaldet*
4	1.41	1.86	2.25	2.7
6	1.49	1.94	2.75	3.2
8	1.58	2.03	3.25	3.7
10	1.66	2.11	3.75	4.2
12	1.74	2.19	4.25	4.7
14	1.82	2.27	4.75	5.2
16	1.9	2.35	5.25	5.7
20	2.06	2.51	6.25	6.7
24	2.22	2.68	7.25	7
No 12 Copper Wire				
30	2.02	2.47		
40	2.27	2.72		
50	2.53	2.98		
60	2.79	3.21		
70	3.04	3.49		
80	3.3	3.75		
100	3.81	4.26		
120	4.33	4.77		
150	5.09	5.54		
200	6.37	6.82		
250	7.65	8.1		
300	8.93	9.38		
350	10.16	10.66		
400	11.49	11.94		

* **CAUTION:** These resistance values apply only to detonators manufactured by Hercules Incorporated. Do not use these values with detonators made by other manufacturers.

B&S Gauge	Ohms per 1,000 ft.
No. 8	0.628
No. 10	0.999
No. 12	1.59
No. 14	2.52
No. 16	4.02
No. 18	6.38
No. 20	10.15
No. 22	16.14

CAP FACTS

Table III: RECOMMENDED MINIMUM FIRING CURRENT	
Series Wiring	1.5 amps DC or 3 amps AC
Parallel Wiring	1 amp AC or DC per Detonator
Series-In-Parallel Wiring	2 amps AC or DC per Series

Maximum recommended firing current is not to exceed 10 amperes continuous current through any detonator.

Total Resistance of a Series Circuit

The total resistance of a series circuit is equal to the resistance of each detonator multiplied by the number of detonators plus the resistance of the lead line and connecting wire.

Example 1

Assume a series circuit of 25 40-foot copper wire delay detonators with a 600-foot 14-gauge copper lead line:

Step 1 – Determine the resistance of the detonator circuit.
Consult ***Table 16.1*** for the resistance of a 40-foot copper wire Delay. This is 2.06 ohms/detonator.

Resistance of Detonator Circuit = No. of Detonators x Resistance/detonator

$$\mathbf{R = 25 \times 2.06}$$

$$\mathbf{R = 51.5\ ohms}$$

Step 2 – Determine resistance of the lead line:
Consult ***Table 16.2*** for the resistance of 14-gauge copper wire.
This is 2.525 ohms/1000 feet. A lead line that is 600 feet long has 1200 feet of wire.

(600 feet x 2 conductors = 1200 feet)

Resistance of Lead Line = Length of Wire x Resistance/1000 ft.

$$\mathbf{R = 1200 \times \frac{2.525}{1000}}$$

$$\mathbf{R = 3.03\ ohm}$$

Step 3 – Determine total resistance of the blasting circuit.

Total Resistance = Detonator Circuit Resistance + Lead Line Resistance

$$\mathbf{R = 51.5 + 3.03}$$

$$\mathbf{R = 54.53\ ohms}$$

On a "swing needle" type tester the needle on the instrument must be adjusted to "zero" when it is shorted between terminals. Digital instruments should show "zero" on the readout. The terminals are then connected to the lead line. The instrument should then read approximately 54 to 55 ohms. Too low a reading indicates some detonators are not connected into the circuit. Too high a reading indicates too many detonators in the series or loose or dirty connections.

Series Circuit

1. A series circuit provides a single path for the current through all detonators.

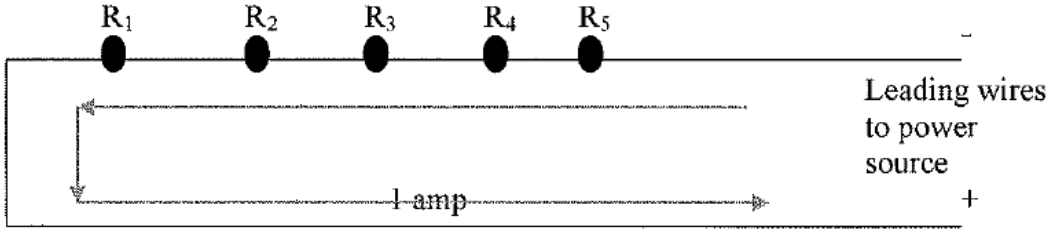
2. The same current flows through each part of a series circuit.

3. The total resistance of a series circuit is equal to the sum of individual resistances.

4. Voltage applied to a series circuit is equal to the sum of the individual voltage drops.

5. The voltage drop across a resistor in a series circuit is directly proportional to the size of the resistor.

6. If the circuit is broken at any point, no current will flow.



- In a series circuit, the amperage at any point in the circuit is the same. This will help in calculating circuit values using Ohm's Law.

- In a series circuit you will need to calculate the total resistance of the circuit in order to figure out the amperage. This is done by adding up the individual values of each component in series.

- In this example we have three resistors. To calculate the total resistance, we use the formula:

$$\mathbf{R_T = R_1 + R_2 + R_3 + R_4 + R_5}$$

Parallel Circuit

A parallel circuit cannot be tested with the instruments usually available in field operation as the total resistance of the circuit is so small it will read close to zero resistance on the instrument and will not indicate a meaningful reading. This is true whether using a "swing needle" or digital meter.

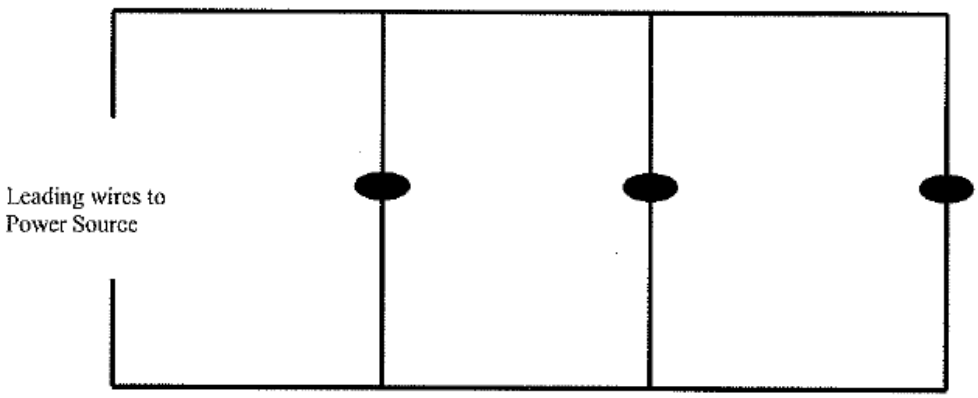
A parallel circuit has certain characteristics and basic rules summarized here:

1. A parallel circuit has two or more paths for current to flow through.
2. Voltage is the same across each component of the parallel circuit.
3. The sum of the currents through each path is equal to the total current that flows from the source.

You can find total resistance in a parallel circuit with the following formula:

$$\mathbf{1/R_t = 1/R_1 + 1/R_2 + 1/R_3 + R_t = R\,(t)otal}$$

If one of the parallel paths is broken, current will continue to flow in all the other paths.



Total Resistance of a Series-in-Parallel

In a series-in-parallel circuit each series should be electrically balanced with each series reading the same number of ohms. Usually, an equal number of detonators in each series will produce a balanced series.

In a balanced series-in-parallel circuit, the resistance of one series divided by number of series will equal the total resistance of the circuit.

Example 2

Assume a blast of 300 50-foot copper wire MS delays connected in six series with 50 detonators-per-series and a 700-foot 14-gauge copper wire lead line.

Step 1 – Determine the resistance of a single series. Resistance of one series = No. of Detonators x Resistance of each. Consult ***Table 16.1*** for detonator and wire resistance.

$$R = 50 \times 2.32$$
$$\mathbf{R = 116\ ohms}$$

Step 2 – Determine the resistance as each series is connected to the lead line or bus wire:

$$\mathbf{Resistance} = \frac{\mathbf{Resistance/Series}}{\mathbf{No.\ of\ Series}}$$
$$\mathbf{One\ Series\ Resistance} = \frac{\mathbf{116.0}}{\mathbf{1}}$$
$$\mathbf{Two\ Series\ Resistance} = \frac{\mathbf{116.0}}{\mathbf{2}}$$
$$\mathbf{Three\ Series\ Resistance} = \frac{\mathbf{116.0}}{\mathbf{3}}$$

Series-in-Parallel

The series-in-parallel circuit is the most common type of circuit used in blasting. The simplest series-in-parallel circuit is made by dividing a single series into two series as shown in ***Figure 16.6***. As shown, each of the two rows of electric detonators is connected in a straight series. The two free ends from each series are connected together and these are connected to the lead line.

The main advantage of the series-in-parallel circuit is the large number of detonators, which can be fired from a blasting machine without a large input voltage requirement. A series-in-parallel hookup with five balanced series is shown in ***Figure 16.7***.

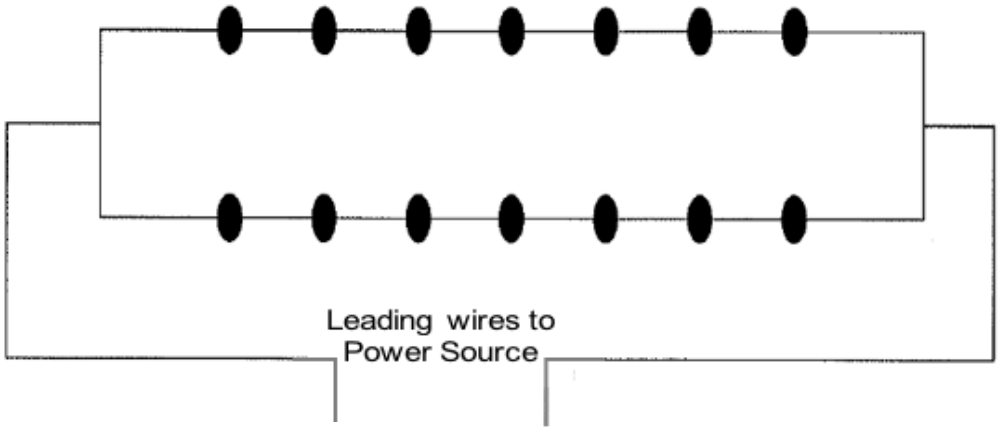


Figure 16.6 – Simplest series-in-parallel circuit is made by dividing a single series into two series. The two free ends from each series are then connected to the lead line.

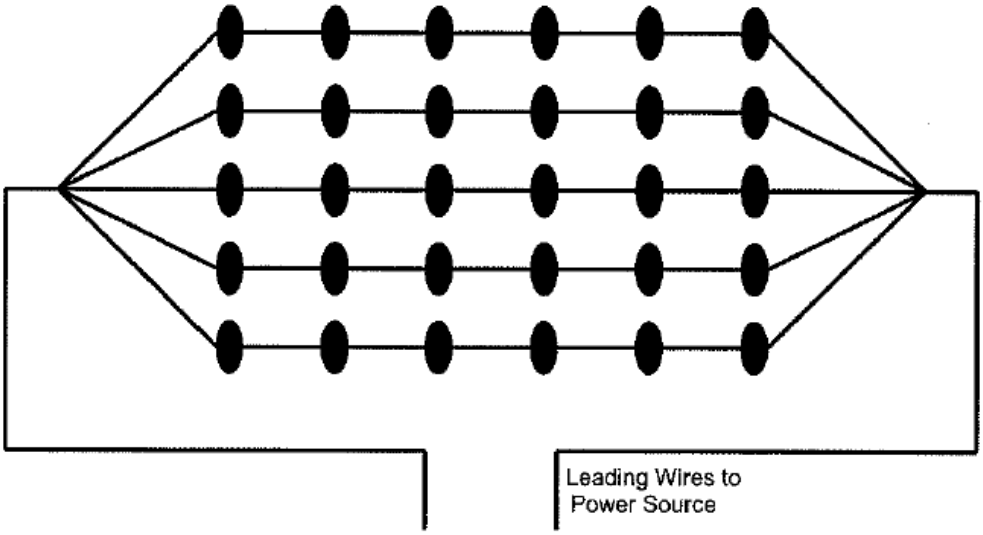
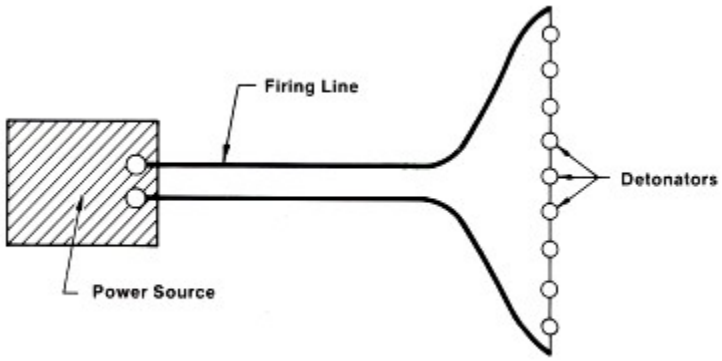
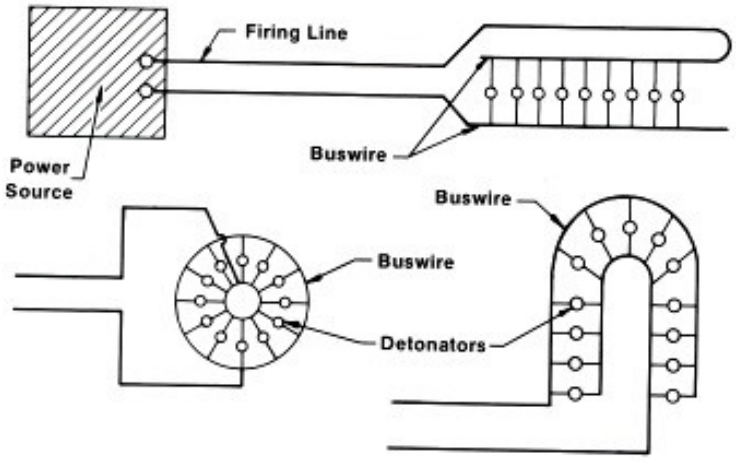


Figure 16.7 – Main advantage of the series-in-parallel is the large number of detonators that can be fired from the blasting machine without a large input voltage requirement.

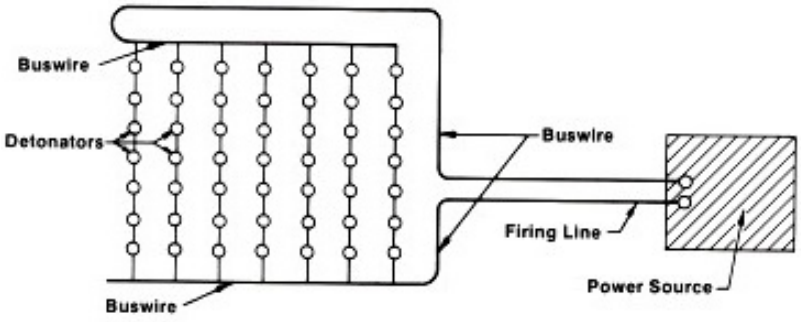
Single-Series Electric Blasting Circuit



Parallel Electric Blasting Circuit



Parallel Series Electric Circuit



Electric Firing Techniques

Electric blasting, with such refinements as delay detonators and electronic timers, has made possible the safe firing of a large number of charges in a predesigned sequence from a remote, safe location with precise control over the time of firing. The remarkable safety record compiled by explosives consumers is the result of knowledge applied with care.

Successful electrical blasting depends on four general principles: (1) proper selection and layout of the blasting circuit; (2) an adequate energy source compatible with the type of blasting circuit selected; (3) recognition and elimination of all electrical hazards; and (4) circuit balancing, good electrical connections, and careful circuit testing.

The selection of the circuit will depend on the number of detonators to be fired and type of operation. In general, a simple series circuit is used on small blasts consisting of less than 50 electric detonators. A series-in-parallel circuit is used where a large number of detonators are involved.

In almost every application, capacitor discharge blasting machines offer the safest, most cost-dependable, and economical source of electrical energy for blasting.

Elimination of electrical hazards must be the first consideration before starting to load any blast.

Lack of attention to details is the most frequent cause of electrical misfires resulting in fatal or serious injury and costly property damage. The electrical connections must be tight, clean, and insulated from the ground. Care must be taken to avoid abrading or stripping the leg wires either in the hole or on the surface. Lead lines should be inspected and tested prior to every blast.

The resistance of all circuits should be calculated, and a Blaster's Multimeter or Blasting Ohmmeter should be used to verify the calculations. No attempt should be made to fire the blast until the theoretical calculations and test readings are the same.

In brief, extreme care in wiring and testing the circuit is absolutely necessary to avoid misfires.

Current Requirements

Successful simultaneous initiation of a large number of electric detonators requires delivery of sufficient current to all devices within a few milliseconds. The time required to heat the bridgewire in an electric detonator or to a temperature that will cause burning of the ignition charge is a function of the current intensity.

Although manufacturer's specifications may vary, the bridgewire in domestic commercial detonators is approximately 0.5 millimeters in diameter and requires 1 to 1.5 amperes for reliable initiation. The bridgewire heats up very quickly, but it rapidly transfers heat to the bridge posts and ignition mix. As a result, energy delivered over a time interval of more than 10 milliseconds is not as efficient in heating the bridgewire as the same amount of energy delivered in a few milliseconds.

The importance of delivering sufficient current to all detonators in the circuit within a few milliseconds cannot be overemphasized. At marginal low current levels, slight differences from one device to another can result in large variations in initiation times. In series circuits this can result in one detonator functioning prior to initiation of others in the circuit. This fast firing of one detonator cuts off the flow of current before all others have been initiated and results in failure of one or more detonators.

The internal construction of electric detonators manufactured by different companies varies considerably. As a result, they are not compatible in the same blasting circuit. Therefore, electric detonators of different manufacturers must never be used in the same blast. Such a practice is almost certain to result in dangerous misfires. Further, in the U.S., it is in direct violation of MSHA regulation 30 CFR 56/57.6400.

Basic Safety Requirements

In any blasting operation the blasting machine, or blasting switch, should be directly under the control of the blaster in charge. It should be kept locked while not in use with the key in the blaster's possession.

The lead wires should never be laid out until the blast circuit is completely wired and all unnecessary personnel have been removed to a safe location. After the lead line is laid out, it should be checked electrically with a Blaster's Multimeter for continuity of circuit. It should also be visually inspected for cuts and serious abrasions in the insulation. The end of the lead line must be shunted before the other end of the line is connected to the blasting circuit. After the final connections are completed, the resistance of the entire circuit should be tested with a Blaster's Multimeter or a Blasting Ohmmeter (Blasting Galvanometer). The calculated resistance of the entire circuit must always agree with the readings on the instrument or no attempt should be made to fire the blast. If proper readings are not obtained, reshunt the lead line before returning to the blast area to locate and correct the source of trouble. Do not allow the bare ends of the circuit or the lead line to come in contact with the ground or with any metallic object.

When the instrument readings confirm the calculated resistance, the blasting machine, or blasting switch, can be unlocked and the lead lines can be connected for firing.

After the blast, the blasting machine, or blasting switch, should be locked before returning to the blast area. Never leave a blasting machine or blasting switch unguarded.

Lead Lines

Lead lines or firing lines are an essential part of the blasting circuit and must be inspected, tested, and kept in good repair to ensure a successful blast.

Well-insulated, solid-core copper wire or 10-gauge to 14-gauge is recommended for series and series-in-parallel circuits of normal size. Where the basting line is soled on a reel after every blast, stranded wire should never be used because individual strands may break due to flexing. This results in a reduced load-carrying capacity that is not readily detectable with the instruments normally available in the field.

The lead line should be tested with a Blaster's Multimeter for continuity of circuit before every blast. It should be replaced when there is any evidence of physical damage to the insulation.

Where lead lines are permanently installed, the lines should be tested under load by an electrician. This test should be carried out on a regular schedule.

Connecting Wires

Connecting wire is usually 16-gauge to 20-gauge, plastic-insulated copper wire used to connect between holes or to connect individual series to the lead line. They are always subject to damage by the blast and should be considered expendable. Never reuse connecting wire.

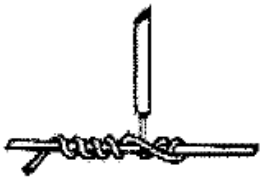
Bus Wire

Bus wire is usually 10, 12, or 14-gauge, solid-core uninsulated copper wire used in connecting parallel circuits in tunnel and shaft rounds. Aluminum bus wire is not recommended because oxidation of the aluminum can result in high resistance connections.

Splices

The reliability of every circuit is dependent on the number and quality of the wire splices in that circuit. Their importance is as significant as any other factor in good blasting practice.

The twisted loop shown is recommended for joining light gauge wires of similar size (legwire to legwire or connecting wire). It is easy and quick to make, yet strong and reliable. It is also a highly visible splice that is easy to disassemble if a circuit has to be taken apart for any reason.



When joining lighter gauge legwires or connecting wire to heavier gauge firing line or buswire, the lighter gauge wire is wrapped around the heavier gauge wire as shown. These splices are easy to make and provide a strong and reliable connection.

To prevent current leakage or the shorting out of two wires, the bare wire at the splices should be insulated with electrical tape. If insulating tape is not available, support the splices in the air by propping up the wire on boxes or dry cardboard and staggering their locations so that they cannot accidentally short out. The need to make a splice stronger and keep the bare wire connections from pulling apart can be accomplished by various means. One method is to join the insulated portion of the wires about 4 in. back from the splice by tying or twisting them together. This secondary connection will then absorb strain induced into the wire and prevent separation of the splices. It is now easier to position the bare wire splice so that it is off the ground, hence reducing the chance of current leakage.

Extraneous Electricity

Sources of hazardous extraneous electricity include: (1) Lightning discharges to ground from electrical storms; (2) Stray ground currents from poorly insulated and improperly grounded electrical equipment; (3) Radio Frequency (RF) energy from transmitters; (4) Induced currents, present in alternating electromagnetic fields, such as those commonly found near high-voltage transmission lines; (5) Static electricity generated by wind-driven dust and snow storms, by moving conveyor belts, and by the pneumatic conveying of ANFO; (6) Galvanic currents generated by dissimilar metals touching or separated by a conductive material.

The accepted "safe" level of extraneous electricity for electrical blasting is derived from the current required to detonate the most sensitive commercial electric detonators plus a safety factor. The minimum firing current for commercial electric detonators presently manufactured in the United States is approximately 0.25 amperes (250 milliamperes). The Institute of Makers of Explosives (IME) has established the maximum "safe" current permitted to flow through an electric detonator without hazard of initiation as one-fifth of the minimum firing current, or 0.05 amperes (50 milliamperes). Operators using electric detonators must be alerted to the measure of extraneous current and if a source is suspected, should measure for extraneous currents in the area of the blast site at frequent intervals to ensure that all extraneous currents are at a safe level.

When extraneous currents exceed 0.05 amperes (50 milliamperes), the source of the current must be traced and eliminated before electric detonators can be safely used. If the source of the current cannot be traced and eliminated, a Nonelectric initiating system must be utilized. It must be remembered however that high voltages such as lightning can potentially initiate even Nonelectric initiating devices. Extremely high static levels also can be reached by the pneumatic loading of ANFO.

Electrical Hazards to Blasting

Electrical Energy	Source	Products Affected	Safety Measures	Shunt Protection
Lightning (DC)	Atmosphere	Direct hit, all Products, Nearby, Electric Detonators	Detect potential Lightning, Clear & guard	No help, keep shunted but don't assume protected
Stray Current (AS and DC)	Leaking power Source, utilities & Machinery	Electric Detonators	Stray Current Test, Place wires safely	Yes, keep detonators & circuits shunted
Radio Frequency (AC)	RF Transmitters	Electric Detonators in use, & in original package	Follow IME Safety Library Publication No. 20	No Help
Induced Current (AC)	AC Power Lines	Electric Detonators	Keep shunted & avoid high voltage transmission lines	Some protection, keep shunted until blast
Static (DC)	Pneumatic loading of ANFO, dust & snow storms, belts	Electric and Nonelectric detonators, cap, and fuse	Do not use in dust or snowstorms. Use grounded semi-conductive hose	Some protection, keep shunted until blast
Galvanic Current (DC)	Dissimilar metals in ionic solutions	Electric Detonators	Keep shunted until blast	Yes

Mechanical Static

The following recommended precautions should be taken for cases in which static electricity is generated mechanically.

1) All parts of moving equipment in the vicinity of blasting operations should be electrically connected at a common point and this common point should be connected to a good earth ground rod.

2) All conductors and metal parts of the system should be kept away from electric detonators and blasting circuit wires.

3) The ground wires and earth ground rod for the system should be kept away from rails, wiring, and piping that might conduct stray currents from these sources to the blasting site.

4) All moving equipment in the immediate area that might be capable of generating static electricity should be shut down while the blasting circuits are being connected and until the blast has been fired.

Electrostatic Discharges (Lightning)

Lightning undoubtedly represents the greatest single hazard to blasting because of its erratic nature and high energy. A lightning strike can have over a million volt potential and discharge currents of over 100,000 amperes. If lightning strikes a blast area, all or part of the blast probably will be detonated. Because of the extremely high currents involved, even distant lightning strikes can be hazardous to electric initiating systems in both underground and surface operations.

Therefore, in the interest of safety, blasting on land, on water, and in some underground operations should be suspended, and all personnel should be evacuated to a safe distance from the blast area whenever lightning storms are in the vicinity.

The danger from lightning is considerably increased if there is a transmission line, water line, compressed air line, fence, stream, or other conductor available to carry the current between the storm and the shot location.

Where permanent firing lines and electric blasting caps are used, typically in underground operations, a 15-foot (4.6m) air gap should be provided to act as a "lightning break" between the blasting system and the supply power circuit. This air gap should be bridged by a flexible jumper cable just prior to firing the blast.

Blasting operations must constantly be alert to atmospheric conditions that indicate the possibility of lightning and be prepared to temporally abandon all explosive loading activities until the threat passes. Lightning storms tend to be somewhat seasonal and often occur during the late afternoon and early evening hours. Scheduling blasting to avoid these hours is a commonsense option.

A commonsense rule is to evacuate the shot area when thunderstorm activity comes within 5 miles of the shot site. Regulations require that electric blasting circuits be shunted at all times unless being tested or tied in. In wiring situations where some series are complete and shunted and some are incomplete and in the process of being wired and the approach of thunderstorm activity is noted, common sense dictates that the shot wiring activity be abandoned and the area cleared and guarded.

Radio Frequency (RF)

All radio transmitters send out energy in the form of electromagnetic waves; leg wires and lead lines can act as antennae, converting energy from these waves into electrical energy in the wire.

The amount of electrical energy produced in the wires depends upon: the output power of wattage of the transmitter; the frequency of the radio waves; the distance from the source of the RF energy to the blast site; and the configuration of the wires which act as the antenna.

The hazard exists regardless of whether the wires are shunted (short circuited) or left unshunted (open circuit).

Recommended Distances for Blasting

50,000 watt AM radio (540 – 16500 KHz)..... 2900 ft (880 m)
100,000 watt FM radio (88 – 108 MHz)..... 2600 ft (790 m)
300,000 watt VHFTV (Channels 7-13) ..... 2500 ft (760 m)
1,000,000 watt UHFTV (Channels 14-83) ..... 2000 ft (610 m)
100 watt mobile police radio (35-44 MHz) ..... 260 ft (80 m)
5 watt Citizen's Band radio (26.96 – 27.41 MHz)..... 5 ft (1.5 m)

Precaution

Keep mobile transmitters away from the area.

Posting adequate signs to remind operators to turn off radio transmitters.

Testing Blasting Circuits

A Blaster's Multimeter, Blasting Ohmmeter or Blasting Galvanometer can be used to test blasting circuits for continuity and resistance.

Never use any test instruments not specifically designed for blasting circuits.

Before using an instrument, make certain the needle can be adjusted to "zero" when the terminals are shunted. Digital meters should read, "zero" in the display. If not, replace the batteries and make the necessary adjustments as recommended in the meter instructions.

Replace the battery with the same type of battery specified by the manufacturer for use in the blasting instrument. If in doubt, contact your supplier's technical representative. Do not change batteries in the presence of electric detonators.

To properly test the circuit, the theoretical resistance of the circuit must be calculated. ***Table 16.1*** gives the resistance of a typical series of electric detonators with copper and iron leg wire of various lengths. This table is presented only for purposes of illustrating how to make circuit calculations. The actual resistances of the electrical detonators available to the blaster from the various manufacturers may vary widely from those shown in the table. Be sure to use your manufacturer's data when actually making circuit calculations in the field. ***Table 16.2*** gives the resistance per 1,000 feet for the various types of wire.

Nominal Resistance of Electric Blasting Detonators in Ohms per Detonator*

(This is for example calculation only: refer to your supplier for actual resistances of your products)

COPPER WIRE			***IRON WIRE***		
Length of Wire in Feet	Instantaneous Delay Detonators	Delay Detonators	Instantaneous Detonator	Delay Detonators	Length of Wire in Feet
4	1.26	1.16	2.10	2.00	4
6	1.34	1.24	2.59	2.49	6
7	-	-	2.84	-	7
8	1.42	1.32	3.09	2.99	8
9	-	-	3.34	-	9
10	1.50	1.40	3.59	3.49	10
12	1.58	1.48	4.09	3.99	12
14	1.67	1.57	4.58	4.48	14
16	1.75	1.65	5.08	4.98	16
20	1.91	1.81	6.06	5.98	20
24	2.07	1.97			24
30	2.31	2.21			30
40	2.15	2.06			40
50	2.42	2.32			50
60	2.69	2.59			60
80	2.71	2.61			80
100	3.11	3.01			100
120	3.51	3.41			120
150	4.11	4.01			150
200	5.12	5.02			200
250	6.12	6.02			250
300	7.13	7.03			300
400	9.13	9.03			400

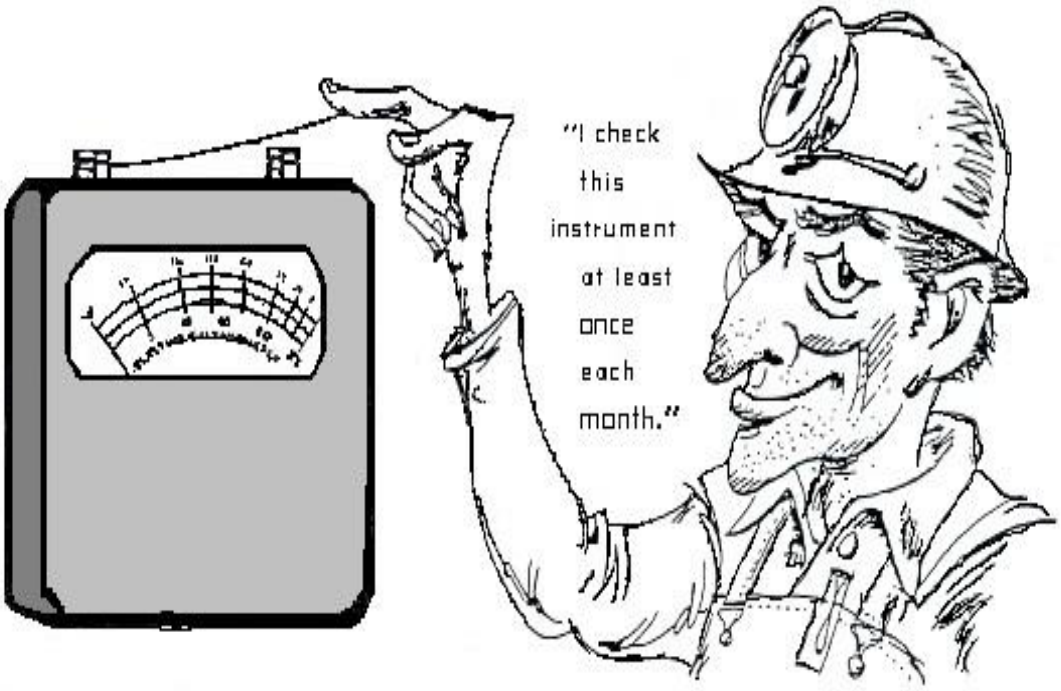
***Table 16.1* - Nominal Resistance* of Electric Blasting Detonators in Ohms per Detonator**

* At 68° Fahrenheit

Resistance* of Copper Wire	
AWG Gauge No.	**Ohms per 1,000 Feet**
6	0.395
8	0.628
10	0.999
12	1.588
14	2.525
16	4.02
18	6.39
20	10.15
22	16.14

***Table 16.2* – Resistance* of Copper Wire**

* At 68° Fahrenheit



Using a Blasting Galvanometer

Proper use of the blasting galvanometer helps assure safe blasting practice. You should consider using this test instrument in some, or all, of the following cases:

1. Check electric blasting caps for circuit continuity prior to stemming the hole. If this is done, be sure to twist the cap leg wires together after the test, so that they are short-circuited.

2. When wiring a blasting circuit series-in-parallel, check each series after wiring is completed and also when hooking up to the bus line or firing cable. Note the galvanometer reading. Readings should be approximately the same for every series. This assures an equal current distribution to each series.

3. Check firing cables in both the open and shunted positions. This will verify that there are no shorts or breaks in the cable.

4. When placing protective mats over a shot, lead wires on the terminals of the blasting galvanometer and make sure there is no change in instrument reading. If mats are of wire cable, it is good practice to tape each leg wire connection.

5. Upon completion of all wiring, check circuit continuity at the firing end of the firing cable. Read the continuity check immediately prior to hooking up to the blasting machine.

6. Inspect the shot after blasting for possible missed holes. Use the galvanometer to check suspected misfired caps.

Blaster's Multimeter

The Blaster's Multimeter is a compact volt-ohm-milli-volt meter specifically designed to measure resistance, voltage, and current in electric blasting operations. As with all blasting test devices, be certain the name includes the word "**Blaster's**". **A standard multimeter should never be used to test a blasting circuit**.

This versatile meter can be used to:

- Measure the resistance of a single blasting circuit for continuity, and the total resistance in a series-in-parallel circuit, with a high degree of precision and accuracy.
- Survey blast sites in order to determine if extraneous current hazards exist. For operating instructions, refer to stray current measurement methods recommended by the manufacturer.
- Measure a wide range of resistances necessary to investigate static electricity hazards, such as those possible in a pneumatic loading operation.
- Measure power line voltages up to 1500 volts AC and DC.

Blasting Ohmmeter

The Blasting Ohmmeter (sometimes called "Blaster's Ohmmeter") is an analog ("swing needle") device utilized to measure the resistance in ohms of the blasting circuit: (1) in order to determine if the bridgewire of an individual electric detonator is intact; (2) to determine the continuity of an electric detonator series circuit, (3) to locate broken wires and connections in a series or series-in-parallel circuit. To measure resistance with this compact instrument, place each of the two lead-in wires from the open end of the circuit on the two contact posts that extend out of the top of the Blasting Ohmmeter. The meter reading will approximate the circuit's resistance (number of ohms). To determine if the meter is functioning properly, short circuit the contact posts and determine if the meter is reading zero. If not, turn the adjustment screw on the instrument until the needle indicates zero ohms on the scale that will be used to test the circuit. If the needle cannot be adjusted to zero, or the needle is drifting when the instrument is shorted, the battery may be weak or other circuitry must be repaired prior to use. Never use an instrument that cannot be adjusted to zero.

Some Blasting Ohmmeters use special silver chloride batteries. When the battery is exhausted, it must be replaced with the same type of cell. Never attempt to replace it with a standard battery. Never change batteries near electric detonators. Never allow the silver chloride cell, or any battery, to come in direct contact with electric detonators.

Blasting Digital Ohmmeter

The Blasting digital ohmmeter is used to measure the resistance of blasting circuits and individual detonators in the same manner as the Blasting Ohmmeter, but with greater accuracy and range. Blasting Digital Ohmmeters are available in both permissible and non-permissible versions. Never use a non-permissible instrument underground in a gassy environment. The Blasting Digital Ohmmeter will give a direct reading of the resistance (ohms) of the blasting circuit when the two wires from the circuit are placed against the posts of the ohmmeter. A test of the ohmmeter can be made by shorting across the posts. The reading should be zero.

Blasters must use only the recommended batteries in these machines. Other batteries will produce a hazardous current level. Never test an electric detonator or blasting circuit directly with a battery, recommended or otherwise, and never allow any battery to come in direct contact with electric detonators.

Date / Plant / Shift Code

In 1971 IME member companies implemented a product identification system for packaged explosive products manufactured in the United States.

The code for the date, work shift and plant of manufacture is plainly marked on each unit to be identified. Marked units include all cartridges of dynamite, blasting agent, water gel, slurry, cast boosters, primers, cartons of detonating cord, containers of blasting caps and similar accessories. The shipping case bears the same number as the units.

The following is the format for the Date / Plant / Shift code used for product tracing:				
Day	**Month**	**Year**	**Location**	**Shift or Machine**
2 digits	2 digits	2 digits	1 digit	1 digit
Numeric	**Alpha**	**Numeric**	**Alpha**	**Numeric**

When writing months, a two-letter abbreviation is used:			
January	**JA**	**July**	**JY**
February	**FE**	**August**	**AU**
March	**MA**	**September**	**SE**
April	**AP**	**October**	**OC**
May	**MY**	**November**	**NO**
June	**JU**	**December**	**DE**

As an example, a product manufactured on September 30, 1997 during the first shift at a plant which the manufacturer has assigned the letter "A" would be **30SE97A1**.

Manufacturers advise the Bureau of Alcohol, Tobacco and Firearms (BATF) when codes are changed.

Approved by the IME Board of Governors December 8-9, 1987

Ammonium Nitrate Oil (ANFO)

Ammonium nitrate is an essential ingredient in nearly all-commercial explosives including dynamite, emulsions, and water gels. Its predominant use, however, is in the form of a small porous pellet, called a prill, mixed with fuel oil. Nearly four billion pounds of these mixtures, commonly referred to as ANFO, are consumed each year in the U.S. They account for approximately 80 percent of the domestic commercial explosive market.

Since their introduction in the 1950's, ANFO products have found extensive use in a wide variety of blasting applications such as surface mining of coal, metal mining, quarrying, and construction. Their dominant use is attributed to economy and convenience.

Their limitations—no water resistance and low-product density—should be recognized as product deficiencies prior to introducing ANFO into a blasting system.

The most widely used ANFO product is an oxygen-balanced, free flowing mixture of about 94 percent ammonium nitrate prills and 6 percent No. 2 diesel fuel oil. Other ANFO products are modifications of this basic ANFO formula in which:

1) Substances such as finely-sized aluminum or carbonaceous materials are used in conjunction with No. 2 diesel fuel, or,

2) The AN prill is crushed, mixed with No. 2 diesel fuel (and possibly other substances), and packaged in water resistant package for use in damp to slightly wet boreholes.

The AN Blasting Prill

This material is also frequently referred to by the terminology "porous", "explosive-grade", "industrial", or "low-density prilled ammonium nitrate".

Production of ammonium nitrate (AN) prills is a multi-step process that begins with natural gas and air.

The end point in this process involves spraying a concentrated (94% to 96%) AN solution through perforated plates or shower heads at the top of a prill tower. Liquid AN droplets are formed as the solution exits the shower heads.

During a free fall of 100 to 200 feet (30.5 – 61m), the droplets crystallize into spherical AN prills. These prills are dried, cooled, and may be coated with anti-setting agents prior to shipment.

A major domestic use of AN prills is for agricultural fertilizers. However, the agricultural AN prill differs from the AN prills most suitable for explosive use. Blasting prills are usually less dense and, consequently, more porous.

Density

Prills best suited for blasting products have a particle density in the range of 1.3 to 1.5 g/cc. AN prills with particle densities approaching the density of solid ammonium nitrate (slightly over 1.7 g/cc) are less sensitive to detonation. The voids in the porous, less dense blasting prill serve two functions:

1) They enable the prill to absorb and retain fuel oil in a uniform and intimate manner; and

2) They improve sensitivity by acting as sites for high temperature "hot spots" or ignition points.

Anti-setting Coating

Liquid surface-active agents (surfactants) and finely ground (minus 325 mesh) kaolin or talc coat prill to disperse ambient humidity. This retards the prill's affinity for moisture on its surface, thereby minimizing caking. In some cases, the use of the surfactant alone has proven to be an effective anti-setting coating. Excessive amounts of talc or kaolin will, 1) decrease ANFO sensitivity because of the inert nature of those minerals and 2) interfere with the oil distribution, which will affect ANFO performance. Excessive quantities of certain surfactants may affect the stability of the emulsifier in blasting emulsions. This could in turn affect the performance of ANFO/emulsion blends. A good blasting prill has typically less than 1.0 percent anti-setting coating.

Loading of Holes

ANFO is extensively used because of the low-cost advantages. When properly stored, handled, and used, ANFO will give good performance. ANFO mixed to the proper proportion (94.3% ammonium nitrate and 5.7% fuel oil or Corvus oil for less oil fumes) has a Fume Class 1 rating. However, improper storage or usage can result in the generation of toxic fumes. Prolonged storage can also result in evaporation of the fuel oil. Ammonium nitrate is highly hydroscopic and will absorb moisture from the humid mine air if left stored in an open container. The loading of wet holes must also be avoided. Excessive moisture and/or unbalanced fuel ratios will result in poor sensitivity, reduced explosive efficiency, and the generation of toxic fumes.

ANFO is normally packaged in 50 lb. pillow-type or poly-burlap bags for easy handling by the mine personnel. However, recently some mine operators have adopted a bulk handling system to reduce handling cost. Since mine layout and systems vary greatly, any bulk handling system must be evaluated and designed for each situation.

Pneumatic Loading

The degree of sensitivity of ANFO mixes allows for the use of pneumatic loaders. Pneumatic loaders can be classified into three categories: pressure pots, Venturi loaders, or a combination of both systems.

A pressure pot consists of a pressure vessel with a conical base and a loading hose of proper diameter and length. The pot is sealed, and a pressure of 25-40 psi is applied. The flow of ANFO is controlled by a ball valve at the base. Pressure pots can load at a rate of 25-50 lb. per minute through a 100 ft. 1in. ID hose. A disadvantage of a pressure pot is that it will not crush or compact the ANFO in the blast hole because of its lower air stream velocity in the loading hole as efficiently as the Venturi loader. This will result in lower velocity of detonation, density, and energy. Boreholes that are inclined upward cannot readily be loaded with the pressure pot system.

A Venturi loader consists of a hopper with suction at its base supplied by a Venturi. Venturi loaders are simple, portable, and inexpensive. This is offset by slow loading rates of 8-15 lb. per minute. They are also restricted to short boreholes but provide very good compaction of the ANFO prill in the blast hole.

The pressure pot/Venturi loader combines the advantages of both loaders. It has a high loading rate (50-75 lb. per minute) with good crushing and compaction of the ANFO in the blast hole.

Static Electricity

Static electricity is a form of potential energy in which electric charges are stored on some person or object. When the static electricity is converted to kinetic energy by means of a static discharge, it represents a possible hazard to the use of flammable or explosive materials. When considering commercial blasting, the primary concern is that static electricity may cause a premature detonation when blasting electrically. Experience has shown, however, that static electricity, under some conditions, may also represent a hazard to nonelectric blasting.

The safety procedures that eliminate the accumulation of a static charge are listed below. They should be made an integral part of the pneumatic loading operation since they are the principal mechanism for minimizing the static electricity hazard.

1. *Ground the Pneumatic Loader*. The pneumatic loader (includes both pressure pot and Venturi types) should be constructed of a conductive material and should be grounded to earth. The resistance between the loader and earth should be a maximum of 1,000,000 ohms. This can usually be accomplished by physical contact between the loader and earth. If the loader is mounted on a vehicle of some type, a positive grounding means should be used. One grounding method that has proven satisfactory is to bolt or weld one end of a heavy, flexible wire to the loader. The opposite end should be connected to a metal rod embedded in the earth. If the loader is moved often, the opposite end of the wire should be bolted or welded to a metal plate (about 8″ x 8″ x 1/2″ thick with a handle for easy handling) that is rested on wetted earth during loading. Never ground the loader to metal air or water lines, metal support frames, or to any fixture that is also used to ground electrical equipment, as these may be sources of stray currents.

2. *Use a Semi-Conductive Loading Hose*. When loading ANFO pneumatically, use a semi-conductive hose that is electrically connected to the pneumatic loader. In most cases, this can be accomplished by clamping the hose to the outlet from the loader. The semi-conductive hose should have a minimum resistance of 5,000 ohms per foot and a maximum total resistance of 2,000,000 ohms. There are a number of companies that manufacture acceptable semi-conductive hoses.

3. *The Operator Handling the Loading Hose Should Not Wear Gloves*. Unless some other positive means is utilized to ground the operator, he or she should be in direct physical contact with the semi-conductive loading hose. This is necessary to prevent the accumulation of a static charge on his or her person. If he or she wears gloves, the direct physical contact between the two cannot be achieved.

4. *The Resistance of the Earth between the Ground from the Pneumatic Loader and the Boreholes Should Be a Maximum of 1,000,000 Ohms*. The resistance of the ore body and/or rock between the ground from the pneumatic loader and the location of the boreholes being pneumatically loaded must be less than 1,000,000 ohms, so that the charge on the ANFO particles can neutralize the opposite charge that is left on the loading hose. Experience has shown that this requirement is easily satisfied in most mines.

5. *The Ambient Relative Humidity Should Be a Minimum of 50%.* Humidity serves two functions in minimizing the accumulation of static electricity. Under conditions of high humidity, a thin film of moisture condenses onto the surfaces of objects on which static accumulates. The moisture film is usually sufficiently conductive that it backs up the grounding procedures by permitting electrostatic charges to drain to earth as they are being generated. The humidity in the compressed air that conveys the ANFO to the boreholes provides moisture that is absorbed by the ANFO particles. This provides a conductive film on the surfaces of the particles that drains any electrostatic charges to earth that may be on the ANFO as it is packed in the borehole.

6. *Avoid the Use of Nonconductive Borehole Liners*. A plastic liner is sometimes used to keep the water in the borehole away from the ANFO or to prevent the ANFO from escaping from the borehole into cavities, cracks, or vugs. The nonconductive nature of these liners prevents the grounding of the static charge on the ANFO particles. Hence, they should not be used in boreholes that are pneumatically loaded unless some positive means is provided to drain electrostatic charges to earth from inside the liner. There are semi-conductive ground straps available to accomplish this grounding.

7. *Make Periodic Tests to Check the Effectiveness of the Recommended Safety Procedures*. There are three types of tests that should be made prior to the introduction of pneumatic loading and periodically thereafter. These are:

   1) Grounding resistance measurements,

   2) Static voltage measurements, and

   3) Relative humidity measurements.

   The purpose of the grounding resistance measurements is to ensure that static charges will be dissipated to earth and neutralized instead of accumulating on some person or object. They entail checking the resistance of the loading hose, the pneumatic loader grounding, and the surrounding ore body to ascertain that they do not exceed the maximum values previously recommended. The purpose of the static voltage measurements is also to ensure that static electricity is not being accumulated. These measurements entail using an electrostatic voltmeter to monitor the pneumatic loader, the loading hose, the operator, and the ANFO particles as they are packed into the borehole for the presence of excessive electrostatic voltages. Although condensation on the surfaces of objects is not depended only to drain off static charges, experience has shown that static is more likely to be a problem when the relative humidity is low (less than 50%). Therefore, measurements of the relative humidity of the ambient air and the compressed air that services the pneumatic loader will help to further define the overall background conditions. The test instruments and procedures that are used in making the grounding resistance, static voltage, and relative humidity measurements are discussed in the next section.

When blasting non-electrical, the safety procedures listed above should be followed to eliminate the accumulation of static electricity generated by pneumatic loading.

Emulsion Explosives

Explosive Properties—Physical Form

An emulsion is an intimate mixture of two immiscible liquids with one liquid phase dispersed uniformly throughout the second phase. Emulsion explosives are dispersions of water solutions of oxidizers in oil medium or "water-in-oil" emulsions. It is this unique structure and high ratio of oxidizer to fuel that give emulsion explosives their special characteristics.

The oil or fuel phase is known as the continuous or external phase because it surrounds and coats all of the oxidizer droplets. The fuel phase is generally oil or wax or a combination of the two. No. 2 diesel fuel oil (FO) is common to emulsion explosives.

The water or oxidizer solution phase is called the discontinuous or internal phase because the microscopically fine droplets are kept apart and surrounded by the continuous fuel phase. The oxidizer phase always contains ammonium nitrate. Other salts such as sodium nitrate, calcium nitrate and ammonium or sodium perchlorate may also be included.

The oxidizer remains dispersed in the fuel to form a stable emulsion through the action of a surfactant (emulsifier). For example, oil and vinegar are held together by egg yolks to form the emulsion known as mayonnaise. There are many different emulsifiers and choosing which one to use depends on the particular requirements for the product. The emulsion formed from the fuel phase, oxidizer phase and emulsifier, before any addition of bulking agent, aluminum, or solid ammonium nitrate, is called the matrix and is the foundation of subsequent products.

Structure

Because of the necessity to have close to zero oxygen balance, emulsion explosives need the volume of oxidizer to be much greater than the volume of fuel: the ratio is approximately 9 to 1. Because the relative volume of fuel is so much less than that of the oxidizer, it must be spread in a very thin layer in order to cover all of the oxidizer droplets. The size of the droplets is very small: and, due to the oxidizer/fuel ratio, the droplets are in the shape of many-sided polyhedrons. Droplets are usually in the range of 0.2-10 microns in diameter, or about $1/4^{th}$ to $1/2000^{th}$ the size of a grain of table salt.

The rheology or viscosity of the emulsion is controlled by the nature of the fuel phase and the droplet size. The composition (wax, oil, emulsifier) of the full fuel phase has the greatest influence on the final viscosity of the product. Low viscosity oils, such as No. 2 diesel fuel, can be used to make pumpable emulsions. Waxes and high viscosity oils are used to make thick, putty-like packaged products. The droplet size is controlled by the amount of work put into the emulsion. The faster and longer it is stirred, the greater the work input and the smaller the droplet size and size distribution. The smaller the droplet size, the thicker the emulsion.

Thermochemical Energy

The addition of aluminum or ANFO to an emulsion explosive can be used to increase its energy (cal/g). Aluminum does not significantly increase the sensitivity of emulsions, so a much coarser and less costly aluminum can be used rather than the high cost paint-grade aluminum used to attain sensitivity in some water gels. Theoretically, an addition of 5% aluminum will increase the energy of the emulsion by about 25-35%. Ten percent aluminum increases the energy by about 40-60%. Above 10% the addition of aluminum may not be cost effective.

ANFO added to emulsions can increase the energy by about 5% for every 10% increment added. ANFO also has the added advantage of producing only gaseous detonation products, and therefore, an increase in gas volume is also realized. An increase in gas volume usually leads to better heave and throw of rock being blasted.

The ratio of the amount of energy released to the calculated thermochemical energy is the measure of the efficiency of an explosive. Water gels generally have a liquid and a solid phase. They are generally made at elevated temperatures; as the product cools, oxidizer salt crystals begin to form. The colder the product becomes, the greater the tendency for crystals to form. The more crystals present and the larger they are, the more insensitive and less efficient the product becomes. The components are not intimately associated with one another because a relatively large amount of oxidizer surrounds a relatively small amount of fuel. In contrast, the increased intimacy between fuel and oxidizer in emulsions, and the very small particle size of the droplets, is believed to be responsible for the greater efficiency and enhanced detonation properties of these products.

The emulsions are two phase systems. In order to have a suitable oxygen balance, only a very small amount of fuel is available to spread over each individual oxidizer droplet. This results in a very intimate mixture. Because there are so many oxidizer droplets and because they are so small, the oxidizer salts, regardless of temperature, will not easily crystallize and grow. Since the oxidizer salts remain in solution, the detonation properties of emulsion explosives remain unchanged for long periods of time and over wide temperature ranges.

Detonation, Physical and Safety Properties

Safety

Emulsions fail to detonate in impact and friction tests, which have been standard to the explosive industry for years. When placed against a metal plate, the emulsions fail to detonate under the impact of a 30-06 projectile. Other high velocity impact tests with larger caliber projectiles show emulsions to have a greater resistance to initiation by impact than either water gels or dynamites. Normally, emulsion explosives will not detonate during burning, but there is no guarantee of this, particularly if the material is contaminated with foreign materials such as rust, detonators, dynamites, or aluminum powders. When pumping emulsions, care must be taken so that the pump does not run dry or against a closed system ("deadhead"). In either case, friction can raise the temperature of the emulsion in the pump beyond the decomposition point of ammonium nitrate or other ingredients. If this happens a detonation can occur. Remember—it can be just as hazardous to pump unsensitized emulsion oxidizers, as it is to pump sensitized ones. Although tests have demonstrated that emulsions offer a great degree of safety, they will detonate if subjected to severe conditions. They are explosives, and regardless of their degree of safety should never be abused.

Velocity

It is an established fact that the smaller the particle size of the ingredients of an explosive, the higher the velocity of detonation (VOD). Since the droplet size of emulsions is so fine, the VOD of explosive emulsions is very high – close to theoretical. The VOD does decrease somewhat as the charge diameter decreases or as solids such as aluminum or AN prills are added, but the VOD generally remains relatively high when compared to most water gels.

Detonation Pressure

Since emulsions have a high velocity of detonation and a reasonable density, they also have a relatively high detonation pressure. Emulsion detonation pressures measured by the "aquarium" technique are found to be between 100 and 120 Kbar/(1.45-1.74 x 10^6 psi). As a result, emulsions are particularly well-suited for improving fragmentation in hard massive rock, for breaking hard bottom rock, and for use as a booster for ANFO mixtures and other blasting agents.

Sensitivity

Because emulsions have a very fine particle size and are an extremely intimate mixture of fuel and oxidizer, only a density reducing agent needs to be added to make them detonate. It is not necessary to use high explosives or chemical sensitizers for sensitivity. The density can be reduced by occluded air, chemically generated gas, perlite, expanded plastic, hollow glass or phenolic microspheres, or even AN prills. The sensitivity of the emulsions can be made to vary from that of a No. 8 strength detonator (or less) for a high explosive classification at 68ºF (-20ºC) to booster sensitivity for blasting agent 1.5D products. The emulsions are sensitive over a wide temperature range, and they also maintain their sensitivity over a wide range of diameters (7/8 inch [22mm] and up for "Explosive, Blasting, type E 1.5D" [blasting agent]). Different density reducing agents are used for different reasons, but the glass microspheres are the most common, although chemical gassing is becoming popular. Because certain glass microspheres will withstand high pressures, they are especially useful in sensitizing emulsion products for use in deep bore holes or close borehole spacing where high hydrostatic or shock pressures are likely to be encountered.

Generally, the lower the density of an emulsion explosive, the more sensitive it becomes. Also, the lower the water content of the emulsion explosive, the more sensitive it becomes. The water content of blasting agents is usually higher than that of 1.1D emulsions, but so is the density. This keeps the overall bulk strength energy level of blasting agents close to that of the high explosive emulsions.

Water Resistance

Water-in-oil emulsions have a continuous, water-immiscible oil phase and are extremely water resistant. They do not depend upon the integrity of the package for water resistance. Emulsions are a good choice when wet holes are encountered, because they will perform successfully after sleeping underwater for weeks or even months.

Dynamites

Straight Dynamite

Guhr dynamite, originally formulated by Nobel in 1864, was the forerunner of today's straight dynamites. Nobel's guhr dynamite contained kieselguhr totally saturated with liquid NG. The kieselguhr absorbs three times its weight in NG; as such, guhr dynamite contained about 75% NG. Kieselguhr, being inert, detracted from the explosive strength.

In time, this problem was solved by using sawdust to absorb the NG, which added to the energy.

Present-day straight dynamites are no longer straight because they contain various proportions of active ingredients substituted for much of the kieselguhr, with resulting higher performance. Among the ingredients added to increase the performance was sodium nitrate, which created higher energy and a more favorable oxygen balance.

High density and high velocity result in good *brisance*, the shattering effect. They generally have fair water resistance, but poor fume characteristics, which disqualifies them for underground applications. Because of their high cost, industrial use and importance are declining, with ammonia dynamites being used as a substitute. Today straight dynamite is used in ditch blasting in wet soil by the sympathetic propagation technique.

Ammonia Dynamite

The first use of ammonium nitrate in explosives was patented by Nobel in 1867. In the first ammonia dynamite, ammonium nitrate was mixed with charcoal and nitroglycerin. This was an advancement, as the ammonium nitrate decomposes completely, adding to the energy. It also supplies oxygen to the reaction for better fume characteristics.

Since a portion of the NG is replaced by ammonium nitrate, ammonia dynamite generally has a lower density and higher shock and friction tolerance. Ammonia dynamites have low to medium VODs and exhibit good heaving action due to increased gas production. Ammonia dynamites are suited for use in relatively soft ground. The strength and density of ammonia dynamite can be varied greatly by changing the ingredient ratios. Most ammonia dynamites, however, have poor to fair water resistance and are thus limited in their use.

Gelatin Dynamite

In 1862, Alfred Nobel first prepared nitrocotton (nitrocellulose), searching for a substance that would retain NG in the presence of water. Guncotton (i.e., nitrocotton or nitrocellulose), listed as an absorbent in a dynamite patent by Nobel in 1863, did not perform as desired. In 1873, Maynard, an American medical student, found that a nitrocellulose with a lower nitrogen content than that used earlier by Nobel would produce a solution called collodion. Initially, it was used as a protective film over a cut as it dried into a thin tough coating. In 1875, Nobel cut his finger and applied the collodion. He then decided to try its effects on NG, which resulted in a very plastic and cohesive gelatin.

Straight Gelatin Dynamite

Straight gelatin contains a high ratio of nitrocellulose to nitroglycerin. Because of its highly gelatinous “rubber like” consistency, it has excellent water resistance. Nobel’s straight gelatin composition contained 91% NG, 8% nitrocotton, and 1% chalk, and produced a plastic substance resembling crepe rubber in appearance and texture. This

was called 100% blasting gelatin. Similar to the development of the straight dynamites, sodium nitrate and other carbonaceous ingredients were added to obtain a closer oxygen balance and higher energy characteristics.

Ammonia Gelatin Dynamite

This type of gelatin dynamite has ammonium nitrate substituted for some of the nitroglycerin to form a plastic cohesive product with good water resistance. Ammonia gelatins have high densities and high velocities, giving them high detonation pressure, which make them excellent boosters. Because of high-energy output, they are particularly suited for shooting tough rock.

Semi-gelatin Dynamite

A semi-gelatin is a cross between the high-density ammonia dynamites and the ammonia gelatins. The semi-gelatin dynamites exhibit moderately high detonation pressure and an adequate amount of water resistance for all but the most severe conditions. The rationale of the semi-gelatin dynamite is based upon economics. They have a higher cartridge count per case and cost less per cartridge than gelatins of equivalent strength but exhibit less water resistance.

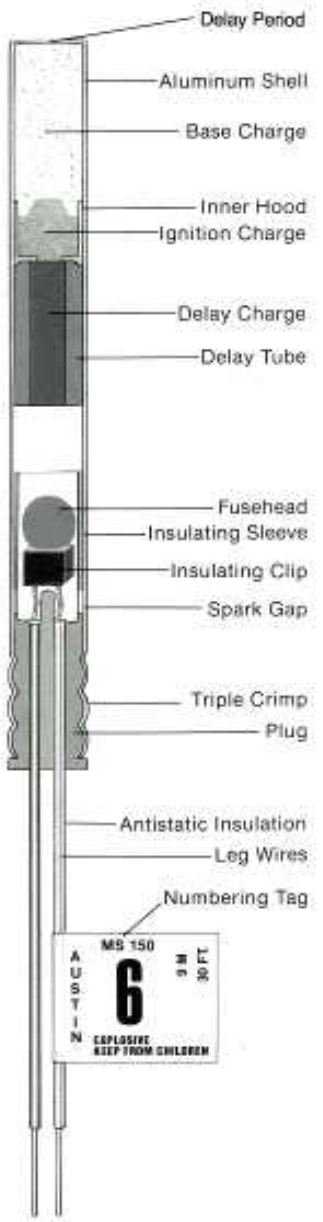
Permissible Dynamite

Permissible dynamites are specifically formulated and developed for underground coal mining. Each formula must pass many tests conducted by the U.S. Bureau of Mines and has been assigned an individual permissible certificate by MSHA. They are also subject to periodic testing to ensure permissibility for use in underground coal and gaseous metal and nonmetal mines.

Electric Detonators

This classification includes high, medium, and low firing-current electric detonators, semiconductor bridge detonators, toroid induction/electric blasting detonators, exploding bridgewire (EBW) detonators, and the electronic detonator.

Over the years, in the North American market the most widely used electric detonator has been of the low firing-current variety. With the proper electrical energy source and blast circuitry, large numbers of electric detonators can be initiated on command from a location that is safely removed from the immediate blast area.



The electric detonator consists of a metal shell containing a high explosive base charge designed to initiate other explosives. Above the base charge is a small charge of primary explosive (primer charge) that converts a burning reaction transmitted from the ignition or pyrotechnic fuse into a detonating reaction. Above the primer charge, in delay detonators, is a pyrotechnic delay element that burns at a known rate and whose length and composition control the transit time of the burning front. Detonators classified as instantaneous or zero delay does not contain a delay feature. The topmost reactive element in the electric detonator is the ignition area where a bridge wire is attached between the leg wire pins and is embedded in an ignition mixture. The ignition mixture may be in the form of loose powder, a primer spot, or match head, depending on the manufacturer's design. When sufficient electrical current passes through the system, a bridge becomes hot enough to ignite the ignition mixture. The majority of electric detonators surround the ignition area with a plastic ferrule that insulates and protects the ignition mixture from the shell. The leg wire pins are embedded in a thermosetting resin plug and are connected to the detonator's leg wires within an electrometric material above the resin plug. The electrometric material top seal is securely crimped near the open end of the initiator shell, forming a water-resistant closure that firmly positions and secures the leg wires inside the shell.

All modern commercial electric detonators include an internal feature to prevent electrostatic energy from accidentally initiating the detonator. There are several designs, some of which provide a bypass path around the bridgewire using a semi-conductive material and others, which utilize a printed circuit, which provides a controlled path to ground.

Detonator leg wires are made of solid copper, iron, or copper-clad iron wire in a variety of gauges and lengths. Iron or copper-clad iron leg wires are designed for use in operations where it is desirable or necessary to remove the leg wire remnants from the blasted rock by magnetic means. Plastic insulation provides insulation, abrasion resistance, and flexibility. The wire insulations are typically color-coded to provide product identification with maximum visibility and to assist in wiring hookups. Most short-length electric detonator leg wires are coiled in a figure eight-fold that is secured with a paper band. Longer length detonator wires are usually supplied as either duplex wire with a single color and wound on spools or single individually colored wires that are coiled in a figure eight-fold. Longer length leg wires are typically heavier gauge wire in order to provide improved tensile strength and lower resistance per unit of length.

All electric detonators produced in North America have shunts on the free ends of the leg wires to provide a low resistance path to prevent current from flowing through the bridgewire. In addition, some designs completely enclose the ends of the wires in order to prevent corrosion and to keep bare wires from contacting extraneous electrical current sources. In one design the shunt consists of aluminum foil with an insulation layer on the outside.

Electric detonators are supplied with a distinctive, numbered tag to facilitate easy identification of the delay period.

Instantaneous Electric Detonators generally contain the same charges as fuse caps and function in a similar manner with the exception that the activating energy is applied electrically.

Two electrical wires, commonly called leg wires, enter the shell through a non-conductive plug of rubber or plastic around which the shell is crimped during manufacture. These are connected to each other within the shell at a point within or close to the ignition charge by a high resistance bridge wire or match head. The plug through which the leg wires enter prevents moisture or other contaminants from reaching the ignition charge. Electric detonators are not as subject to mass detonation as are fuse caps provided that the leg wires are kept folded until the cap is to be used. They are, however, more subject to accidental initiation by extraneous electricity.

When the proper amount of current is passed through the leg wires, the high resistance of the bridge wire or match head causes it to heat very quickly. This heat ignites the ignition charge and from that point functioning is essentially the same as in a fuse cap.

Leg wires may be made of copper or iron. Iron wires are normally used only in coal and salt mines where the iron can later be magnetically separated from the coal or salt. Where iron wires are used, they are available in standard lengths from 4 to 20 ft.

Electric detonators with copper leg wires are most commonly used because of their lower electrical resistance. Generally, they are available in standard lengths from 4 ft. to 400 ft. Other lengths are available on special order.

Because of differences in resistance, timing characteristics and designation of delay periods, brands of different manufacture should never be mixed in the same round, as risk of misfire is likely.

For all practical purposes, instantaneous electric detonators detonate when sufficient current is applied, although there actually is a measurable interval between the application of the current and the development of sufficient heat in the bridge wire or matchhead to activate the cap. This interval varies so slightly within **caps of the same manufacturer** that it can normally be ignored so long as sufficient current is applied. Thus, instantaneous electric detonators, unlike fuse caps, can be used for reliable simultaneous detonation of a large number of separate charges.

Long period electric detonators contain a delay train as an additional component. The delay train is interposed between the ignition and primer charges and delays detonation of the cap by the amount of time required to burn through it. This may depend on either the composition or the length or diameter of the delay train or both. Because the time interval between successive delay periods approximates one-half second, this type is sometimes referred to as slow or long delay electric detonators. It should be clearly understood, however, that each manufacturer establishes his own delay interval and numbers his delays in accordance with his own system. These facts provide an additional reason why caps of different manufacture must not be used in the same round.

Long period detonators are numbered to indicate progression and can normally also be identified by the manufacturers color code system. The lowest number, normally “0”, indicates the shortest delay while the highest, presently 14 or 15, indicates the highest. It is emphasized that a “0” delay is not an instantaneous cap and that it will delay from 8 to 25 thousandths of a second, depending on the brand.

Primers

A unit, package, or cartridge of explosives used to initiate other explosives or blasting agents, and which contains:

1) A detonator, or

2) Detonating cord to which is attached a detonator designed to initiate the detonating cord.

Making Primers with Electric / Electronic Detonators

Small Diameter Cartridges

(Less than four inches in diameter) –

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

Step 2: Insert the detonator into the hole.

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

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

Figure 1: Recommended method of making primer with small diameter cartridge and electric detonator.

Large Diameter Cartridge

(Four inches and larger in diameter)

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

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

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

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

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

Figure 2: Recommended method of making primer with large diameter cartridge and electric/electronic detonator.

Cast Boosters

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

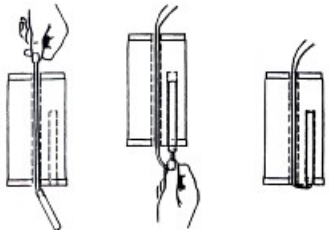


Figure 3: Recommended method of making primer with cast booster and electric detonator.

Plastic Film Cartridges

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

Making Primers with Fuse or Nonelectric Detonators

Side Priming Method

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

***Step 2*: Insert the detonator.**

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

***Step 4*: Tape the fuse, shock tube or plastic tubing over the end so that it lies along the length of the cartridge.**

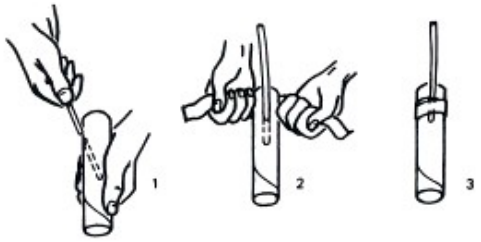


Figure 5: Recommended method of making primer using the side priming method.

Reverse Priming Method

***Step 1*: Punch a hole in the side of the cartridge. Make the hole deeper than length of detonator.**

***Step 2*: Insert the detonator.**

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

***Step 4*: Tape the fuse, shock tube to the cartridge.**

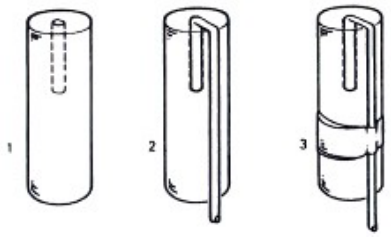


Figure 6: Recommended method for making primer by reverse priming method.

CAUTION: If miniaturized detonating cord is used, the explosives must be insensitive to initiation by the detonating cord for this method to work.

Plastic Film Cartridge Primer

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

Making Primers with Detonating Cord

Detonating Cord with Cast Boosters

ALWAYS follow manufacturer's recommendations for using detonating cord with cast or manufactured boosters.

Figure 8: Recommended method for making primer with cast booster and detonating cord.

Miscellaneous Types of Primers

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

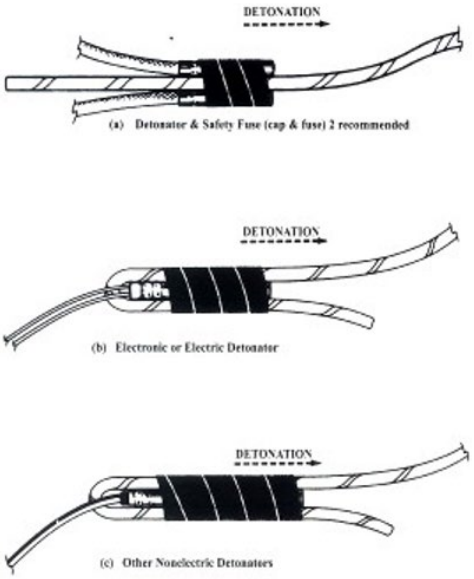


Figure 9: Methods for attaching detonators to detonating cord.

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

ALWAYS Handle detonating cord as carefully as other explosive materials.

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

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

ALWAYS Make tight connections, following manufacturer's directions.

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

ALWAYS Point the detonators toward the direction of detonation.

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

ALWAYS Use a suitable booster to initiate wet detonating cord.

ALWAYS Use surface delay connectors designed for use with detonating cord.

NEVER Make loops, kinks, or sharp angles in the cord, which might direct the cord back toward the oncoming line of detonation.

NEVER Damage detonating cord prior to firing.

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

NEVER Use damaged detonating cord.

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

Detonating Cord

Standard detonating cords commonly consist of a core of Pentaerythritol tetranitrate (PETN) encased in various textile wrappings and waterproofing compounds for the purpose of either:

1) Direct initiation of high explosives at any one point along its length, and;

2) Propagation of the detonation wave from one detonating cord to another, or;

3) Propagation of the detonation wave of the detonating cord to a non-electric delay detonator, by transmission of the detonation wave in the core.

The various textile wrappings and waterproofing compounds that encase the core are intended to:

1) Provide protection of the core from abrasion.

2) Provide a reasonable working tensile strength.

3) Resist side penetration of contaminating fluids.

4) Enhance knot-tying characteristics while maintaining flexibility.

Therefore, any procedure that may damage the protective encasement of the core, or permit contaminating fluid to reach the core, will result in erratic performances.

Description and Application of Detonating Cord

Type of Cord

1. Fineline, 10 grain, 100 lb. tensile strength, magenta in color.

General Applications: Recommended for use as a downline when used with a specially designed Austin Powder cast booster.

2. Lite Line, 15 grain, 230 lb. tensile strength, pink in color.

General Applications: Downline or upline under all but the most severe conditions.

3. Scotch Cord, 18 grain, 230 lb. tensile strength, orange in color.

General Applications: Surface trunklines, secondary blasting, and downlines in shallow small diameter holes.

4. "A" Cord, 25 grain, 230 lb. tensile strength, green in color.

General Applications: Small, medium, and large hole downlines and trunklines, secondary blasting and one-hole blasting underground.

5. 50 Reinforced, 50 grain, 250 lb. tensile strength, yellow in color.

General Applications: Excellent general-purpose cord for reliable blasting initiation under virtually all conditions.

6. Heavy Duty, 100, 150, and 200 grain. 100 grain has 200 lb. tensile strength and is orange in color, 150 grain has 275 lb. tensile strength and is purple in color, and 200 grain has 275 lb. tensile strength and is red in color.

General Applications: Constructed for severe service to meet a wide range of specialized applications such as presplit or dimensional stone.

7. Slide Line, different core loads available, 15 grain through 50 grain.

General Applications: For use with bulk loaded blends and emulsions.

Selection of Detonating Cord

1. Type of explosives being used (example, whether using ANFO, Emulsions, or High Explosives).

2. Hole Diameter (example, if using detonating cord in small diameter holes, the lowest core load is preferred).

3. Using cord as trunkline, things to consider:

   A. Locations (example, if you are close to a dwelling or other structure where airblast or noise is a problem, you should use a lower core load detonating cord and cover it with at least 6″ of dirt or sand.

   B. Avoid using sharp angles such as 10º.

   C. Avoid kinks in the trunkline or downlink.

4. Using detonating cord with NDS (Non-Electric Delay Slider). A low core load of 15 gr/ft to 25 gr/ft is a must when using NDS, because if you use a 50 grain cord, you will destroy the delay element attached to the booster.

5. Slide Line - Slide Line is detonating cord without the woven outer layer. It is used when using bulk emulsions or blends, because of the build-up of product along the cord length prohibiting the NDS booster from easily sliding down the cord.

6. When tying detonating cord to downlines or trunklines, make sure the knots are snug to the cord for detonation. A square knot will do fine in splicing.

7. When hooking a detonator to detonating cord, a few things must be considered:

   A. The detonator must be attached pointing in the direction of detonation.

B. The detonator should be attached several inches from the end of the cord because of PETN leakage from the core. If the cord is wet at the end, the PETN will not perform.

Firing with Detonating Cord

Detonating cord is a flexible cord containing a center core of a high velocity, detonator-sensitive explosive, usually PETN, which is used to:

- Detonate other high explosives with which it comes in contact.
- Transmit a detonation wave from one detonating cord to another or to a nonelectric delay detonator.

Other core loadings, such as RDX and HMX, are used in cords designed for specialized uses, such as in oil wells or other hot environments. If such applications arise, contact the cord manufacturer for recommendations.

The number of grains of explosive per linear foot and the type and thickness of countering (coverings or wrappings) determine the cord's priming ability. With this product, the term "50 grain" used in relation to cord means "50 grains per linear foot of cord." The various combinations of textile and plastic wrappings provide the cord's tensile strength, tie-in characteristics, and abrasion and water resistance.

Although PETN detonating cords are sensitive enough to be initiated by all strengths of commercial detonators, they are relatively resistant to accidental detonation from impact, shock, friction, or extraneous electricity.

The most widely used detonating cords have 15 to 50 grains of PETN per foot (3.2 – 10.6 g/m) of cord. All cords detonate at approximately 23,000 fps (7,000 m/s). Their explosives initiating energy varies with the core load. In all cases, they will initiate nitroglycerin-based explosives and many other detonator-sensitive products. Some products may not be initiated, but might be dead pressed or otherwise damaged by the energy output of cord. Consult with the explosive manufacturer as to which products can safely be used with detonating cord. Detonating cord initiation is particularly well suited for:

- Operators who prefer a nonelectric blasting system because potentially hazardous stray currents may be present.
- Firing multiple charges of explosives without significant delay between charges (e.g., as done in preshear blasting).
- Multiple priming or decking in deep, large-diameter boreholes.
- Coyote blasting or for large blasts to fracture low-grade ore bodies for in situ leaching.

- Initiating chute-blasting charges in underground mines.
- Submarine blasting where it is difficult to insulate electrical connections.
- Firing a single down line to initiate multiple nonelectric delay detonators for each explosive deck.

Fumes

The reaction product gases resulting from the detonation of commercial explosives and blasting agents consist principally of carbon dioxide, nitrogen, and water vapor (steam). Admixed with air these are, in the ordinary sense, nontoxic. However, poisonous gases, including carbon monoxide and nitrogen oxides, are also present in some small concentration in the detonation reaction products from all real explosives. In the explosives industry these toxic gases are called fumes. The toxic gas components, carbon monoxide and nitrogen oxides are sometimes referred to jointly as noxious gas. Fumes should not be confused with smoke, which is composed mainly of steam and the solid products of combustion or detonation. Although smoke is nontoxic, excessive exposure to smoke, especially that produced by dynamite, can cause severe headaches and should be avoided. The headache may be the result of small particles of unreacted or partially reacted nitroglycerin/nitro glycol in the smoke. Both the nature and the total quantity of poisonous gases and smoke vary between types of explosives. For example, the detonation of emulsion explosives or water gels may produce significantly less smoke than dynamite. Fumes may also vary according to conditions of use. Anything that tends to cool the gases quickly increases the formation of oxides of nitrogen.

In open blasting, fumes cause little concern if they can be quickly dispersed by air movement, but in underground work the type and amount of explosive, the conditions, ventilation, and other factors should be considered.

Where fumes can be a problem, properly formulated and manufactured explosives and basting agents will give minimum quantities of toxic gases. However, it must be recognized that some carbon monoxide and some oxides of nitrogen will result from every detonation of an explosive or blasting agent and that conditions of use can drastically shift the types of gases produced.

Some factors that increase fumes are poor product formulation, inadequate priming, insufficient water resistance, lack of confinement, reactivity of the product with the rock or other material being blasted, and incomplete product reaction. Adequate waiting periods before returning to the blast area are mandatory. This is important because some toxic gases are odorless and colorless. Absence of post blast smoke is no guarantee that hazardous levels of toxic gases are not still present. Never return to an area before ventilation has cleared the fumes from the area.

IME Fume Classification

A classification indicating the amount of poisonous or toxic gases produced by an explosive or blasting agent. The IME Fume Classification is expressed as follows:

Fume Class	Cubic Feet of Poisonous Gases Per (1¼″ x 8″) Cartridge of Explosive Material
1	Less than 0.16
2	0.16 – 0.33
3	0.33 – 0.67

Note: The U.S. Bureau of Mines limits poisonous or toxic gases to 2.5 cu ft per pound of permissible explosive.

For the purpose of fume classification, only poisonous or toxic gases, such as carbon monoxide, hydrogen sulfide, and nitrogen oxides are considered.

Section XII: Gases

Category of Gases

Noxious: Asphyxiant due to lack of oxygen.

Toxic: Poisonous - short term exposure.

Physics of Gases

Specific Gravity/Vapor Density: The weight of a ratio of a specific gas compared to the same ratio of air (Air = 1.000).

Temperature: Cold gases will diffuse slowly - hot gases will diffuse quickly.

Barometric Pressure: The lower the pressure, the faster a gas will diffuse.

Solubility: The ability to dissolve in water (taste and/or smell).

Exposure Limits

Threshold Limit Value (TLV): The amount of a gas exposure for an 8-hour day for 5 days a week without any harmful effects.

Ceiling Limits: The amount of gas at no time a person can be exposed to.

Immediately dangerous to life or health (IDLH): The maximum concentration of a gas, in case of SCBA failure, one could escape without any irreversible health effects.

Measurement of Gases

Parts Per Million (PPM): The most accurate measurement of a contaminant in the atmosphere.

PERCENT	**PPM**
1.0	10,000
.1	1,000
.01	100
.001	10
.0001	1

Mine Gases & Their Components

Normal Air

Chemical Formula: None
Specific Gravity: 1.00
Source: Atmosphere
Characteristics: No color, odor, or taste

Pure dry air at sea level contains the following:

Oxygen	20.94%
Nitrogen	78.09%
Argon	0.94%
Carbon Dioxide	0.03%

Oxygen

Chemical Formula: O_2
Specific Gravity: 1.105
Source: Atmosphere
Characteristics: No color, odor, or taste, Oxygen will not burn or explode.

Note: When another gas is introduced into the atmosphere of an artificial environment, such as a mine, tunnel, or manhole, oxygen is usually displaced causing asphyxiation.

Health Effects:

CONCENTRATION (%)	PHYSIOLOGICAL EFFECT
21%	Breathing easiest.
19.5%	Minimum required by law.
17%	Breathing faster and deeper, possible impaired judgment.
16.25%	First signs of anoxia or hypoxia occur.
15%	Dizziness, buzzing in ears, headache, blurred vision, rapid breathing.
12% to 16%	Rapid breathing and pulse, impaired muscular coordination.
10% to 12%	Emotional upset and abnormal fatigue on exertion.
6% to 10%	Nausea and vomiting, inability to move, unconsciousness.
< 6%	Convulsive movements, gasping respiration, breathing ceases, cardiac arrest occurs.

Carbon Monoxide

Chemical Formula: CO
Specific Gravity: 0.967
Source: Carbon monoxide results from incomplete combustion of organic carbon-based materials. It is also an after-product of detonated explosives and diesel engines. Carbon monoxide is highly toxic to the body. When inhaled, CO quickly bonds with the body's hemoglobin, thus reducing the blood's ability to carry oxygen throughout the body.
Characteristics: Flammable, Colorless, Tasteless, Odorless, Lighter than air.
Ignition Temperature: 1100º
Explosive Range: 12.5% to 74%
Limits: TLV – 50 PPM
Ceiling – 200 PPM
IDLH – 1500 PPM

Health Effects:

CONCENTRATION (PPM)	PHYSIOLOGICAL EFFECT
200	Slight headache, tiredness, dizziness, and nausea after 2 to 3 hours.
400	Frontal headache within 1 to 2 hours, life-threatening after 3 hours.
800	Dizziness, nausea, and convulsions within 45 minutes. Unconsciousness within 2 hours. Death in 2 to 3 hours.
1,600	Headache, dizziness, nausea within 20 minutes. Death within 1 hour.
3,200	Headache, dizziness, and nausea within 5 to 10 minutes. Death within 30 minutes.
6,400	Headache, dizziness, and nausea within 1 to 2 minutes. Death within 10 to 15 minutes.

Nitrogen

Chemical Formula: N_2
Specific Gravity: 0.967
Source: Nitrogen composes 78.09% of the atmosphere. It is a non-flammable gas.
Characteristics: Colorless, Odorless, Tasteless, Non-flammable, Lighter than air.
Limits: Ceiling – 810,000 PPM

Nitrogen Dioxide

Chemical Formula: NO_2
Specific Gravity: 1.589
Source: Nitrogen dioxide is an extremely toxic gas to the human body. It is produced from the detonation of explosives and it is found in diesel exhaust. It is a non-flammable gas that is heavier than air. In high concentrations, nitrogen dioxide forms nitric acid in the lungs causing pulmonary edema.
Characteristics: Reddish-brown color in high concentrations, Acrid or "bleach" odor, Non-flammable, Heavier than air.
Limits: TLV – 1 PPM
Ceiling – 5 PPM
IDLH – 50 PPM

Health Effects:

CONCENTRATION (PPM)	PHYSIOLOGICAL EFFECT
1 to 13	Irritation of nose and throat.
10 to 20	Mild irritation of eyes, nose, and upper respiratory tract.
80	Tightness in chest after 3 to 5 minutes.
90	Pulmonary edema after 30 minutes.

Hydrogen Sulfide

Chemical Formula: H_2S
Specific Gravity: 1.191
Source: Hydrogen sulfide is an extremely toxic gas. It blocks the use of oxygen by the body's cells. It is produced when sulfur compounds decompose. It is commonly associated with acid mine water. This gas is released whenever a mine pool is agitated. Can be produced in mine fires should sulfide ores be present.
Characteristics: Colorless, Sweet taste, Odor similar to rotten eggs at very low concentrations (0.003 PPM), Extremely flammable, heavier than air, highly soluble.
Ignition Temperature: 700º
Explosive Range: 4.3% to 46%
Limits: TLV – 10 PPM
Ceiling – 15 PPM
IDLH – 300 PPM

Health Effects:

CONCENTRATION (PPM)	PHYSIOLOGICAL EFFECT
10	Obvious and unpleasant odor (rotten eggs).
50	Mild conjunctivitis, respiratory tract irritation in 30 to 60 minutes.
100	Kills sense of smell in 3 to 5 minutes, may sting eyes and throat.
200	Stings eyes and throat.
250	Exposure for 1 hour is the Hazardous Limit concentration which may cause death.
300	Immediately dangerous to life.
500	Dizziness, coughing, breathing ceases within minutes, artificial respiration required.
600	May cause death within 2 minutes.
700	Unconscious quickly, death if not rescued immediately.
1000	Unconscious instantly, breathing ceased, death within a few breaths. Death may occur even if rescued immediately.

Sulfur Dioxide

Chemical Formula: SO_2
Specific Gravity: 2.264
Source: Sulfur dioxide is produced when iron pyrite burns in gob fires or by blasting sulfide ores. It is also found in diesel exhaust. Sulfur dioxide has the same effect on the body as nitrogen dioxide, except that sulfuric acid is created in the lungs. It is a non-flammable gas.
Characteristics: Colorless, Heavy sulfur odor, Acidic taste, Heavier than air, Non-flammable.
Limits: TLV – 5 PPM
Ceiling – 10 PPM
IDLH – 100 PPM
Health Effects:

CONCENTRATION (PPM)	PHYSIOLOGICAL EFFECT
0.3 to 1	Detectable by taste rather than odor.
3 to 5	Detectable odor.
10	Maximum concentration allowable for prolonged exposure.
20	Least amount causing coughing and irritation of eyes.
50	Irritation to eyes, lungs, throat.
50 to 100	Maximum concentration for short exposure (30 to 60 minutes).
150	May be endured for several minutes. Extremely disagreeable.
400 to 500	Life-threatening.

Carbon Dioxide

Chemical Formula: CO_2
Specific Gravity: 1.529
Source: Carbon Dioxide is a natural component of air at approximately 0.03%. It is also a key component of Black Damp, caused by biological oxidation such as rotting mine timbers. Increased concentrations of carbon dioxide replace the oxygen content of the mine air thus producing a toxic atmosphere.
Characteristics: Colorless, Odorless, Heavier than air, Acidic taste at high concentrations.
Limits: Ceiling – 1.5%
IDLH – 50,000 PPM
Health Effects: At 5%, stimulated respiration.
At 7% to 10%, unconsciousness after few minutes of exposure.

Methane

Chemical Formula: CH_4
Specific Gravity: 0.555
Source: Carbon products decaying in anoxic environment.
Characteristics: No color, odor, or taste. Needs 12.5% O2 to ignite.
Ignition Temperature: 1100º – 1300º F
Explosive Range: 5 – 15%

Hydrogen

Chemical Formula: H_2
Specific Gravity: 0.0695
Source: Hydrogen is an extremely explosive gas that is commonly found in battery charging stations. It can also be created when water is applied to super-hot mine fires or from the incomplete combustion in explosions. Adding strong acids to iron or steel can also release hydrogen into the atmosphere.
Characteristics: Colorless, Odorless, Tasteless, Flammable, Lighter than air, Explosive when exposed to heat or flame. Needs 5% oxygen to ignite.
Ignition Temperature: 1030º – 1130º F
Explosive Range: 4.1% – 74%
Health Effects: Asphyxiant at high concentrations.

The Wheatstone Bridge – catalyst diffusion

Resistor R1 is the reference element. It is a fixed resistor, but its value will vary slightly with atmospheric temperature. It is mounted near the sensing element to compensate for atmospheric effects upon RX.

Resistor R3 has a fixed resistance.

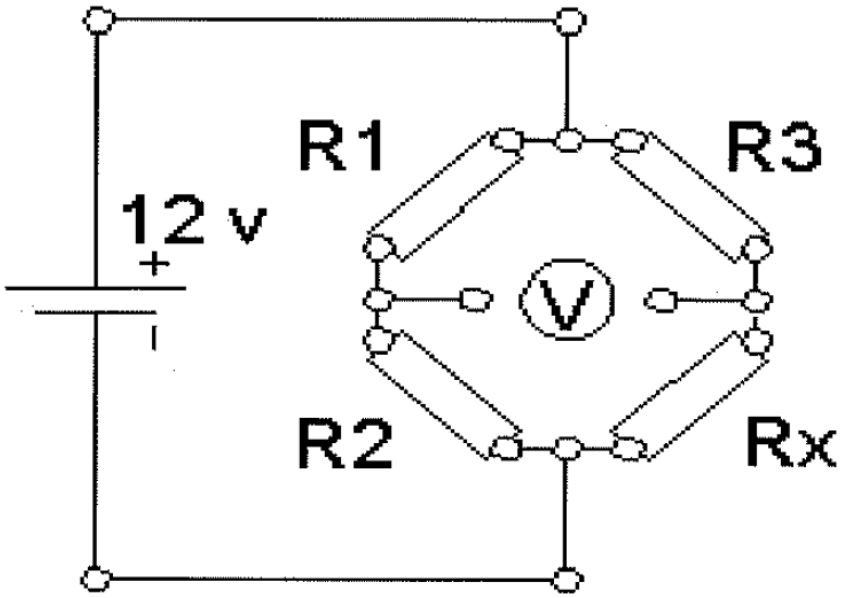
Resistor RX is the sensing element. Its resistance will vary according to some variable factor, which will be measured.

Resistor R2 is a potentiometer, which has variable resistance. By the use of R2, we adjust the balance of the bridge until the meter reads zero. (This is electrical zero).

When the bridge is balanced, there is no difference in potential between points A and C, thus no current through the meter, and it will read zero.

At this time, the voltage drop across RX is equal to that of R2, and the voltage drop across R1 is equal to that of R3.

A balanced bridge has a formula of $\frac{R_x}{R_1} = \frac{R_2}{R_3}$



Electrochemical Sensors:

Infrared Sensors:

Hand Held Detectors

CSE 102 METHANOMETER (single gas)
Gases Detected: Methane (Pre-Set)
Range of Detection: 0% to 9.9%
Display: L.E.D.
Principal of Operation: Catalytic Diffusion
Sampling Method: Manually Operated Internal Pump

MSA METHANE SPOTTER (single gas)
Gases Detected: Methane (Pre-Set)
Range of Detection: 0% to 9.9%
Display: Needle & Gauge
Principal of Operation: Catalytic Diffusion
Sampling Method: Manually Operated Internal Pump

INDUSTRIAL SCIENTIFIC CD210 (single gas)
Gases Detected: Methane (Pre-Set)
Range of Detection: 0% to 9.9%
Display: L.E.D.
Principal of Operation: Catalytic Diffusion
Sampling Method: Manually Operated Internal Pump

INDUSTRIAL SCIENTIFIC MDU420 (single gas)
Gases Detected: Methane (Pre-Set)
Range of Detection: 0% to 100%
Display: L.C.D.
Principal of Operation: Non-Dispersive Infrared Absorption (NDIR)
Sampling Method: Internal Constant Flow Pump

INDUSTRIAL SCIENTIFIC MX240/250 (two gas)
Gases Detected: Methane & Oxygen (Pre-Set)
Range of Detection: 0% to 9.9% Methane
0% to 30% Oxygen
Display: L.C.D.
Principal of Operation: Catalytic Diffusion, Electrochemical Sensor
Sampling Method: Internal Constant Flow Pump

INDUSTRIAL SCIENTIFIC CMX270 (three gas)

Gases Detected:	Methane/Oxygen/Carbon Monoxide (Pre-Set)
Range of Detection:	0% to 9.9% Methane
	0% to 30% Oxygen
	0 ppm to 999 ppm Carbon Monoxide
Display:	L.C.D.
Principal of Operation:	Catalytic Diffusion, Electrochemical Sensor
Sampling Method:	Internal Constant Flow Pump

CSE EXPLORER (three gas)

Gases Detected:	Methane/Oxygen/Carbon Monoxide/Hydrogen Sulfide
	(Interchangeable)
Range of Detection:	0% to 5% Methane
	0% to 25% Oxygen
	N/A - Carbon Monoxide/Hydrogen Sulfide
Display:	L.E.D.
Principal of Operation:	Catalytic Diffusion, Electrochemical Sensor
Sampling Method:	Internal Constant Flow Pump

MSA FIVESTAR PASSPORT (four gas)

Gases Detected:	Methane/Oxygen/Carbon Monoxide/Hydrogen Sulfide
	Sulfur Dioxide/Nitrogen Dioxide/Nitric Oxide
Range of Detection:	0% to 5% Methane
	0% to 30% Oxygen
	N/A - Carbon Monoxide/Hydrogen Sulfide/Sulfur Dioxide
	Nitrogen Dioxide/Nitric Oxide
Display:	L.C.D.
Principal of Operation:	Catalytic Diffusion, Electrochemical Sensor
Sampling Method:	Internal Constant Flow Pump

INDUSTRIAL SCIENTIFIC CO262 (single gas)

Gases Detected:	Carbon Monoxide (Pre-Set)
Range of Detection:	0 ppm to 999 ppm
Display:	L.C.D.
Principal of Operation:	Electrochemical Sensor
Sampling Method:	Internal Constant Flow Pump

DRAGER MULTI WARN (five gas)

Gases Detected:	Methane/Oxygen/Carbon Monoxide/Nitrogen Dioxide Hydrogen Sulfide/ Nitric Oxide/Carbon Dioxide (Interchangeable)
Range of Detection:	0% to 100% Methane 0% to 25% Oxygen 0 ppm to 2000 ppm Carbon Monoxide 0 ppm to 100 ppm Hydrogen Sulfide 0 ppm to 20 ppm Sulfur Dioxide 0 ppm to 20 ppm Nitrogen Dioxide 0 ppm to 100 ppm Nitric Oxide 0% to 25% Carbon Dioxide
Display:	L.C.D.
Principal of Operation:	Electrochemical Sensor, Catalytic Diffusion, Infrared Sensor

INDUSTRIAL SCIENTIFIC TMX412 (four gas)

Gases Detected:	Methane/Oxygen/Hydrogen Sulfide/Carbon Monoxide Nitrogen Dioxide/Sulfur Dioxide (Interchangeable)
Range of Detection:	0% to 5% Methane 0% to 30% Oxygen 0 ppm to 999 ppm Carbon Monoxide 0 ppm to 999 ppm Hydrogen Sulfide 0 ppm to 99.9 ppm Sulfur Dioxide 0 ppm to 99.9 ppm Nitrogen Dioxide
Display:	L.C.D.
Principal of Operation:	Catalytic Diffusion, Electrochemical Sensor
Sampling Method:	Internal Constant Flow Pump

DRAGER MULTIGAS DETECTOR (single gas)

Gases Detected:	Available Sampling Tubes from Manufacturer
Range of Detection:	Determined by Sampling Tube
Display:	Increments on Tube
Principal of Operation:	Atmospheric Reaction to Chemical in Preset Tubes
Sampling Method:	Hand Operated Bellows Pump

INDUSTRIAL SCIENTIFIC STX70 (single gas)

Gases Detected:	Oxygen/Carbon Monoxide/Hydrogen Sulfide Nitrogen Dioxide/Nitric Oxide/Sulfur Dioxide
Range of Detection:	0% to 30% Oxygen 0 ppm to 999 ppm Carbon Monoxide 0 ppm to 999 ppm Hydrogen Sulfide 0 ppm to 999 ppm Nitric Oxide 0 ppm to 99.9 ppm Nitrogen Dioxide 0 ppm to 99.9 ppm Sulfur Dioxide
Display:	L.C.D.
Principal of Operation:	Electrochemical Sensor
Sampling Method:	Internal Constant Flow Pump

Section XIII: Ventilation

Anemometer

Most common instrument to measure air velocity over 100 feet per minute.

The air flowing against the vanes causes the wheel to rotate which in turn causes the dials to move.

Large dial registers a velocity of 1 to 100 feet per minute.

Smaller dials register 100+ and 1000+, respectively.

When needle is not on a number, go back to the preceding number.

Usually anemometer reading is taken over 1 minute.

Reading is 3,296, taken for one (1) minute.

If taken for more than one (1) minute, divide the reading by the time in minutes.

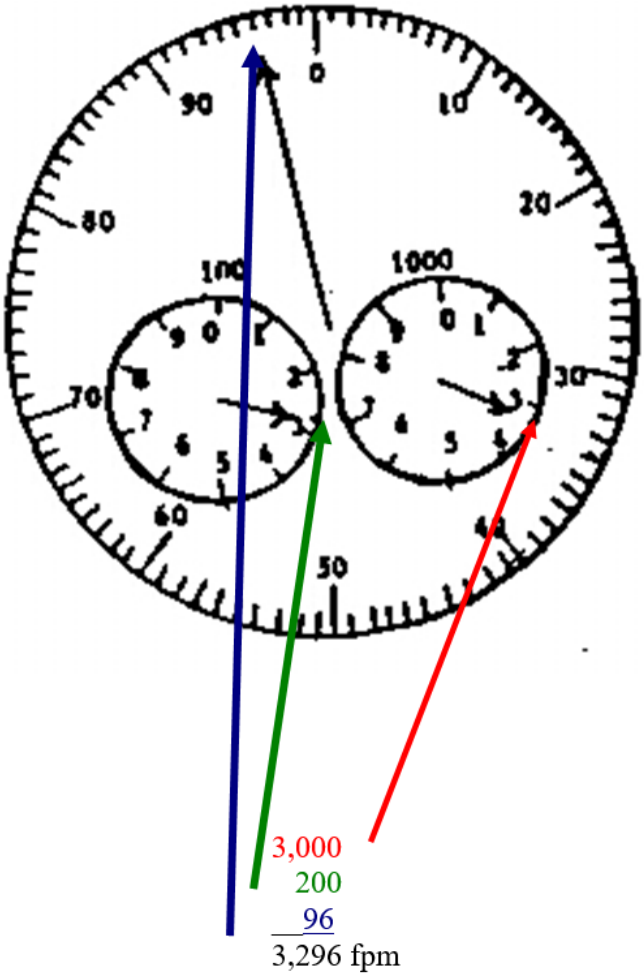
If taken under one (1) minute, multiply the reading.

Example:

30 second reading = x 2

15 second reading = x 4

All readings are in feet per minute.



Correcting Anemometer Readings

The indicated velocity (dial reading) does not indicate true air velocity. Therefore, a correction table is provided with each instrument.

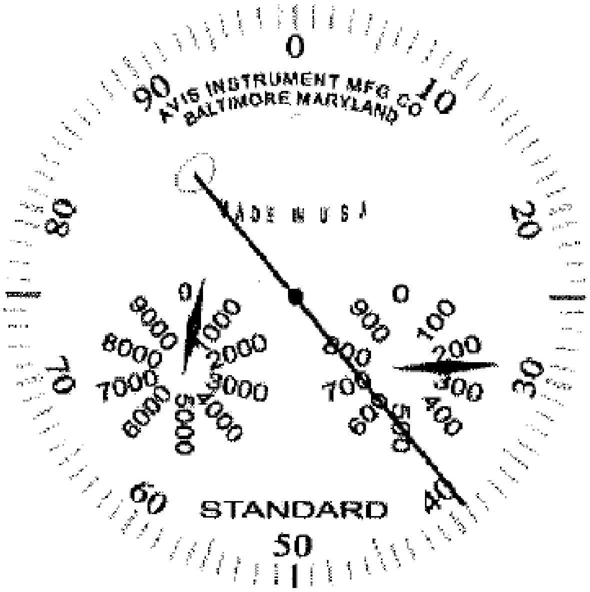
An example is shown below. Each anemometer has a unique correction table and cannot be used with any other anemometer.

Calibration Factor Chart

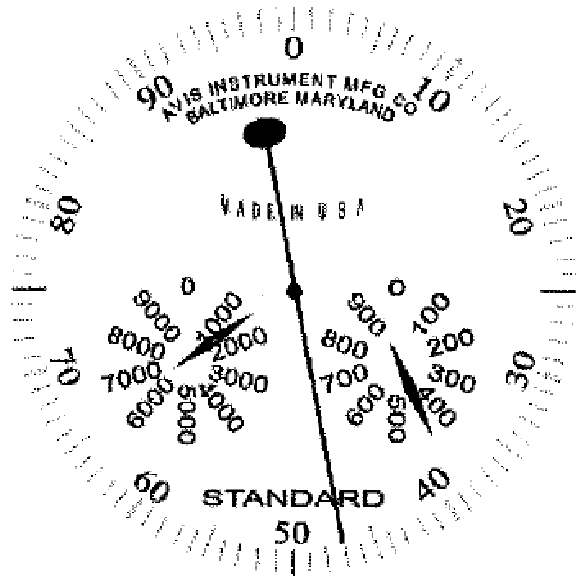
Serial Number	**52832**		
Date	04/14/99		
Ind. Vel.	Correction	Ind. Vel.	Correction
50	+64	500	-15
75	+53	550	-19
100	+41	600	-22
125	+33	700	-27
150	+27	800	-33
175	+21	900	-40
200	+17	1000	-45
250	+9	1200	-56
300	+2	1400	-65
350	-3	1600	-84
400	-8	1800	-104
450	-12	2000	-112
When sign is:	+ Add	- Subtract	

Practice Reading

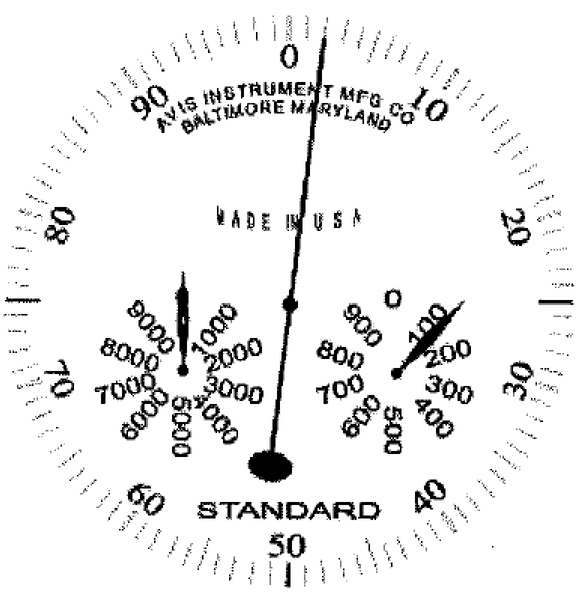
(Use Correction Chart on preceding page)



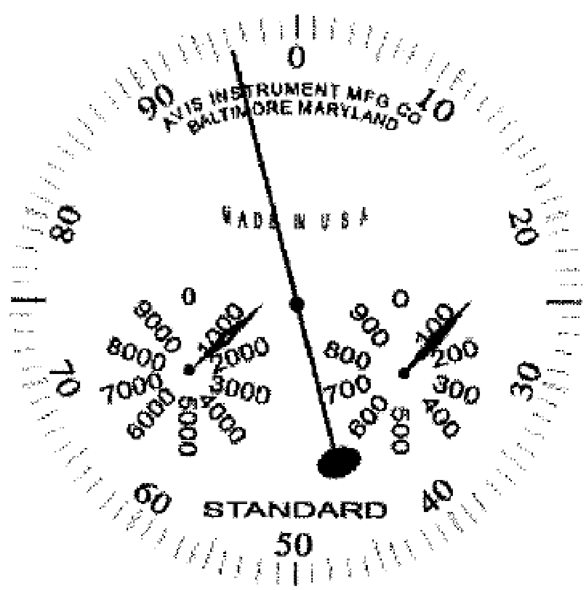
Reading: ________________



Reading: ________________



Reading: ________________

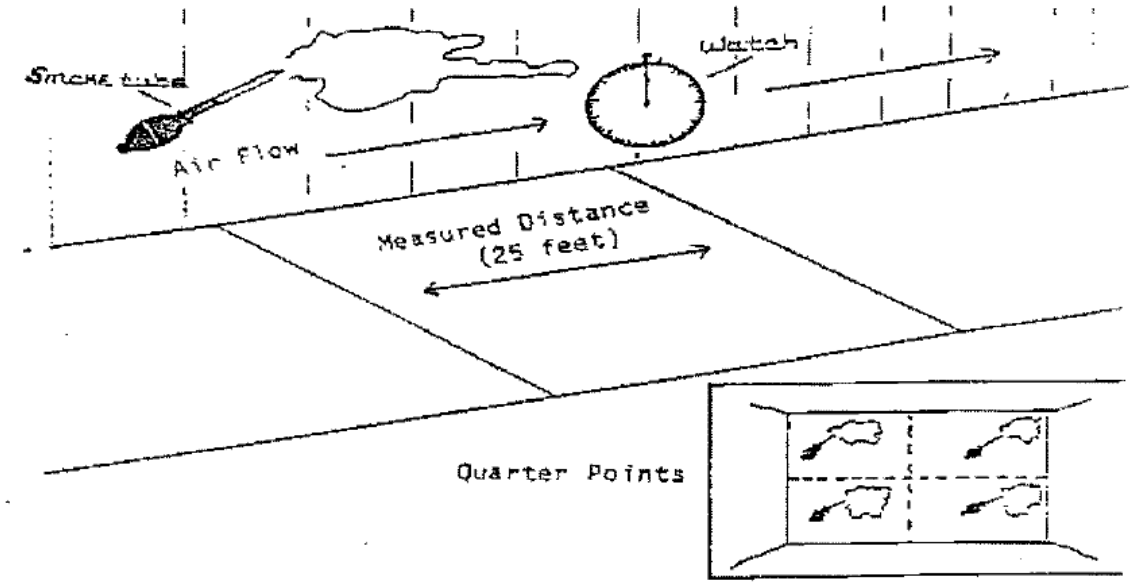


Reading: ________________

Smoke Tube Velocity Readings

When air velocity is less than 100 fpm, the dial on the anemometer hardly turns.

Items needed: aspirator bulb, smoke tubes, tape measure, watch, and two persons are needed to perform this task.



- To calculate air velocity using a smoke tube.
- As shown above, the measured distance is 25 ft., and it averages 23 seconds to travel to the downwind point.
- You first have to convert the smoke tube reading into feet per minute.
- Find the decimal equivalent of 23 seconds of 60 seconds.
    - To find what fraction of a minute is:

$$\frac{23 \text{ seconds}}{60 \text{ seconds}} = .38 \text{ minute, then } \frac{25 \text{ feet of travel}}{.38 \text{ minute}} = 67.7 \text{ feet per minute}$$

Velocity = 67.7

Use the Quantity Formula to calculate the Quantity of Air: $Q = A \times V$

Section XIV: Basic Math & Problem Solving

Review of Formula Terms

a = sectional area of airway, in square feet ($ft.^2$)
v = velocity of air current, in feet per minute (fpm)
q = quantity of air, in cubic feet per minute (cfm)

Common Area Formulas

Area of Squares and Rectangles

$$\text{Area} = \text{Height} \times \text{Width}$$

Note: Please remember to convert inches into the decimal equivalent of one foot (inches divided by 12).

Practice Problems – Area; Rectangle

Determine the area of a mine entry that is 19 feet wide and 7 feet high:

***Solution*:**

$A = W \times H$

$A = 19' \times 7'$

$\mathbf{A = 133\ sq.ft.}$

Practice Problems – Area; Rectangle

Determine the area of a mine entry that is 18 feet wide and 5 feet, 6 inches high:

Solution:

$A = W \times H$

$A = 5.5' \times 18'$

$\mathbf{A = 99\ sq.ft.}$

Practice Problems

Determine the area of a mine entry that is 17 feet 3 inches wide and 6 feet 9 inches high:

Solution:

$A = W \times H$

$A = 17.25' \times 6.75'$

$\mathbf{A = 116.43\ sq.ft.}$

Area of Trapezoids

$$\text{Area} = \frac{\text{Top Width} + \text{Bottom Width}}{2} \times \text{Height}$$

Practice Problems – Area; Trapezoid

Determine the area of a mine entry that is 6 feet high, 18 feet wide across the top, and 19 feet wide across the bottom.

Solution:

$$\text{Area} = \frac{\text{Top Width} + \text{Bottom Width}}{2} \times \text{Height}$$

$$\text{A} = \frac{18' + 19'}{2} \times 6'$$

$$\text{A} = \frac{37'}{2} \times 6'$$

$$\text{A} = 18.5' \times 6'$$

$$\mathbf{A = 111.00\ sq.ft.}$$

Practice Problems – Area; Trapezoid

Determine the area of a mine entry that is 5 feet high, 20 feet wide across the top, and 22 feet wide across the bottom.

Solution:

$$\text{Area} = \frac{\text{Top Width} + \text{Bottom Width}}{2} \times \text{Height}$$

$$\text{A} = \frac{20' + 22'}{2} \times 5'$$

$$\text{A} = \frac{42'}{2} \times 5'$$

$$\text{A} = 21' \times 5'$$

$$\mathbf{A = 105\ sq.ft.}$$

Practice Problems

Determine the area of a mine entry that is 4 feet 6 inches high, 17 feet wide across the top, and 20 feet wide across the bottom.

Solution:

$$\text{Area} = \frac{\text{Top Width} + \text{Bottom Width}}{2} \times \text{Height}$$

$$\text{A} = \frac{17' + 20'}{2} \times 4.5'$$

$$\text{A} = \frac{37'}{2} \times 4.5'$$

$$\text{A} = 18.5' \times 4.5'$$

$$\mathbf{A = 83.25\ sq.ft.}$$

Area of Circles

$$\text{A} = \frac{¶ \times \text{D}^2}{4}$$

or

$$\text{A} = ¶ \times \text{R}^2$$

Please use the following for Pi: $¶ = 3.1416$

Practice Problems – Area; Circle

Determine the area of a circle that has a diameter of 20 feet 9 inches.

Solution:

$$\text{A} = ¶ \times \text{R}^2$$

$$\text{R} = \frac{20.75}{2} = 10.375$$

$$\text{A} = 3.1416 \times 10.375^2$$

$$\text{A} = 3.1416 \times 107.640$$

$$\mathbf{A = 338.16\ sq.ft.}$$

Practice Problems – Area; Circle

Determine the area of a circular airshaft with a diameter of 20 feet.

Solution:

$$A = ¶ \times R^2$$

$$R = \frac{20}{2} = 10$$

$$A = 3.1416 \times 10^2$$

$$A = 3.1416 \times 100$$

$$\mathbf{A = 314.16\ sq.ft.}$$

Practice Problems

Determine the area of a circle that has a diameter of 17 feet.

Solution:

$$A = ¶ \times R^2$$

$$R = \frac{17}{2} = 8.5$$

$$A = 3.1416 \times 8.5^2$$

$$A = 3.1416 \times 72.25$$

$$\mathbf{A = 226.98\ sq.ft.}$$

Formula Equations

Quantity of Air (cfm)

$$Q = AV$$

$$\text{Quantity} = \text{Area} \times \text{Velocity}$$

Velocity of Air (fpm)

$$V = \frac{Q}{A}$$

$$\text{Velocity} = \text{Quantity} \div \text{Area}$$

Area (When Velocity and Quantity Are Known)

$$A = \frac{Q}{V}$$

$$\text{Area} = \text{Quantity} \div \text{Velocity}$$

Practice Problems – Quantity

Find the quantity of air passing through an entry 17 feet 6 inches wide and 9 feet high, with 180 fpm registered on the anemometer.

$$A = WH$$
$$Q = AV$$

Solution:

$$A = WH$$
$$A = 17.5' \times 9'$$
$$A = 157.5 \text{ sq. ft.}$$

$$Q = AV$$
$$Q = (157.5 \text{ sq. ft.})(180 \text{ fpm})$$
$$\mathbf{Q = 28,350 \text{ CFM}}$$

Practice Problems – Quantity

Find the quantity of air passing through an entry 18 feet wide and 6 feet 6 inches high, with 110 fpm registered on the anemometer.

$$A = WH$$
$$Q = AV$$

Solution:

$$A = WH$$
$$A = 18' \times 6.5'$$
$$A = 117 \text{ sq. ft.}$$

$$Q = AV$$
$$Q = (117 \text{ sq. ft.})(110 \text{ fpm})$$
$$\mathbf{Q = 12,870 \text{ CFM}}$$

Practice Problems – Velocity

What is the velocity in an entry 10 feet high and 22 feet wide, with a quantity of 11,380 CFM?

$$\mathrm{A} = \mathrm{WH}$$
$$\mathrm{V} = \frac{\mathrm{Q}}{A}$$

Solution:

$$\mathrm{A} = \mathrm{WH}$$
$$\mathrm{A} = 22' \times 10'$$
$$\mathrm{A} = 220 \text{ sq. ft.}$$

$$\mathrm{V} = \frac{\mathrm{Q}}{\mathrm{A}}$$
$$\mathrm{V} = \frac{11{,}380 \text{ CFM}}{220 \text{ sq. ft.}}$$
$$\mathbf{V = 51.72 \text{ fpm}}$$

Practice Problems – Area

An entry has 12,500 CFM of air with a velocity of 150 fpm. What is the area of the entry?

$$\mathrm{A} = \frac{\mathrm{Q}}{\mathrm{V}}$$

Solution:

$$\mathrm{A} = \frac{\mathrm{Q}}{\mathrm{V}}$$
$$\mathrm{A} = \frac{12{,}500 \text{ CFM}}{150 \text{ fpm}}$$
$$\mathbf{A = 83.33 \text{ sq. ft.}}$$

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United States Department of Labor, Mine Safety and Health Administration: https://www.msha.gov/

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