Test Preparation Study Guide
for
Coal Miner Certification

SURFACE MINE FOREMAN

Test Preparation Study Guide
For
Surface Mine Foreman Certification

SURFACE MINE FOREMAN

This guide was developed by the Utah Labor Commission.
The CFR references throughout this guide are current as of 2014.

Tables of Contents

CHAPTER 1

Electricity	**Page**
Electrical Accidents	6
High and Low Voltages	7
Electrical Symbols	8
Federal Mine Safety & Health Act of 1977	10
Code of Federal Regulations Part 77	16
Questions and Review	29

CHAPTER 2

Mine Law	**Page**
Federal Mine Safety & Health Act of 1977	32
Code of Federal Regulations Part 48	59
Code of Federal Regulations Part 50	67
Code of Federal Regulations Part 77	72
Utah State Code	88
Questions and Review	99

CHAPTER 3

General Mining and Mechanical	**Page**
Hazardous Material - CFR Part 47	102
Occupational Noise Exposure – CFR Part 62	116
General Mining - CFR Part 71	129
Safeguards for Mechanical Equipment - CFR Part 77	138
Questions and Review	146

CHAPTER 4

First Aid

	Page
MSHA Safety Manual – First Aid	149
Code of Federal Regulations – First Aid	168
Questions and Review	173

CHAPTER 5

Dust Control

	Page
Best Practices for Dust Control – NIOSH publication	176
Federal Mine Safety & Health Act of 1977 – Title II	185
Code of Federal Regulations Part 71	190
Code of Federal Regulations Part 72 and 74	199
Questions and Review	212

CHAPTER 6

Surface Haulage

	Page
Surface Haulage Safety	214
Code of Federal Regulations Part 77	231
Questions and Review	237

CHAPTER 7

Fires and Explosions

	Page
Historical Mine Disasters	241
Fire Classifications	242
Mining Terms for Explosive Mixtures	245
Code of Federal Regulations Part 77	247
Questions and Review	251

CHAPTER 8

Mine Gases

	Page
Methane	254
Carbon Monoxide	255
Carbon Dioxide	257
Hydrogen Sulfide	258
Hydrogen	260
Sulfur Dioxide	261
Nitrogen Dioxide	262
Nitrogen	263
Oxygen	264
Acetylene	265
Properties of Air	268
Types of Coal	269
Properties of Mine Gases	270
Questions and Review	271

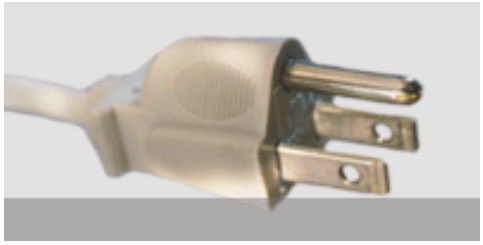
CHAPTER ONE

ELECTRICITY

1. Electrical Accidents
2. High and Low Voltages
3. Electrical Symbols
4. Federal Mine Safety & Health Act of 1977
5. Code of Federal Regulation Part 77
6. Questions and Review

ELECTRICTY

ELECTRICAL ACCIDENTS



Electrical accidents are the 4th leading cause of death in mining and are disproportionately fatal compared with most other types of mining accidents. Electrical shock causes over 90% of all mine electrical fatalities. About one-fifth of these deaths result when high-reaching mobile equipment contacts power lines overhead. Burns are the leading cause of electrical injury by a nearly 2-to-1 margin. They typically result from non-contact electrical arc flashes which can produce temperatures as high as 35,000 degrees F. Pressure waves from the rapidly-heated air cause secondary injuries such as blunt-force trauma, cuts, abrasions, and hearing damage. One-half of all mine electrical injuries and fatalities occur during electrical maintenance work, with the following electrical components most commonly involved: circuit breakers, conductors, batteries, and meters. The wide variety of electrical injuries on-the-job suggests that no single intervention strategy can eliminate occupational electrical fatalities and injuries. Instead, multi-faceted research approaches that consider not only engineering controls but also organization of work, training, and personal protective equipment are needed to mitigate electrical hazards.

Information electrical accidents was obtained from the following publications/websites:

- **NIOSH Office of Mine Safety and Health Research**

ELECTRICTY

HIGH AND LOW VOLTAGES

The numerical definition of ***high voltage*** depends on the context of the discussion. Two factors considered in the classification of a "high voltage" are the possibility of causing a spark in air, and the danger of electric shock by contact or proximity. The definitions may refer either to the voltage between two conductors of a system, or between any conductor and ground.

"Low voltage" is characterized by carrying a substantial risk of electric shock, but only a minor risk of electric arcs through air.

IEC voltage range	AC	DC	defining risk
High voltage	Greater than 1000 V_{rms}	Greater than 1500 V	electrical arcing
Low voltage	50–1000 V_{rms}	120–1500 V	electrical shock
Extra-low voltage	Less than 50 V_{rms}	Less than 120 V	low risk

Safety

International safety symbol "Caution, risk of electric shock" (ISO 3864), colloquially known as ***high voltage symbol.***

Voltages of greater than 50 V applied across dry unbroken human skin are capable of producing heart fibrillation if they produce electric currents in body tissues which happen to pass through the chest area. The electrocution danger is mostly determined by the low electrical conductivity of dry human skin. If skin is wet, or if there are wounds, or if the voltage is applied to electrodes which penetrate the skin, then even voltage sources below 40 V can be lethal if contacted.

Accidental contact with high voltage supplying sufficient energy will usually result in severe injury or death. This can occur as a person's body provides a path for current flow causing tissue damage and heart failure. Other injuries can include burns from the arc generated by the accidental contact. These can be especially dangerous if the victim's airways are

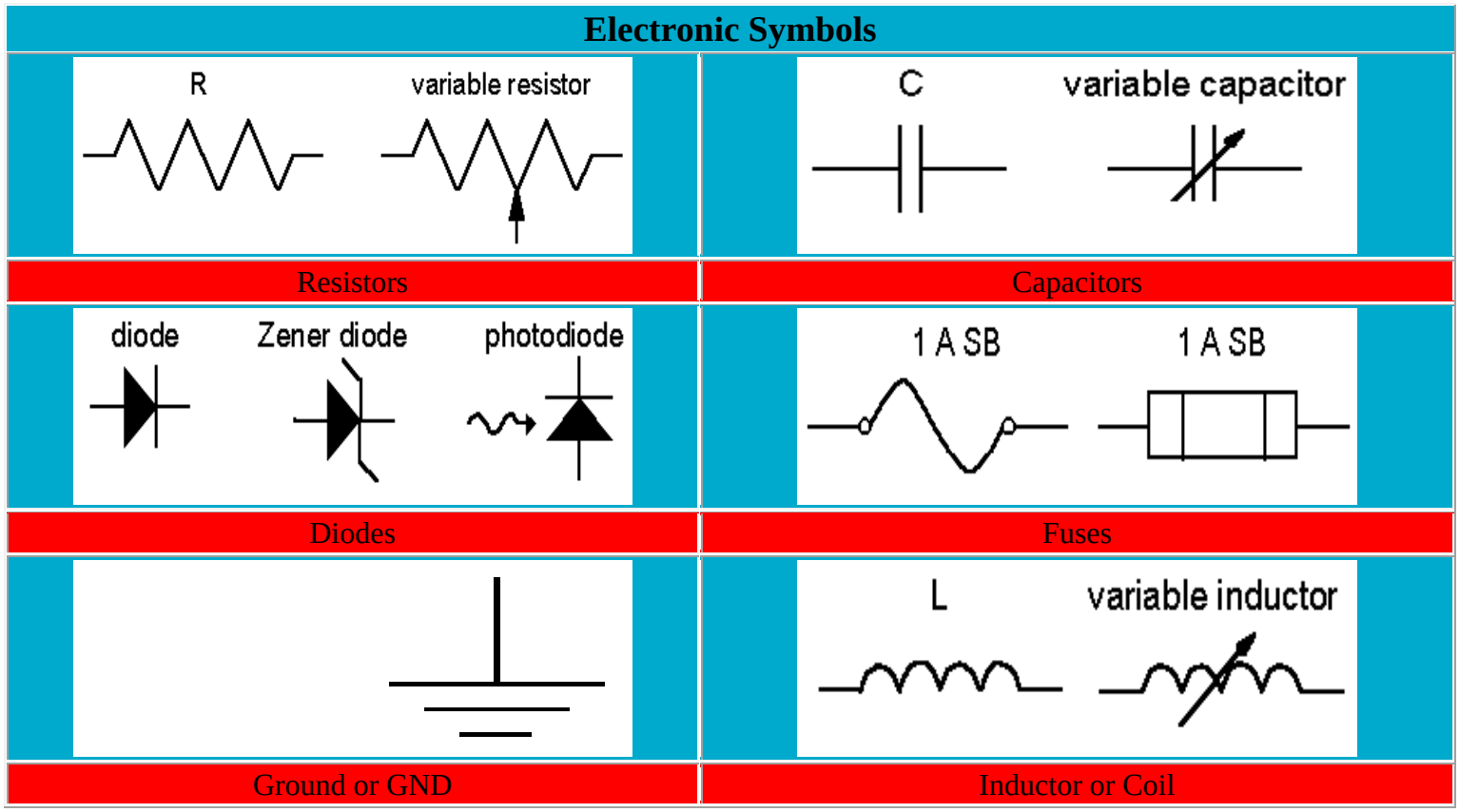
affected. Injuries may also be suffered as a result of the physical forces exerted as people may fall from height or be thrown a considerable distance.

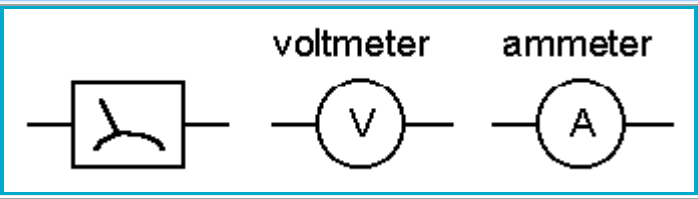
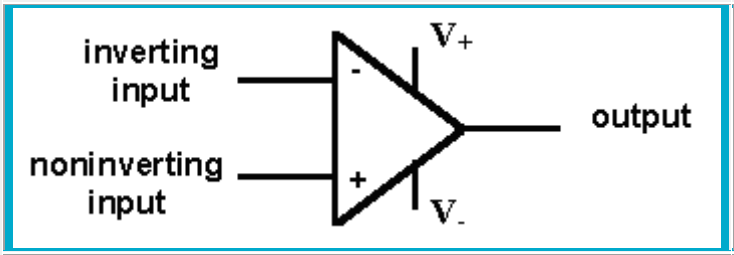
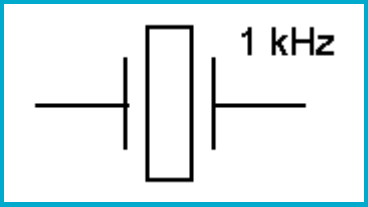
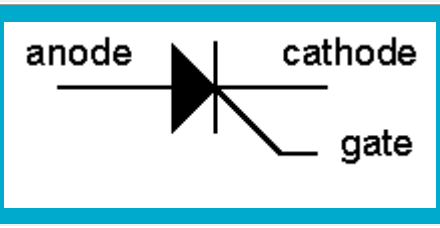
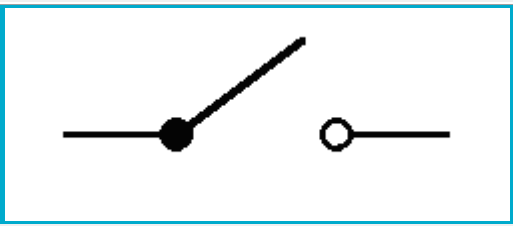
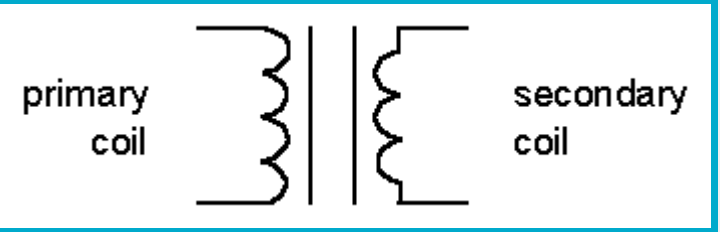
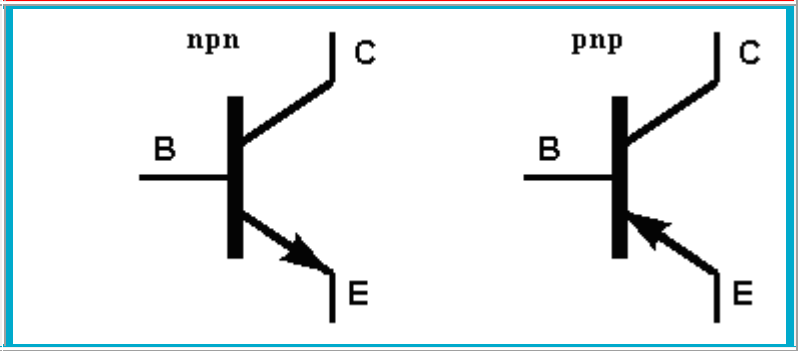
Low-energy exposure to high voltage may be harmless, such as the spark produced in a dry climate when touching a doorknob after walking across a carpeted floor.

Toxic gases

Electrical discharges, including partial discharge and corona, can produce small quantities of toxic gases, which in a confined space can be a serious health hazard. These gases include ozone and various oxides of nitrogen.

Basic Analog Electronic Symbols



Electronic Symbols	
	
Lamp	Meters
	
Operational Amplifier or Op-Amp	Oscillator Crystal
	
Silicon Controlled Rectifier or SCR	Switch
	
Iron Core Transformer	Bi-Polar Transistors

Federal Mine Safety & Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164*

TITLE III - INTERIM MANDATORY SAFETY STANDARDS

DEFINITIONS

SEC. 318. For the purpose of this title and title II of this Act, the term--

(a) "certified" or "registered" as applied to any person means a person certified or registered by the State in which the coal mine is located to perform duties prescribed by such titles, except that, in a State where no program of certification or registration is provided or where the program does not meet at least minimum Federal standards established by the Secretary, such certification or registration shall be by the Secretary;

(b) "qualified person" means, as the context requires,

(1) an individual deemed qualified by the Secretary and designated by the operator to make tests and examinations required by this Act; and
(2) an individual deemed, in accordance with minimum requirements to be established by the Secretary, qualified by training, education, and experience, to perform electrical work, to maintain electrical equipment, and to conduct examinations and tests of all electrical equipment;

(c) "permissible" as applied to--

(1) equipment used in the operation of a coal mine, means equipment, other than permissible electric face equipment, to which an approval plate, label, or other device is attached as authorized by the Secretary and which meets specifications which are prescribed by the Secretary for the construction and maintenance of such equipment and are designed to assure that such equipment will not cause a mine explosion or a mine fire,
(2) explosives, shot firing units, or blasting devices used in such mine, means explosives, shot firing units, or blasting devices which meet specifications which are prescribed by the Secretary, and
(3) the manner of use of equipment or explosives, shot firing units, and blasting devices, means the manner of use prescribed by the Secretary;

(d) "rock dust" means pulverized limestone, dolomite, gypsum, anhydrite, shale, adobe, or other inert material, preferably light colored, 100 per centum of which will pass through a sieve having twenty meshes per linear inch and 70 per centum or more of which will pass through a sieve having two hundred

meshes per linear inch; the particles of which when wetted and dried will not cohere to form a cake which will not be dispersed into separate particles by a light blast of air; and which does not contain more than 5 per centum of combustible matter or more than a total of 4 per centum of free and combined silica (SiO_2), or, where the Secretary finds that such silica concentrations are not available, which does not contain more than 5 per centum of free and combined silica;

(e) "anthracite" means coals with a volatile ratio equal to 0.12 or less;

(f) "volatile ratio" means volatile matter content divided by the volatile matter plus the fixed carbon;

(g)(1) "working face" means any place in a coal mine in which work of extracting coal from its natural deposit in the earth is performed during the mining cycle,

(2) "working place" means the area of a coal mine inby the last open crosscut,

(3) "working section" means all areas of the coal mine from the loading point of the section to and including the working faces,

(4) "active workings" means any place in a coal mine where miners are normally required to work or travel;

(h) "abandoned areas" means sections, panels, and other areas that are not ventilated and examined in the manner required for working places under section 303 of this title;

(i) "permissible" as applied to electric face equipment means all electrically operated equipment taken into or used inby the last open crosscut of an entry or a room of any coal mine the electrical parts of which, including, but not limited to, associated electrical equipment, components, and accessories, are designed, constructed, and installed, in accordance with the specifications of the Secretary, to assure that such equipment will not cause a mine explosion or mine fire, and the other features of which are designed and constructed, in accordance with the specifications of the Secretary, to prevent, to the greatest extent possible, other accidents in the use of such equipment; and the regulations of the Secretary or the Director of the Bureau of Mines in effect on the operative date of this title relating to the requirements for investigation, testing, approval, certification, and acceptance of such equipment as permissible shall continue in effect until modified or superseded by the Secretary, except that the Secretary shall provide procedures, including, where feasible, testing, approval, certification, and acceptance in the field by an authorized representative of the Secretary, to facilitate compliance by an operator with the requirements of section 305(a) of this title within the periods prescribed therein;

(j) "low voltage" means up to and including 660 volts; "medium voltage" means voltages from 661 to 1,000 volts; and "high voltage" means more than 1,000 volts;

(k) [repealed]

(l) "coal mine" includes areas of adjoining mines connected underground.

ELECTRICAL EQUIPMENT GENERAL

SEC. 305. (a)(1) Effective one year after the operative date of this title--

(A) all junction or distribution boxes used for making multiple power connections inby the last open crosscut shall be permissible;
(B) all handheld electric drills, blower and exhaust fans, electric pumps, and such other low horsepower electric face equipment as the Secretary may designate within two months after the operative date of this title which are taken into or used inby the last open crosscut of any coal mine shall be permissible;
(C) all electric face equipment which is taken into or used inby the last open crosscut of any coal mine classified under any provision of law as gassy prior to the operative date of this title shall be permissible; and
(D) all other electric face equipment which is taken into or used inby the last crosscut of any coal mine, except a coal mine referred to in paragraph (2) of this subsection, which has not been classified under any provision of law as a gassy mine prior to the operative date of this title shall be permissible;

(2) Effective four years after the operative date of this title, all electric face equipment, other than equipment referred to in paragraph (1)(B) of this subsection, which is taken into or used inby the last open crosscut of any coal mine which is operated entirely in coal seams located above the watertable and which has not been classified under any provision of law as a gassy mine prior to the operative date of this title and in which one or more openings were made prior to the date of enactment of this Act, shall be permissible, except that any operator of such mine who is unable to comply with the provisions of this paragraph on such effective date may file with the Panel an application for a permit for noncompliance ninety days prior to such date. If the Panel determines, after notice to all interested persons and an opportunity for a public hearing under section 5 of this Act, that such application satisfies the provisions of paragraph (10) of this subsection and that such operator, despite his diligent efforts, will be unable to comply with such provisions, the Panel may issue to such operator such a permit. Such permit shall entitle the permittee to an additional extension of time to comply with the provisions of this paragraph of not to exceed twenty-four months, as determined by the Panel, from such effective date.

(3) The operator of each coal mine shall maintain in permissible condition all electric face equipment required by this subsection to be permissible which is taken into or used inby the last open crosscut of any such mine.

(4) Each operator of a coal mine shall, within two months after the operative date of this title, file with the Secretary a statement listing all electric face equipment by type and manufacturer being used by such operator in connection with mining operations in such mine as of the date of such filing, and stating whether such equipment is permissible and maintained in permissible condition or is nonpermissible on such date of filing, and, if nonpermissible, whether such nonpermissible equipment has ever been rated as permissible, and such other information as the Secretary may require.

(5) The Secretary shall promptly conduct a survey as to the total availability of new or rebuilt permissible electric face equipment and replacement parts for such equipment and, within six months after the operative date of this title, publish the results of such survey.

(6) Any operator of a coal mine who is unable to comply with the provisions of paragraph (1)(D) of this subsection within one year after the operative date of this title may file with the Panel an application for a permit for noncompliance. If the Panel determines that such application satisfies the provisions of paragraph (10) of this subsection, the Panel shall issue to such operator a permit for noncompliance. Such permit shall entitle the permittee to an extension of time to comply with such provisions of paragraph (1)(D) of not to exceed twelve months, as determined by the Panel, from the date that compliance with the provisions of paragraph (1)(D) of this subsection is required.

(7) Any operator of a coal mine issued a permit under paragraph (6) of this subsection who, ninety days prior to the termination of such permit, or renewal thereof, determines that he will be unable to comply with the provisions of paragraph (1)(D) of this subsection upon the expiration of such permit may file with the Panel an application for renewal thereof. Upon receipt of such application, the Panel, if it determines, after notice to all interested persons and an opportunity for a public hearing under section 5 of this Act, that such application satisfies the provisions of paragraph (10) of this subsection and that such operator, despite his diligent efforts, will be unable to comply with the provisions of paragraph (1)(D), may renew the permit for a period not exceeding twelve months.

(8) Any permit or renewal thereof issued pursuant to this subsection shall entitle the permittee to use such nonpermissible electric face equipment specified in the permit during the term of such permit.

(9) Permits for noncompliance issued under paragraphs (6) or (7) of this subsection shall, in the aggregate, not extend the period of noncompliance more than forty-eight months after the date of enactment of this Act.

(10) Any application for a permit of noncompliance filed under this subsection shall contain a statement by the operator--

> (A) that he is unable to comply with paragraph (1)(D) or paragraph (2) of this subsection, as appropriate, within the time prescribed;
> (B) listing the nonpermissible electric face equipment being used by such operator in connection with mining operations in such mine on the operative

date of this title and the date of the application by type and manufacturer for which a noncompliance permit is requested and whether such equipment had ever been rated as permissible;

(C) setting forth the actions taken from and after the operative date of this title to comply with paragraph (1)(D) or paragraph (2) of this subsection, as appropriate, together with a plan setting forth a schedule of compliance with said paragraphs for each such equipment referred to in such paragraphs and being used by the operator in connection with mining operations in such mine with respect to which such permit is requested and the means and measures to be employed to achieve compliance; and

(D) including such other information as the Panel may require.

(11) No permit for noncompliance shall be issued under this subsection for any nonpermissible electric face equipment, unless such equipment was being used by an operator in connection with the mining operations in a coal mine on the operative date of this title.

(12) Effective one year after the operative date of this title, all replacement equipment acquired for use in any mine referred to in this subsection shall be permissible and shall be maintained in a permissible condition, and in the event of any major overhaul of any item of equipment in use one year from the operative date of this title such equipment shall be put in, and thereafter maintained in, a permissible condition, unless, in the opinion of the Secretary, such equipment or necessary replacement parts are not available.

(b) A copy of any permit granted under this section shall be mailed immediately to a representative of the miners of the mine to which it pertains, and to the public official or agency of the State charged with administering State laws relating to coal mine health and safety in such mine.

(c) Any coal mine which, prior to the operative date of this title, was classed gassy under any provision of law and was required to use permissible electric face equipment and to maintain such equipment in a permissible condition shall continue to use such equipment and to maintain such equipment in such condition.

(d) All power-connection points, except where permissible power connection units are used, outby the last open crosscut shall be in intake air.

(e) The location and the electrical rating of all stationary electric apparatus in connection with the mine electric system, including permanent cables, switchgear, rectifying substations, transformers, permanent pumps and trolley wires and trolley feeder wires, and settings of all direct-current circuit breakers protecting underground trolley circuits, shall be shown on a mine map. Any changes made in a location, electric rating, or setting shall be promptly shown on the map when the change is made. Such map shall be available to an authorized representative of the Secretary and to the miners in such mine.

(f) All power circuits and electric equipment shall be deenergized before work is done on such circuits and equipment, except when necessary for trouble shooting or testing.

In addition, energized trolley wires may be repaired only by a person trained to perform electrical work and to maintain electrical equipment and the operator of such mine shall require that such person wear approved and tested insulated shoes and wireman's gloves. No electrical work shall be performed on low-, medium-, or high-voltage distribution circuits or equipment, except by a qualified person or by a person trained to perform electrical work and to maintain electrical equipment under the direct supervision of a qualified person. Disconnecting devices shall be locked out and suitably tagged by the persons who performed such work, except that, in cases where locking out is not possible, such devices shall be opened and suitably tagged by such persons. Locks or tags shall be removed only by the persons who installed them or, if such persons are unavailable, by persons authorized by the operator or his agent.

(g) All electric equipment shall be frequently examined, tested, and properly maintained by a qualified person to assure safe operating conditions. When a potentially dangerous condition is found on electric equipment, such equipment shall be removed from service until such condition is corrected. A record of such examinations shall be kept and made available to an authorized representative of the Secretary and to the miners in such mine.

(h) All electric conductors shall be sufficient in size and have adequate current-carrying capacity and be of such construction that a rise in temperature resulting from normal operation will not damage the insulating materials.

(i) All electrical connections or splices in conductors shall be mechanically and electrically efficient, and suitable connectors shall be used. All electrical connections or splices in insulated wire shall be reinsulated at least to the same degree of protection as the remainder of the wire.

(j) Cables shall enter metal frames of motors, splice boxes, and electric compartments only through proper fittings. When insulated wires other than cables pass through metal frames the holes shall be substantially bushed with insulated bushings.

(k) All power wires(except trailing cables on mobile equipment, specially designed cables conducting high-voltage power to underground rectifying equipment or transformers, or bare or insulated ground and return wires) shall be supported on well-insulated insulators and shall not contact combustible material, roof, or ribs.

(l) Power wires and cables, except trolley wires, trolley feeder wires, and bare signal wires, shall be insulated adequately and fully protected.

(m) Automatic circuit-breaking devices or fuses of the correct type and capacity shall be installed so as to protect all electric equipment and circuits against short circuit and overloads. Three-phase motors on all electric equipment shall be provided with overload protection that will deenergize all three phases in the event that any phase is overloaded.

(n) In all main power circuits, disconnecting switches shall be installed underground within five hundred feet of the bottoms of shafts and boreholes through which main

power circuits enter the underground area of the mine and within five hundred feet of all other places where main power circuits enter the underground area of the mine.

(o) All electric equipment shall be provided with switches or other controls that are safely designed, constructed, and installed.

(p) Each ungrounded, exposed power conductor that leads underground shall be equipped with suitable lightning arresters of approved type within one hundred feet of the point where the circuit enters the mine. Lightning arresters shall be connected to a low resistance grounding medium on the surface which shall be separated from neutral grounds by a distance of not less than twenty-five feet.

(q) No device for the purpose of lighting any coal mine which has not been approved by the Secretary or his authorized representative shall be permitted in such mine.

(r) An authorized representative of the Secretary may require in any mine that electric face equipment be provided with devices that will permit the equipment to be deenergized quickly in the event of an emergency.

GROUNDING

SEC. 307. (a) All metallic sheaths, armors, and conduits enclosing power conductors shall be electrically continuous throughout and shall be grounded by methods approved by an authorized representative of the Secretary. Metallic frames, casings, and other enclosures of electric equipment that can become "alive" through failure of insulation or by contact with energized parts shall be grounded by methods approved by an authorized representative of the Secretary. Methods other than grounding which provide no less effective protection may be permitted by the Secretary or his authorized representative.

(b) The frames of all offtrack direct current machines and the enclosures of related detached components shall be effectively grounded, or otherwise maintained at no less safe voltages, by methods approved by an authorized representative of the Secretary.

(c) The frames of all stationary high-voltage equipment receiving power from ungrounded delta systems shall be grounded by methods approved by an authorized representative of the Secretary.

(d) High-voltage lines, both on the surface and underground, shall be deenergized and grounded before work is performed on them, except that repairs may be permitted, in the case of energized surface high-voltage lines, if such repairs are made by a qualified person in accordance with procedures and safeguards, including, but not limited to, a requirement that the operator of such mine provide, test, and maintain protective devices in making such repairs, to be prescribed by the Secretary prior to the operative date of this title.

(e) When not in use, power circuits underground shall be deenergized on idle days and idle shifts, except that rectifiers and transformers may remain energized.

Title 30
Code of Federal Regulation
Part 77

30 CFR § 77.500
Electric power circuits and electric equipment; deenergization.

Power circuits and electric equipment shall be deenergized before work is done on such circuits and equipment, except when necessary for troubleshooting or testing.

30 CFR § 77.501
Electric distribution circuits and equipment; repair.

No electrical work shall be performed on electric distribution circuits or equipment, except by a qualified person or by a person trained to perform electrical work and to maintain electrical equipment under the direct supervision of a qualified person. Disconnecting devices shall be locked out and suitably tagged by the persons who perform such work, except that in cases where locking out is not possible, such devices shall be opened and suitably tagged by such persons. Locks or tags shall be removed only by the persons who installed them or, if such persons are unavailable, by persons authorized by the operator or his agent.

30 CFR § 77.501-1
Qualified person.

A qualified person within the meaning of §77.501 is an individual who meets the requirements of §77.103.

30 CFR § 77.502
Electric equipment; examination, testing, and maintenance.

Electric equipment shall be frequently examined, tested, and properly maintained by a qualified person to assure safe operating conditions. When a potentially dangerous condition is found on electric equipment, such equipment shall be removed from service until such condition is corrected. A record of such examinations shall be kept.

30 CFR § 77.502-2
Electric equipment; frequency of examination and testing.

The examinations and tests required under the provision of this §77.502 shall be conducted at least monthly.

30 CFR § 77.503
Electric conductors; capacity and insulation.

Electric conductors shall be sufficient in size and have adequate current carrying capacity and be of such construction that a rise in temperature resulting from normal operation will not damage the insulating materials.

30 CFR § 77.503-1
Electric conductors.

Electric conductors shall be sufficient in size to meet the minimum current carrying capacity provided for in the National Electric Code, 1968. All trailing cables shall meet the minimum requirements for ampacity provided in the standards of the Insulated Power Cable Engineers Association National Electric Manufacturers Association in effect when such cables are purchased.

30 CFR § 77.504
Electrical connections or splices; suitability.

Electrical connections or splices in electric conductors shall be mechanically and electrically efficient, and suitable connectors shall be used. All electrical connections or splices in insulated wire shall be reinsulated at least to the same degree of protection as the remainder of the wire.

30 CFR § 77.505
Cable fittings; suitability.

Cables shall enter metal frames of motors, splice boxes, and electric compartments only through proper fittings. When insulated wires, other than cables, pass through metal frames, the holes shall be substantially bushed with insulated bushings.

30 CFR § 77.506
Electric equipment and circuits; overload and short-circuit protection.

Automatic circuit-breaking devices or fuses of the correct type and capacity shall be installed so as to protect all electric equipment and circuits against short circuit and overloads.

30 CFR § 77.507
Electric equipment; switches.

All electric equipment shall be provided with switches or other controls that are safely designed, constructed, and installed.

30 CFR § 77.508-1
Lightning arresters; wires entering buildings.

Lightning arresters protecting exposed telephone wires entering buildings shall be provided at the point where each such telephone wire enters the building.

30 CFR § 77.508-1
Lightning arresters; wires entering buildings.

Lightning arresters protecting exposed telephone wires entering buildings shall be provided at the point where each such telephone wire enters the building.

30 CFR § 77.509
Transformers; installation and guarding.

(a) Transformers shall be of the totally enclosed type, 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.

(b) Transformer stations shall be enclosed to prevent persons from unintentionally or inadvertently contacting energized parts.

(c) Transformer enclosures shall be kept locked against unauthorized entry.

30 CFR § 77.510
Resistors; location and guarding.

Resistors, heaters, and rheostats shall be located so as to minimize fire hazards and, where necessary, provided with guards to prevent personal contact.

30 CFR § 77.511
Danger signs at electrical installations.

Suitable danger signs shall be posted at all major electrical installations.

30 CFR § 77.512
Inspection and cover plates.

Inspection and cover plates on electrical equipment shall be kept in place at all times except during testing or repairs.

30 CFR § 77.513
Insulating mats at power switches.

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.

30 CFR § 77.514
Switchboards; passageways and clearance.

Switchboards shall be installed to provide passageways or lanes of travel which permit access to the back of the switchboard from both ends for inspection, adjustment or repair. Openings permitting access to the rear of any switchboard shall be guarded, except where they are located in buildings which are kept locked.

30 CFR § 77.515
Bare signal or control wires; voltage.

The voltage on bare signal or control wires accessible to personal contact shall not exceed 40 volts..

30 CFR § 77.516
Electric wiring and equipment; installation and maintenance.

In addition to the requirements of §§77.503 and 77.506, all wiring and electrical equipment installed after June 30, 1971, shall meet the requirements of the National Electric Code in effect at the time of installation.

30 CFR § 77.700
Grounding metallic sheaths, armors, and conduits enclosing power conductors.

Metallic sheaths, armors, and conduits enclosing power conductors shall be electrically continuous throughout and shall be grounded by methods approved by an authorized representative of the Secretary.

30 CFR § 77.700-1
Approved methods of grounding.

Metallic sheaths, armors, and conduits in resistance grounded systems, where the enclosed conductors are a part of the system, will be approved if a solid connection is made to the neutral conductor; in all other systems, the following methods of grounding will be approved:

(a) A solid connection to metal waterlines having low resistance to earth;

(b) A solid connection to a grounding conductor, other than the neutral conductor of a resistance grounded system, extending to a low-resistance ground field;

(c) Any other method of grounding, approved by an authorized representative of the Secretary, which ensures that there is no difference in potential between such metallic enclosures and the earth.

30 CFR § 77.702
Protection other than grounding.

Methods other than grounding which provide no less effective protection may be permitted by the Secretary or his authorized representative. Such methods may not be used unless so approved.

30 CFR § 77.704
Work on high-voltage lines; deenergizing and grounding.

High-voltage lines shall be deenergized and grounded before work is performed on them, except that repairs may be permitted on energized high-voltage lines if (a) such repairs are made by a qualified person in accordance with procedures and safeguards set forth in §§77.704-1 through 77.704-11 of this Subpart H as applicable, and (b) the operator has tested and properly maintained the protective devices necessary in making such repairs.

30 CFR § 77.704-1
Work on high-voltage lines.

(a) No high-voltage line shall be regarded as deenergized for the purpose of performing work on it, until it has been determined by a qualified person (as provided in §77.103) that such high-voltage line has been deenergized and grounded. Such qualified person shall by visual observation (1) determine that the disconnecting devices on the high-voltage circuit are in open position, and (2) insure that each ungrounded conductor of the high-voltage circuit upon which work is to be done is properly connected to the system grounding medium. In the case of resistance grounded or solid wye-connected systems, the neutral wire is the system grounding medium. In the case of an ungrounded power system, either the steel armor or conduit enclosing the system or a surface grounding field is a system grounding medium;

(b) No work shall be performed on any high-voltage line which is supported by any pole or structure which also supports other high-voltage lines until: (1) All lines supported on the pole or structure are deenergized and grounded in accordance with all of the provisions of this §77.704-1 which apply to the repair of deenergized surface high-voltage lines; or (2) the provisions of§§77.704-2 through 77.704-10 have been complied with, with respect to all energized lines, which are

supported on the pole or structure.

(c) Work may be performed on energized surface high-voltage lines only in accordance with the provisions of §§77.704-2through 77.704-10, inclusive.

30 CFR § 77.704-2
Repairs to energized high-voltage lines.
An energized high-voltage line may be repaired only when:
(a) The operator has determined that,
(a)(1) Such repairs cannot be scheduled during a period when the power circuit could be properly deenergized and grounded;
(a)(2) Such repairs will be performed on power circuits with a phase-to-phase nominal voltage no greater than 15,000 volts;
(a)(3) Such repairs on circuits with a phase-to-phase nominal voltage of 5,000 volts or more will be performed only with the use of live line tools; and,
(a)(4) Weather conditions will not interfere with such repairs or expose those persons assigned to such work to an imminent danger; and,
(b) The operator has designated a person qualified under the provisions of §77.104 as the person responsible for carrying out such repairs and such person, in order to ensure protection for himself and other qualified persons assigned to perform such repairs from the hazards of such repair, has prepared and filed with the operator:
(b)(1) A general description of the nature and location of the damage or defect to be repaired;
(b)(2) The general plan to be followed in making such repairs;
(b)(3) A statement that a briefing of all qualified persons assigned to make such repairs was conducted informing them of the general plan, their individual assignments, and the dangers inherent in such assignments;
(b)(4) A list of the proper protective equipment and clothing that will be provided; and
(b)(5) Such other information as the person designated by the operator feels necessary to describe properly the means or methods to be employed in such repairs.

30 CFR § 77.704-6
Protective clothing; use and inspection.

All persons performing work on energized high-voltage surface lines shall wear protective rubber lineman's gloves, sleeves, and climber guards if climbers are worn. Protective rubber gloves shall not be worn wrong side out or without protective leather gloves. Protective devices worn by a person assigned to perform repairs on high-voltage surface lines shall be worn continuously from the time he leaves the ground until he returns to the ground and, if such devices are employed for extended periods, such person shall visually inspect the equipment assigned him for defects before each use and, in no case, less than twice each day.

30 CFR § 77.704-7
Protective equipment; inspection.

Each person shall visually inspect protective equipment and clothing provided him in connection with work on high-voltage surface lines before using such equipment and clothing, and any equipment or clothing containing any defect or damage shall be discarded and replaced with proper protective equipment or clothing prior to the performance of any electrical work on such lines.

30 CFR § 77.800
High-voltage circuits; circuit breakers.

High-voltage circuits supplying power to portable or mobile equipment shall be protected by suitable circuit breakers of adequate interrupting capacity which are properly tested and maintained and equipped with devices to provide protection against under voltage, grounded phase, short circuit and overcurrent. High-voltage circuits supplying power to stationary equipment shall be protected against overloads by either a circuit breaker or fuses of the correct type and capacity.

30 CFR § 77.800-1
Testing, examination, and maintenance of circuit breakers; procedures.

(a) Circuit breakers and their auxiliary devices protecting high-voltage circuits to portable or mobile equipment shall be tested and examined at least once each month by a person qualified as provided in §77.103.

(b) Tests shall include:

(1) Breaking continuity of the ground check conductor where ground check monitoring is used; and,

(2) Actuating any of the auxiliary protective relays.
(c) Examination shall include visual observation of all components of the circuit breaker and its auxiliary devices, and such repairs or adjustments as are indicated by such tests and examinations shall be carried out immediately.

30 CFR § 77.800-2
Testing, examination, and maintenance of circuit breakers; record.

The operator shall maintain a written record of each test, examination, repair, or adjustment of all circuit breakers protecting high-voltage circuits. Such record shall be kept in a book approved by the Secretary.

30 CFR § 77.801
Grounding resistors.

The grounding resistor, where required, shall be of the proper ohmic value to limit

the voltage drop in the grounding circuit external to the resistor to not more than 100 volts under fault conditions. The grounding resistor shall be rated for maximum fault current continuously and insulated from ground for a voltage equal to the phase-to-phase voltage of the system.

30 CFR § 77.802
Protection of high-voltage circuits; neutral grounding resistors; disconnecting devices.

High-voltage circuits supplying portable or mobile equipment shall contain either a direct or derived neutral which shall be grounded through a suitable resistor at the source transformers, and a grounding circuit, originating at the grounded side of the grounding resistor, shall extend along with the power conductors and serve as a grounding conductor for the frames of all high-voltage equipment supplied power from that circuit, except that the Secretary or his authorized representative may permit other high-voltage circuits to feed stationary electrical equipment, if he finds that such exception will not pose a hazard to the miners. Disconnecting devices shall be installed and so equipped or designed in such a manner that it can be determined by visual observation that the power is disconnected.

30 CFR § 77.803
Fail safe ground check circuits on high-voltage resistance grounded systems.

On and after September 30, 1971, all high-voltage, resistance grounded systems shall include a fail safe ground check circuit or other no less effective device approved by the Secretary to monitor continuously the grounding circuit to assure continuity. The fail safe ground check circuit shall cause the circuit breaker to open when either the ground or ground check wire is broken.

30 CFR § 77.803-1
Fail safe ground check circuits; maximum voltage.

The maximum voltage used for ground check circuits under §77.803 shall not exceed 96 volts.

30 CFR § 77.805
Cable couplers and connection boxes; minimum design requirements.

(a)(1) Couplers that are used in medium- or high-voltage power circuits shall be of the three-phase type and enclosed in a full metallic shell, except that the Secretary may permit, under such guidelines as he may prescribe, no less effective couplers constructed of materials other than metal.

(2) Cable couplers shall be adequate for the intended current and voltage.

(3) Cable couplers with any metal exposed shall be grounded to the ground

conductor in the cable.

(4) Couplers shall be constructed to cause the ground check continuity conductor to break first and the ground conductor last when being uncoupled when pilot check circuits are used.

(b) Cable connection boxes shall be of substantial construction and designed to guard all energized parts from personal contact.

30 CFR § 77.806
Connection of single-phase loads.

Single-phase loads, such as transformer primaries, shall be connected phase to phase in resistance grounded systems.

30 CFR § 77.807
Installation of high-voltage transmission cables.

High-voltage transmission cables shall be installed or placed so as to afford protection against damage. They shall be placed to prevent contact with low-voltage or communication circuits.

30 CFR § 77.807-1
High-voltage powerlines; clearances above ground.

High-voltage powerlines located above driveways, haulageways, and railroad tracks shall be installed to provide the minimum vertical clearance specified in National Electrical Safety Code: *Provided, however,* That in no event shall any high-voltage powerline be installed less than 15 feet above ground.

30 CFR § 77.807-2
Booms and masts; minimum distance from high-voltage lines.

The booms and masts of equipment operated on the surface of any coal mine shall not be operated within 10 feet of an energized overhead powerline. Where the voltage of overhead powerlines is 69,000 volts, or more, the minimum distance from the boom or mast shall be as follows:

Nominal power line voltage (in 1,000 volts)	Minimum distance (feet)
69 to 114	12
115 to 229	15
230 to 344	20
345 to 499	25
500 or more	35

30 CFR § 77.807-3
Movement of equipment; minimum distance from high-voltage lines.
When any part of any equipment operated on the surface of any coal mine is required to pass under or by any energized high-voltage powerline and the clearance between such equipment and powerline is less than that specified in §77.807-2 for booms and masts, such powerlines shall be deenergized or other precautions shall be taken.

30 CFR § 77.808
Disconnecting devices.

Disconnecting devices shall be installed at the beginning of each branch line in high-voltage circuits and they shall be equipped or designed in such a manner that it can be determined by visual observation that the circuit is deenergized when such devices are open.

30 CFR § 77.809
Identification of circuit breakers and disconnecting switches.

Circuit breakers and disconnecting switches shall be labeled to show which units they control, unless identification can be made readily by location.

30 CFR § 77.810
High-voltage equipment; grounding.

Frames, supporting structures, and enclosures of stationary, portable, or mobile high-voltage equipment shall be effectively grounded.

30 CFR § 77.811
Movement of portable substations and transformers.

Portable substations and transformers shall be deenergized before they are moved from one location to another.

Subpart J--Low- and Medium-Voltage Alternating Current Circuits

30 CFR § 77.900
Low- and medium-voltage circuits serving portable or mobile three-phase alternating current equipment; circuit breakers.

Low- and medium-voltage circuits supplying power to portable or mobile three-phase alternating current equipment shall be protected by suitable circuit breakers of adequate interrupting capacity which are properly tested and maintained and equipped with devices to provide protection against undervoltage, grounded phase, short circuit, and over-current.

30 CFR § 77.900-1
Testing, examination, and maintenance of circuit breakers; procedures.

Circuit breakers protecting low- and medium-voltage circuits serving portable or mobile three-phase alternating current equipment and their auxiliary devices shall be tested and examined at least once each month by a person qualified as provided in §77.103. In performing such tests, the circuit breaker auxiliaries or control circuits shall be actuated in any manner which causes the circuit breaker to open. All components of the circuit breaker and its auxiliary devices shall be visually examined and such repairs or adjustments as are indicated by such tests and examinations shall be carried out immediately.

30 CFR § 77.900-2
Testing, examination, and maintenance of circuit breakers; record.

The operator shall maintain a written record of each test, examination, repair or adjustment of all circuit breakers protecting low- and medium-voltage circuits serving three-phase alternating current equipment and such record shall be kept in a book approved by the Secretary.

30 CFR § 77.901
Protection of low- and medium-voltage three-phase circuits.

(a) Low- and medium-voltage circuits supplying power to portable or mobile three-phase alternating equipment shall contain:

(1) Either a direct or derived neutral grounded through a suitable resistor at the power source;

(2) A grounding circuit originating at the grounded side of the grounding resistor which extends along with the power conductors and serves as a grounding conductor for the frames of all the electric equipment supplied power from the circuit.

(b) Grounding resistors, where required, shall be of an ohmic value which limits the ground fault current to no more than 25 amperes. Such grounding resistors shall be rated for maximum fault current continuously and provide insulation from ground for a voltage equal to the phase-to-phase voltage of the system.

(c) Low- and medium-voltage circuits supplying power to three-phase alternating current stationary electric equipment shall comply with the National Electric Code.

30 CFR § 77.902
Low- and medium-voltage ground check monitor circuits.

On and after September 30, 1971, three-phase low- and medium-voltage resistance grounded systems to portable and mobile equipment shall include a fail

safe ground check circuit or other no less effective device approved by the Secretary to monitor continuously the grounding circuit to assure continuity. The fail safe ground check circuit shall cause the circuit breaker to open when either the ground or pilot check wire is broken. Cable couplers shall be constructed to cause the ground check continuity conductor to break first and the ground conductor last when being uncoupled when pilot check circuits are used.

30 CFR § 77.902-1
Fail safe ground check circuits; maximum voltage.

The maximum voltage used for ground check circuits under §77.902 shall not exceed 40 volts.

ELECTRICITY
Questions for Review

Q: What is high voltage?

_____

Q: What are some of the injures caused by accidental contact with high voltage?

_____

Q: Voltages as low as what can be lethal if contacted?

_____

Q: What is extra-low voltage?

_____

Q: Electrical charges can produce small quantities of what?

_____

Q: Two factors are considered in the classification of "High Voltage." What are they?

_____

Q: How often do circuit breakers providing protection for high-voltage portable equipment have to be tested?
A: CFR 77.800-1(a)

_____

Q: What must the tests include?
A: CFR 77.800-1(b)

_____

Q: Booms and masts of equipment operated on the surface shall not be operated within how many feet of an energized powerline?
A: CFR 77.807-2

_____

Q: What must happen before moving a portable transformer?
A: CFR 77.811

Q: How should circuit breakers and disconnecting switches be labeled?
A: CFR 77.809

Q: How often must electrical equipment be examined and tested?
A: CFR 77.502-2

Q: High-voltage powerlines must be installed at least how many feet above ground?
A: CFR 77.807-1

Q: In high-voltage circuits where/how shall disconnecting devices be installed?
A: CFR 77.808

Q: What is the maximum voltage for ground check circuits?
A: CFR 77.902-1

Q: All persons performing work on energized high-voltage surface lines must wear what?
A: CFR 77.704-6

Q: High voltage lines must be deenergized before any work is preformed on them. What are the two exceptions?
A: CFR 77.704

CHAPTER TWO

MINE LAW

1. Federal Mine Safety & Health Act of 1977
2. Code of Federal Regulations - Part 48
3. Code of Federal Regulations - Part 50
4. Code of Federal Regulations - Part 77
5. Utah State Code
6. Questions and Review

Federal Mine Safety & Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164*

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That this Act may be cited as the "Federal Mine Safety and Health Act of 1977".

FINDINGS AND PURPOSE

SEC. 2. Congress declares that--

(a) the first priority and concern of all in the coal or other mining industry must be the health and safety of its most precious resource--the miner;
(b) deaths and serious injuries from unsafe and unhealthful conditions and practices in the coal or other mines cause grief and suffering to the miners and to their families;
(c) there is an urgent need to provide more effective means and measures for improving the working conditions and practices in the Nation's coal or other mines in order to prevent death and serious physical harm, and in order to prevent occupational diseases originating in such mines;
(d) the existence of unsafe and unhealthful conditions and practices in the Nation's coal or other mines is a serious impediment to the future growth of the coal or other mining industry and cannot be tolerated;
(e) the operators of such mines with the assistance of the miners have the primary responsibility to prevent the existence of such conditions and practices in such mines;
(f) the disruption of production and the loss of income to operators and miners as a result of coal or other mine accidents or occupationally caused diseases unduly impedes and burdens commerce; and
(g) it is the purpose of this Act (1) to establish interim mandatory health and safety standards and to direct the Secretary of Health, Education, and Welfare and the Secretary of Labor to develop and promulgate improved mandatory health or safety standards to protect the health and safety of the Nation's coal or other miners; (2) to require that each operator of a coal or other mine and every miner in such mine comply with such standards; (3) to cooperate with, and provide assistance to, the States in the development and enforcement of effective State coal or other mine health and safety programs; and (4) to improve and expand, in cooperation with the States and the coal or other mining industry, research and development and training programs aimed at preventing coal or other mine accidents and occupationally caused diseases in the industry.

DEFINITIONS

SEC. 3. For the purpose of this Act, the term--

(a) "Secretary" means the Secretary of Labor or his delegate;
(b) "commerce" means trade, traffic, commerce, transportation, or communication among the several States, or between a place in a State and any place outside thereof, or within the District of Columbia or a possession of the United States, or between points in the same State but through a point outside thereof;
(c) "State" includes a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, and the Trust Territory of the Pacific Islands;
(d) "operator" means any owner, lessee, or other person who operates, controls, or supervises a coal or other mine or any independent contractor performing services or construction at such mine;
(e) "agent" means any person charged with responsibility for the operation of all or a part of a coal or other mine or the supervision of the miners in a coal or other mine;
(f) "person" means any individual, partnership, association, corporation, firm, subsidiary of a corporation, or other organization;
(g) "miner" means any individual working in a coal or other mine;
(h)(1) "coal or other mine" means (A) an area of land from which minerals are extracted in nonliquid form or, if in liquid form, are extracted with workers underground, (B) private ways and roads appurtenant to such area, and (C) 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 such minerals 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 such minerals, or the work of preparing coal or other minerals, and includes custom coal preparation facilities. In making a determination of what constitutes mineral milling for purposes of this Act, the Secretary shall give due consideration to the convenience of administration resulting from the delegation to one Assistant Secretary of all authority with respect to the health and safety of miners employed at one physical establishment;

(2) For purposes of titles II, III, and IV, "coal mine" means an area of land and all structures, facilities, machinery tools, equipment, shafts, slopes, tunnels, excavations, and other property, real or personal, placed upon, under, or above the surface of such land by any person, used in, or to be used in, or resulting from, the work of extracting in such area bituminous coal, lignite, or anthracite from its natural deposits in the earth by any means or method, and the work of preparing the coal so extracted, and includes custom coal preparation facilities;
(i) "work of preparing the coal" means the breaking, crushing, sizing, cleaning, washing, drying, mixing, storing and loading of bituminous coal, lignite, or anthracite, and such other work of preparing such coal as is usually done by the operator of the coal mine;
(j) "imminent danger" means the existence of any condition or practice in a coal or other mine which could reasonably be expected to cause death or serious

physical harm before such condition or practice can be abated;
(k) "accident" includes a mine explosion, mine ignition, mine fire, or mine inundation, or injury to, or death of, any person;
(l) "mandatory health or safety standard" means the interim mandatory health or safety standards established by titles II and III of this Act, and the standards promulgated pursuant to title I of this Act;
(m) "Panel" means the Interim Compliance Panel established by this Act; and
(n) "Administration" means the Mine Safety and Health Administration in the Department of Labor.
(o) "Commission" means the Federal Mine Safety and Health Review Commission.

MINES SUBJECT TO ACT

SEC. 4. Each coal or other mine, the products of which enter commerce, or the operations or products of which affect commerce, and each operator of such mine, and every miner in such mine shall be subject to the provisions of this Act.

INTERIM COMPLIANCE PANEL

SEC. 5. (a) There is hereby established the Interim Compliance Panel, which shall be composed of five members as follows:

(1) Assistant Secretary of Labor for Labor Standards, Department of Labor, or his delegate;
(2) Director of the Bureau of Standards, Department of Commerce, or his delegate;
(3) Administrator of Consumer Protection and Environmental Health Service, Department of Health, Education, and Welfare, or his delegate;
(4) Director of the Bureau of Mines, Department of the Interior, or his delegate; and
(5) Director of the National Science Foundation, or his delegate.

(b) Members of the Panel shall serve without compensation in, addition to that received in their regular employment, but shall be entitled to reimbursement for travel, subsistence, and other necessary expenses incurred by them in the performance of duties vested in the Panel.

(c) Notwithstanding any other provision of law, the Secretary of Health, Education, and Welfare, the Secretary of Commerce, the Secretary of the Interior, and the Secretary shall, upon request of the Panel, provide the Panel such personnel and other assistance as the Panel determines necessary to enable it to carry out its functions under this Act.

(d) Three members of the Panel shall constitute a quorum for doing business. All decisions of the Panel shall be by majority vote. The chairman of the Panel shall be selected by the members from among the membership thereof.

(e) The Panel is authorized to appoint as many hearing examiners as are necessary for proceedings required to be conducted in accordance with the provisions of this Act. The provisions applicable to hearing examiners appointed under section 3105 of title 5 of the

United States Code shall be applicable to hearing examiners appointed pursuant to this subsection.

(f)(1) It shall be the function of the Panel to carry out the duties imposed on it pursuant to this Act and to provide an opportunity for a public hearing, after notice, at the request of an operator of the affected coal mine or the representative of the miners of such mine. Any operator or representative of miners aggrieved by a final decision of the Panel may file a petition for review of such decision under section 106 of this Act. The provisions of this section shall terminate upon completion of the Panel's functions as set forth under this Act. Any hearing held pursuant to this subsection shall be of record and the Panel shall make findings of fact and shall issue a written decision incorporating its findings therein in accordance with section 554 of title 5 of the United States Code.

(2) The Panel shall make an annual report, in writing, to the Secretary for transmittal by him to the Congress concerning the achievement of its purposes, and any other relevant information (including any recommendations) which it deems appropriate.

TITLE I--GENERAL

MANDATORY SAFETY AND HEALTH STANDARDS

SEC. 101. (a) The Secretary shall by rule in accordance with procedures set forth in this section and in accordance with section 553 of title 5, United States Code (without regard to any reference in such section to sections 556 and 557 of such title), develop, promulgate, and revise as may be appropriate, improved mandatory health or safety standards for the protection of life and prevention of injuries in coal or other mines.

(1) Whenever the Secretary, upon the basis of information submitted to him in writing by an interested person, a representative of any organization of employers or employees, a nationally recognized standards-producing organization, the Secretary of Health, Education, and Welfare, the National Institute for Occupational Safety and Health, or a State or political subdivision, or on the basis of information developed by the Secretary or otherwise available to him, determines that a rule should be promulgated in order to serve the objectives of this Act, the Secretary may request the recommendation of an advisory committee appointed under section 102(c). The Secretary shall provide such an advisory committee with any proposals of his own or of the Secretary of Health, Education, and Welfare, together with all pertinent factual information developed by the Secretary or the Secretary of Health, Education, and Welfare, or otherwise available, including the results of research, demonstrations, and experiments. An advisory committee shall submit to the Secretary its recommendations regarding the rule to be promulgated within 60 days from the date of its appointment or within such longer or shorter period as may be prescribed by the Secretary, but in no event for a period which is longer than 180 days. When the Secretary receives a recommendation, accompanied by appropriate criteria, from the National Institute for Occupational Safety and Health that a rule be promulgated, modified, or revoked, the Secretary must, within 60 days after receipt thereof, refer such recommendation to an advisory committee pursuant to this paragraph, or publish such as a proposed rule pursuant to paragraph (2), or publish in the Federal Register his determination not to do so, and his reasons therefore. The Secretary shall be required to request the recommendations of an advisory committee appointed under section 102(c) if the rule to be promulgated is, in the discretion of the

Secretary which shall be final, new in effect or application and has significant economic impact.

(2) The Secretary shall publish a proposed rule promulgating, modifying, or revoking a mandatory health or safety standard in the Federal Register. If the Secretary determines that a rule should be proposed and in connection therewith has appointed an advisory committee as provided by paragraph (1), the Secretary shall publish a proposed rule, or the reasons for his determination not to publish such rule, within 60 days following the submission of the advisory committee's recommendation or the expiration of the period of time prescribed by the Secretary in such submission. In either event, the Secretary shall afford interested persons a period of 30 days after any such publication to submit written data or comments on the proposed rule. Such comment period may be extended by the Secretary upon a finding of good cause, which the Secretary shall publish in the Federal Register. Publication shall include the text of such rules proposed in their entirety, a comparative text of the proposed changes in existing rules, and shall include a comprehensive index to the rules, cross-referenced by subject matter.

(3) On or before the last day of the period provided for the submission of written data or comments under paragraph (2), any interested person may file with the Secretary written objections to the proposed mandatory health or safety standard, stating the grounds therefore and requesting a public hearing on such objections. Within 60 days after the last day for filing such objections, the Secretary shall publish in the Federal Register a notice specifying the mandatory health or safety standard to which objections have been filed and a hearing requested, and specifying a time and place for such hearing. Any hearing under this subsection for the purpose of hearing relevant information shall commence within 60 days after the date of publication of the notice of hearing. Hearings required by this subsection shall be conducted by the Secretary, who may prescribe rules and make rulings concerning procedures in such hearings to avoid unnecessary cost or delay. Subject to the need to avoid undue delay, the Secretary shall provide for procedures that will afford interested parties the right to participate in the hearing, including the right to present oral statements and to offer written comments and data. The Secretary may require by subpoena the attendance of witnesses and the production of evidence in connection with any proceeding initiated under this section. If a person refuses to obey a subpoena under this subsection, a United States district court within the jurisdiction of which a proceeding under this subsection is conducted may, upon petition by the Secretary, issue an order requiring compliance with such subpoena. A transcript shall be taken of any such hearing and shall be available to the public.

(4)(A) Within 90 days after certification of the record of the hearing held pursuant to paragraph (3), the Secretary shall by rule promulgate, modify, or revoke such mandatory health or safety standards, and publish his reasons therefore.

(B) In the case of a proposed mandatory health or safety standard to which objections requesting a public hearing have not been filed, the Secretary, within 90 days after the period for filing such objections has expired, shall by rule promulgate, modify, or revoke such mandatory standards, and publish his reasons therefore.

(C) In the event the Secretary determines that a proposed mandatory health or safety standard should not be promulgated he shall, within the times specified in subparagraphs (A) and (B) publish his reasons for his determination.

(5) Any mandatory health or safety standard promulgated as a final rule under this section shall be effective upon publication in the Federal Register unless the Secretary specifies a later date.

(6)(A) The Secretary, in promulgating mandatory standards dealing with toxic materials or harmful physical agents under this subsection, shall set standards which most adequately assure on the basis of the best available evidence that no miner will suffer material impairment of health or functional capacity even if such miner has regular exposure to the hazards dealt with by such standard for the period of his working life. Development of mandatory standards under this subsection shall be based upon research, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of health and safety protection for the miner, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws. Whenever practicable, the mandatory health or safety standard promulgated shall be expressed in terms of objective criteria and of the performance desired.

(B) The Secretary of Health, Education, and Welfare, as soon as possible after the date of enactment of the Federal Mine Safety and Health Amendments Act of 1977 but in no event later than 18 months after such date and on a continuing basis thereafter, shall, for each toxic material or harmful physical agent which is used or found in a mine, determine whether such material or agent is potentially toxic at the concentrations in which it is used or found in a mine. The Secretary of Health, Education, and Welfare shall submit such determinations with respect to such toxic substances or harmful physical agents to the Secretary. Thereafter, the Secretary of Health, Education, and Welfare shall submit to the Secretary all pertinent criteria regarding any such substances determined to be toxic or any such harmful agents as such criteria are developed. Within 60 days after receiving any criteria in accordance with the preceding sentence relating to a toxic material or harmful physical agent which is not adequately covered by a mandatory health or safety standard promulgated under this section, the Secretary shall either appoint an advisory committee to make recommendations with respect to a mandatory health or safety standard covering such material or agent in accordance with paragraph (1), or publish a proposed rule promulgating such a mandatory health or safety standard in accordance with paragraph (2), or shall publish his determination not to do so.

(7) Any mandatory health or safety standard promulgated under this subsection shall prescribe the use of labels or other appropriate forms of warning as are necessary to insure that miners are apprised of all hazards to which they are exposed, relevant symptoms and appropriate emergency treatment, and proper conditions and precautions of safe use or exposure. Where appropriate, such mandatory standard shall also prescribe suitable protective equipment and control or technological procedures to be used in connection with such hazards and shall provide for monitoring or measuring miner exposure at such locations and intervals, and in such manner so as to assure the maximum protection of miners. In addition, where appropriate, any such mandatory standard shall prescribe the type and frequency of medical examinations or other tests which shall be made available, by the operator at his cost, to miners exposed to such hazards in order to most effectively determine whether the health of such miners is adversely affected by such exposure. Where appropriate, the mandatory standard shall

provide that where a determination is made that a miner may suffer material impairment of health or functional capacity by reason of exposure to the hazard covered by such mandatory standard, that miner shall be removed from such exposure and reassigned. Any miner transferred as a result of such exposure shall continue to receive compensation for such work at no less than the regular rate of pay for miners in the classification such miner held immediately prior to his transfer. In the event of the transfer of a miner pursuant to the preceding sentence, increases in wages of the transferred miner shall be based upon the new work classification. In the event such medical examinations are in the nature of research, as determined by the Secretary of Health, Education, and Welfare, such examinations may be furnished at the expense of the Secretary of Health, Education, and Welfare. The results of examinations or tests made pursuant to the preceding sentence shall be furnished only to the Secretary or the Secretary of Health, Education, and Welfare, and, at the request of the miner, to his designated physician.

(8) The Secretary shall, to the extent practicable, promulgate separate mandatory health or safety standards applicable to mine construction activity on the surface.

(9) No mandatory health or safety standard promulgated under this title shall reduce the protection afforded miners by an existing mandatory health or safety standard.

(b)(1) The Secretary shall provide, without regard to the requirements of chapter 5, title 5, United States Code, for an emergency temporary mandatory health or safety standard to take immediate effect upon publication in the Federal Register if he determines (A) that miners are exposed to grave danger from exposure to substances or agents determined to be toxic or physically harmful, or to other hazards, and (B) that such emergency standard is necessary to protect miners from such danger.

(2) A temporary mandatory health or safety standard shall be effective until superseded by a mandatory standard promulgated in accordance with the procedures prescribed in paragraph (3) of this subsection.

(3) Upon publication of such standard in the Federal Register, the Secretary shall commence a proceeding in accordance with section 101 (a), and the standards as published shall also serve as a proposed rule for the proceeding. The Secretary shall promulgate a mandatory health or safety standard under this paragraph no later than nine months after publication of the emergency temporary standard as provided in paragraph (2).

(c) Upon petition by the operator or the representative of miners, the Secretary may modify the application of any mandatory safety standard to a coal or other mine if the Secretary determines that an alternative method of achieving the result of such standard exists which will at all times guarantee no less than the same measure of protection afforded the miners of such mine by such standard, or that the application of such standard to such mine will result in a diminution of safety to the miners in such mine. Upon receipt of such petition the Secretary shall publish notice thereof and give notice to the operator or the representative of miners in the affected mine, as appropriate, and shall cause such investigation to be made as he deems appropriate. Such investigation shall provide an opportunity for a public hearing at the request of such operator or representative or other interested party, to enable the operator or the representative of

miners in such mine or other interested party to present information relating to the modification of such standard. Before granting any exception to a mandatory safety standard, the findings of the Secretary or his authorized representative shall be made public and shall be available to the representative of the miners at the affected mine. The Secretary shall issue a decision incorporating his findings of fact therein, and send a copy thereof to the operator or the representative of the miners, as appropriate. Any such hearing shall be of record and shall be subject to section 554 of title 5 of the United States Code.

(d) Any person who may be adversely affected by a mandatory health or safety standard promulgated under this section may, at any time prior to the sixtieth day after such standard is promulgated, file a petition challenging the validity of such mandatory standard with the United States Court of Appeals for the District of Columbia Circuit or the circuit wherein such person resides or has his principal place of business, for a judicial review of such standard. A copy of the petition shall be forthwith transmitted by the clerk of the court to the Secretary. The filing of such petition shall not, unless otherwise ordered by the court, operate as a stay of the standard. No objection that has not been urged before the Secretary shall be considered by the court, unless the failure or neglect to urge such objection shall be excused for good cause shown. The validity of any mandatory health or safety standard shall not be subject to challenge on the grounds that any of the time limitations in this section have been exceeded. The procedures of this subsection shall be the exclusive means of challenging the validity of a mandatory health or safety standard.

(e) The Secretary shall send a copy of every proposed mandatory health or safety standard or regulation at the time of publication in the Federal Register to the operator of each coal or other mine and the representative of the miners at such mine and such copy shall be immediately posted on the bulletin board of the mine by the operator or his agent, but failure to receive such notice shall not relieve anyone of the obligation to comply with such standard or regulation.

ADVISORY COMMITTEES

SEC. 102. (a)(1) The Secretary of the Interior shall appoint an advisory committee on coal or other mine safety research composed of--

(A) the Director of the Office of Science and Technology or his delegate, with the consent of the Director;
(B) the Director of the National Bureau of Standards, Department of Commerce, or his delegate, with the consent of the Director;
(C) the Director of the National Science Foundation, or his delegate, with the consent of the Director; and
(D) such other persons as the Secretary of the Interior may appoint who are knowledgeable in the field of coal or other mine safety research. The Secretary of the Interior shall designate the chairman of the committee.

(2) The advisory committee shall consult with, and make recommendations to, the Secretary of the Interior on matters involving or relating to coal or other mine safety research. The Secretary of the Interior shall consult with, and consider the

recommendations of, such committee in the conduct of such research, the making of any grants, and the entering into of contracts for such research.

(3) The chairman of the committee and a majority of the persons appointed by the Secretary of the Interior pursuant to paragraph (1)(D) shall be individuals who have no economic interests in the coal or other mining industry, and who are not operators, miners, or officers or employees of the Federal Government or any State or local government.

(b)(1) The Secretary of Health, Education, and Welfare shall appoint an advisory committee on coal or other mine health research composed of--

> (A) the Director, Bureau of Mines, or his delegate, with the consent of the Director;
> (B) the Director of the National Science Foundation, or his delegate, with the consent of the Director;
> (C) the Director of the National Institutes of Health, or his delegate, with the consent of the Director; and
> (D) such other persons as the Secretary of Health, Education, and Welfare may appoint who are knowledgeable in the field of coal or other mine health research. The Secretary of Health, Education, and Welfare shall designate the chairman of the committee.

(2) The advisory committee shall consult with, and make recommendations to, the Secretary of Health, Education, and Welfare on matters involving or relating to coal or other mine health research. The Secretary of Health, Education, and Welfare shall consult with, and consider the recommendations of, such committee in the conduct of such research, the making of any grants, and the entering into of contracts for such research.

(3) The chairman of the committee and a majority of the persons appointed by the Secretary of Health, Education, and Welfare pursuant to paragraph (1)(D) shall be individuals who have no economic interests in the coal or other mining industry, and who are not operators, miners, or officers or employees of the Federal Government or any State or local government.

(c) The Secretary or the Secretary of Health, Education, and Welfare may appoint other advisory committees as he deems appropriate to advise him in carrying out the provisions of this Act. The Secretary or the Secretary of Health, Education, and Welfare, as the case may be, shall appoint the chairman of each such committee. A majority of the members (including the chairman) of any such advisory committee appointed pursuant to this subsection shall be composed of individuals who have no economic interests in the coal or other mining industry, and who are not operators, miners, or officers or employees of the Federal Government or any State or local government.

(d) Advisory committee members, other than officers or employees of Federal, State, or local governments, shall be, for each day (including travel time) during which they are performing committee business, entitled to receive compensation at a rate fixed by the appropriate Secretary but not in excess of the maximum rate of pay for grade GS-18 as provided in the General Schedule under section 5332 of title 5 of the United States Code,

and shall, notwithstanding the limitations of sections 5703 and 5704 of title 5 of the United States Code, be fully reimbursed for travel, subsistence, and related expenses.

INSPECTIONS, INVESTIGATIONS, AND RECORDKEEPING

SEC. 103. (a) Authorized representatives of the Secretary or the Secretary of Health, Education, and Welfare shall make frequent inspections and investigations in coal or other mines each year for the purpose of (1) obtaining, utilizing, and disseminating information relating to health and safety conditions, the causes of accidents, and the causes of diseases and physical impairments originating in such mines, (2) gathering information with respect to mandatory health or safety standards, (3) determining whether an imminent danger exists, and (4) determining whether there is compliance with the mandatory health or safety standards or with any citation, order, or decision issued under this title or other requirements of this Act. In carrying out the requirements of this subsection, no advance notice of an inspection shall be provided to any person, except that in carrying out the requirements of clauses (1) and (2) of this subsection, the Secretary of Health, Education, and Welfare may give advance notice of inspections. In carrying out the requirements of clauses (3) and (4) of this subsection, the Secretary shall make inspections of each underground coal or other mine in its entirety at least four times a year, and of each surface coal or other mine in its entirety at least two times a year. The Secretary shall develop guidelines for additional inspections of mines based on criteria including, but not limited to, the hazards found in mines subject to this Act, and his experience under this Act and other health and safety laws. For the purpose of making any inspection or investigation under this Act, the Secretary, or the Secretary of Health, Education, and Welfare, with respect to fulfilling his responsibilities under this Act, or any authorized representative of the Secretary or the Secretary of Health, Education, and Welfare, shall have a right of entry to, upon, or through any coal or other mine.

(b) For the purpose of making any investigation of any accident or other occurrence relating to health or safety in a coal or other mine, the Secretary may, after notice, hold public hearings, and may sign and issue subpoenas for the attendance and testimony of witnesses and the production of relevant papers, books, and documents, and administer oaths. Witnesses summoned shall be paid the same fees and mileage that are paid witnesses in the courts of the United States. In case of contumacy or refusal to obey a subpoena served upon any person under this section, the district court of the United States for any district in which such person is found or resides or transacts business, upon application by the United States and after notice to such person, shall have jurisdiction to issue an order requiring such person to appear and give testimony before the Secretary or to appear and produce documents before the Secretary, or both, and any failure to obey such order of the court may be punished by such court as a contempt thereof.

(c) The Secretary, in cooperation with the Secretary of Health, Education, and Welfare, shall issue regulations requiring operators to maintain accurate records of employee exposures to potentially toxic materials or harmful physical agents which are required to be monitored or measured under any applicable mandatory health or safety standard promulgated under this Act. Such regulations shall provide miners or their representatives with an opportunity to observe such monitoring or measuring, and to have access to the records thereof. Such regulations shall also make appropriate

provisions for each miner or former miner to have access to such records as will indicate his own exposure to toxic materials or harmful physical agents. Each operator shall promptly notify any miner who has been or is being exposed to toxic materials or harmful physical agents in concentrations or at levels which exceed those prescribed by an applicable mandatory health or safety standard promulgated under section 101, or mandated under title II, and shall inform any miner who is being thus exposed of the corrective action being taken.

(d) All accidents, including unintentional roof falls (except in any abandoned panels or in areas which are inaccessible or unsafe for inspections), shall be investigated by the operator or his agent to determine the cause and the means of preventing a recurrence. Records of such accidents and investigations shall be kept and the information shall be made available to the Secretary or his authorized representative and the appropriate State agency. Such records shall be open for inspection by interested persons. Such records shall include man-hours worked and shall be reported at a frequency determined by the Secretary, but at least annually.

(e) Any information obtained by the Secretary or by the Secretary of Health, Education, and Welfare under this Act shall be obtained in such a manner as not to impose an unreasonable burden upon operators, especially those operating small businesses, consistent with the underlying purposes of this Act. Unnecessary duplication of effort in obtaining information shall be reduced to the maximum extent feasible.

(f) Subject to regulations issued by the Secretary, a representative of the operator and a representative authorized by his miners shall be given an opportunity to accompany the Secretary or his authorized representative during the physical inspection of any coal or other mine made pursuant to the provisions of subsection (a), for the purpose of aiding such inspection and to participate in pre- or post-inspection conferences held at the mine. Where there is no authorized miner representative, the Secretary or his authorized representative shall consult with a reasonable number of miners concerning matters of health and safety in such mine. Such representative of miners who is also an employee of the operator shall suffer no loss of pay during the period of his participation in the inspection made under this subsection. To the extent that the Secretary or authorized representative of the Secretary determines that more than one representative from each party would further aid the inspection, he can permit each party to have an equal number of such additional representatives. However, only one such representative of miners who is an employee of the operator shall be entitled to suffer no loss of pay during the period of such participation under the provisions of this subsection. Compliance with this subsection shall not be a jurisdictional prerequisite to the enforcement of any provision of this Act.

(g)(1) Whenever a representative of the miners or a miner in the case of a coal or other mine where there is no such representative has reasonable grounds to believe that a violation of this Act or a mandatory health or safety standard exists, or an imminent danger exists, such miner or representative shall have a right to obtain an immediate inspection by giving notice to the Secretary or his authorized representative of such violation or danger. Any such notice shall be reduced to writing, signed by the representative of the miners or by the miner, and a copy shall be provided the operator or his agent no later than at the time of inspection, except that the operator or his agent shall be notified forthwith if the complaint indicates that an imminent danger exists. The

name of the person giving such notice and the names of individual miners referred to therein shall not appear in such copy or notification. Upon receipt of such notification, a special inspection shall be made as soon as possible to determine if such violation or danger exists in accordance with the provisions of this title. If the Secretary determines that a violation or danger does not exist, he shall notify the miner or representative of the miners in writing of such determination.

(2) Prior to or during any inspection of a coal or other mine, any representative of miners or a miner in the case of a coal or other mine where there is no such representative, may notify the Secretary or any representative of the Secretary responsible for conducting the inspection, in writing, of any violation of this Act or of any imminent danger which he has reason to believe exists in such mine. The Secretary shall, by regulation, establish procedures for informal review of any refusal by a representative of the Secretary to issue a citation with respect to any such alleged violation or order with respect to such danger and shall furnish the representative of miners or miner requesting such review a written statement of the reasons for the Secretary's final disposition of the case.

(h) In addition to such records as are specifically required by this Act, every operator of a coal or other mine shall establish and maintain such records, make such reports, and provide such information, as the Secretary or the Secretary of Health, Education, and Welfare may reasonably require from time to time to enable him to perform his functions under this Act. The Secretary or the Secretary of Health, Education, and Welfare is authorized to compile, analyze, and publish, either in summary or detailed form, such reports or information so obtained. Except to the extent otherwise specifically provided by this Act, all records, information, reports, findings, citations, notices, orders, or decisions required or issued pursuant to or under this Act may be published from time to time, may be released to any interested person, and shall be made available for public inspection.

(i) Whenever the Secretary finds that a coal or other mine liberates excessive quantities of methane or other explosive gases during its operations, or that a methane or other gas ignition or explosion has occurred in such mine which resulted in death or serious injury at any time during the previous five years, or that there exists in such mine some other especially hazardous condition, he shall provide a minimum of one spot inspection by his authorized representative of all or part of such mine during every five working days at irregular intervals. For purposes of this subsection, "liberation of excessive quantities of methane or other explosive gases" shall mean liberation of more than one million cubic feet of methane or other explosive gases during a 24-hour period. When the Secretary finds that a coal or other mine liberates more than five hundred thousand cubic feet of methane or other explosive gases during a 24-hour period, he shall provide a minimum of one spot inspection by his authorized representative of all or part of such mine every 10 working days at irregular intervals. When the Secretary finds that a coal or other mine liberates more than two hundred thousand cubic feet of methane or other explosive gases during a 24-hour period, he shall provide a minimum of one spot inspection by his authorized representative of all or part of such mine every 15 working days at irregular intervals.

(j) In the event of any accident occurring in any coal or other mine, the operator shall notify the Secretary thereof and shall take appropriate measures to prevent the

destruction of any evidence which would assist in investigating the cause or causes thereof. In the event of any accident occurring in a coal or other mine, where rescue and recovery work is necessary, the Secretary or an authorized representative of the Secretary shall take whatever action he deems appropriate to protect the life of any person, and he may, if he deems it appropriate, supervise and direct the rescue and recovery activities in such mine.

(k) In the event of any accident occurring in a coal or other mine, an authorized representative of the Secretary, when present, may issue such orders as he deems appropriate to insure the safety of any person in the coal or other mine, and the operator of such mine shall obtain the approval of such representative, in consultation with appropriate State representatives, when feasible, of any plan to recover any person in such mine or to recover the coal or other mine or return affected areas of such mine to normal.

CITATIONS AND ORDERS

SEC. 104. (a) If, upon inspection or investigation, the Secretary or his authorized representative believes that an operator of a coal or other mine subject to this Act has violated this Act, or any mandatory health or safety standard, rule, order, or regulation promulgated pursuant to this Act, he shall, with reasonable promptness, issue a citation to the operator. Each citation shall be in writing and shall describe with particularity the nature of the violation, including a reference to the provision of the Act, standard, rule, regulation, or order alleged to have been violated. In addition, the citation shall fix a reasonable time for the abatement of the violation. The requirement for the issuance of a citation with reasonable promptness shall not be a jurisdictional prerequisite to the enforcement of any provision of this Act.

(b) If, upon any follow-up inspection of a coal or other mine, an authorized representative of the Secretary finds (1) that a violation described in a citation issued pursuant to subsection (a) has not been totally abated within the period of time as originally fixed therein or as subsequently extended, and (2) that the period of time for the abatement should not be further extended, he shall determine the extent of the area affected by the violation and shall promptly issue an order requiring the operator of such mine or his agent to immediately cause all persons, except those persons referred to in subsection (c), to be withdrawn from, and to be prohibited from entering, such area until an authorized representative of the Secretary determines that such violation has been abated.

(c) The following persons shall not be required to be withdrawn from, or prohibited from entering, any area of the coal or other mine subject to an order issued under this section:

> (1) any person whose presence in such area is necessary, in the judgment of the operator or an authorized representative of the Secretary, to eliminate the condition described in the order;
> (2) any public official whose official duties require him to enter such area;
> (3) any representative of the miners in such mine who is, in the judgment of the operator or an authorized representative of the Secretary, qualified to make such mine examinations or who is accompanied by such a person and whose presence

in such area is necessary for the investigation of the conditions described in the order; and

(4) any consultant to any of the foregoing.

(d)(1) If, upon any inspection of a coal or other mine, an authorized representative of the Secretary finds that there has been a violation of any mandatory health or safety standard, and if he also finds that, while the conditions created by such violation do not cause imminent danger, such violation is of such nature as could significantly and substantially contribute to the cause and effect of a coal or other mine safety or health hazard, and if he finds such violation to be caused by an unwarrantable failure of such operator to comply with such mandatory health or safety standards, he shall include such finding in any citation given to the operator under this Act. If, during the same inspection or any subsequent inspection of such mine within 90 days after the issuance of such citation, an authorized representative of the Secretary finds another violation of any mandatory health or safety standard and finds such violation to be also caused by an unwarrantable failure of such operator to so comply, he shall forthwith issue an order requiring the operator to cause all persons in the area affected by such violation, except those persons referred to in subsection (c) to be withdrawn from, and to be prohibited from entering, such area until an authorized representative of the Secretary determines that such violation has been abated.

(2) If a withdrawal order with respect to any area in a coal or other mine has been issued pursuant to paragraph (1), a withdrawal order shall promptly be issued by an authorized representative of the Secretary who finds upon any subsequent inspection the existence in such mine of violations similar to those that resulted in the issuance of the withdrawal order under paragraph (1) until such time as an inspection of such mine discloses no similar violations. Following an inspection of such mine which discloses no similar violations, the provisions of paragraph (1) shall again be applicable to that mine.

(e)(1) If an operator has a pattern of violations of mandatory health or safety standards in the coal or other mine which are of such nature as could have significantly and substantially contributed to the cause and effect of coal or other mine health or safety hazards, he shall be given written notice that such pattern exists. If, upon any inspection within 90 days after the issuance of such notice, an authorized representative of the Secretary finds any violation of a mandatory health or safety standard which could significantly and substantially contribute to the cause and effect of a coal or other mine safety or health hazard, the authorized representative shall issue an order requiring the operator to cause all persons in the area affected by such violation, except those persons referred to in subsection (c), to be withdrawn from, and to be prohibited from entering, such area until an authorized representative of the Secretary determines that such violation has been abated.

(2) If a withdrawal order with respect to any area in a coal or other mine has been issued pursuant to paragraph (1), a withdrawal order shall be issued by an authorized representative of the Secretary who finds upon any subsequent inspection the existence in such mine of any violation of a mandatory health or safety standard which could significantly and substantially contribute to the cause and effect of a coal or other mine health or safety hazard. The withdrawal order shall remain in effect until an authorized representative of the Secretary determines that such violation has been abated.

(3) If, upon an inspection of the entire coal or other mine, an authorized representative of the Secretary finds no violations of mandatory health or safety standards that could significantly and substantially contribute to the cause and effect of a coal or other mine health and safety hazard, the pattern of violations that resulted in the issuance of a notice under paragraph (1) shall be deemed to be terminated and the provisions of paragraphs (1) and (2) shall no longer apply. However, if as a result of subsequent violations, the operator reestablishes a pattern of violations, paragraphs (1) and (2) shall again be applicable to such operator.

(4) The Secretary shall make such rules as he deems necessary to establish criteria for determining when a pattern of violations of mandatory health or safety standards exists.

(f) If, based upon samples taken, analyzed, and recorded pursuant to section 202(a), or samples taken during an inspection by an authorized representative of the Secretary, the applicable limit on the concentration of respirable dust required to be maintained under this Act is exceeded and thereby violated, the Secretary or his authorized representative shall issue a citation fixing a reasonable time for the abatement of the violation. During such time, the operator of the mine shall cause samples described in section 202(a) to be taken of the affected area during each production shift. If, upon the expiration of the period of time as originally fixed or subsequently extended, the Secretary or his authorized representative finds that the period of time should not be further extended, he shall determine the extent of the area affected by the violation and shall promptly issue an order requiring the operator of such mine or his agent to cause immediately all persons, except those referred to in subsection (c), to be withdrawn from, and to be prohibited from entering, such area until the Secretary or his authorized representative has reason to believe, based on actions taken by the operator, that such limit will be complied with upon the resumption of production in such mine. As soon as possible after an order is issued, the Secretary, upon request of the operator, shall dispatch to the mine involved a person, or team of persons, to the extent such persons are available, who are knowledgeable in the methods and means of controlling and reducing respirable dust. Such person or team of persons shall remain at the mine involved for such time as they shall deem appropriate to assist the operator in reducing respirable dust concentrations. While at the mine, such persons may require the operator to take such actions as they deem appropriate to insure the health of any person in the coal or other mine.

(g)(1) If, upon any inspection or investigation pursuant to section 103 of this Act, the Secretary or an authorized representative shall find employed at a coal or other mine a miner who has not received the requisite safety training as determined under section 115 of this Act, the Secretary or an authorized representative shall issue an order under this section which declares such miner to be a hazard to himself and to others, and requiring that such miner be immediately withdrawn from the coal or other mine, and be prohibited from entering such mine until an authorized representative of the Secretary determines that such miner has received the training required by section 115 of this Act.

(2) No miner who is ordered withdrawn from a coal or other mine under paragraph (1) shall be discharged or otherwise discriminated against because of such order; and no miner who is ordered withdrawn from a coal or other mine under paragraph (1) shall suffer a loss of compensation during the period necessary for such miner to receive such

training and for an authorized representative of the Secretary to determine that such miner has received the requisite training.

(h) Any citation or order issued under this section shall remain in effect until modified, terminated or vacated by the Secretary or his authorized representative, or modified, terminated or vacated by the Commission or the courts pursuant to section 105 or 106.

PROCEDURE FOR ENFORCEMENT

SEC. 105. (a) If, after an inspection or investigation, the Secretary issues a citation or order under section 104, he shall, within a reasonable time after the termination of such inspection or investigation, notify the operator by certified mail of the civil penalty proposed to be assessed under section 110(a) for the violation cited and that the operator has 30 days within which to notify the Secretary that he wishes to contest the citation or proposed assessment of penalty. A copy of such notification shall be sent by mail to the representative of miners in such mine. If, within 30 days from the receipt of the notification issued by the Secretary, the operator fails to notify the Secretary that he intends to contest the citation or the proposed assessment of penalty, and no notice is filed by any miner or representative of miners under subsection (d) of this section within such time, the citation and the proposed assessment of penalty shall be deemed a final order of the Commission and not subject to review by any court or agency. Refusal by the operator or his agent to accept certified mail containing a citation and proposed assessment of penalty under this subsection shall constitute receipt thereof within the meaning of this subsection.

(b)(1)(A) If the Secretary has reason to believe that an operator has failed to correct a violation for which a citation has been issued within the period permitted for its correction, the Secretary shall notify the operator by certified mail of such failure and of the penalty proposed to be assessed under section 110(b) by reason of such failure and that the operator has 30 days within which to notify the Secretary that he wishes to contest the Secretary's notification of the proposed assessment of penalty. A copy of such notification of the proposed assessment of penalty shall at the same time be sent by mail to the representative of the mine employees. If, within 30 days from the receipt of notification of proposed assessment of penalty issued by the Secretary, the operator fails to notify the Secretary that he intends to contest the notification of proposed assessment of penalty, such notification shall be deemed a final order of the Commission and not subject to review by any court or agency. Refusal by the operator or his agent to accept certified mail containing a notification of proposed assessment of penalty issued under this subsection shall constitute receipt thereof within the meaning of this subsection.

(B) In determining whether to propose a penalty to be assessed under section 110(b), the Secretary shall consider the operator's history of previous violations, the appropriateness of such penalty to the size of the business of the operator charged, whether the operator was negligent, the effect on the operator's ability to continue in business, the gravity of the violation, and the demonstrated good faith of the operator charged in attempting to achieve rapid compliance after notification of a violation.

(2) An applicant may file with the Commission a written request that the Commission grant temporary relief from any modification or termination of any order or from any

order issued under section 104 together with a detailed statement giving the reasons for granting such relief. The Commission may grant such relief under such conditions as it may prescribe, if--

(A) a hearing has been held in which all parties were given an opportunity to be heard;
(B) the applicant shows that there is substantial likelihood that the findings of the Commission will be favorable to the applicant; and
(C) such relief will not adversely affect the health and safety of miners.

No temporary relief shall be granted in the case of a citation issued under subsection (a) or (f) of section 104. The Commission shall provide a procedure for expedited consideration of applications for temporary relief under this paragraph.

(c)(1) No person shall discharge or in any manner discriminate against or cause to be discharged or cause discrimination against or otherwise interfere with the exercise of the statutory rights of any miner, representative of miners or applicant for employment in any coal or other mine subject to this Act because such miner, representative of miners or applicant for employment has filed or made a complaint under or related to this Act, including a complaint notifying the operator or the operator's agent, or the representative of the miners at the coal or other mine of an alleged danger or safety or health violation in a coal or other mine, or because such miner, representative of miners or applicant for employment is the subject of medical evaluations and potential transfer under a standard published pursuant to section 101 or because such miner, representative of miners or applicant for employment has instituted or caused to be instituted any proceeding under or related to this Act or has testified or is about to testify in any such proceeding, or because of the exercise by such miner, representative of miners or applicant for employment on behalf of himself or others of any statutory right afforded by this Act.

(2) Any miner or applicant for employment or representative of miners who believes that he has been discharged, interfered with, or otherwise discriminated against by any person in violation of this subsection may, within 60 days after such violation occurs, file a complaint with the Secretary. alleging such discrimination. Upon receipt of such complaint, the Secretary shall forward a copy of the complaint to the respondent and shall cause such investigation to be made as he deems appropriate. Such investigation shall commence within 15 days of the Secretary's receipt of the complaint, and if the Secretary finds that such complaint was not frivolously brought, the Commission, on an expedited basis upon application of the Secretary, shall order the immediate reinstatement of the miner pending final order on the complaint. If upon such investigation, the Secretary determines that the provisions of this subsection have been violated, he shall immediately file a complaint with the Commission, with service upon the alleged violator and the miner, applicant for employment, or representative of miners alleging such discrimination or interference and propose an order granting appropriate relief. The Commission shall afford an opportunity for a hearing; (in accordance with section 554 of title 5, United States Code, but without regard to subsection (a)(3) of such section) and thereafter shall issue an order, based upon findings of fact, affirming, modifying, or vacating the Secretary's proposed order, or directing other appropriate relief. Such order shall become final 30 days after its issuance. The Commission shall have authority in such proceedings to require a person committing a violation of this subsection to take such affirmative action to abate the

violation as the Commission deems appropriate, including, but not limited to, the rehiring or reinstatement of the miner to his former position with back pay and interest. The complaining miner, applicant, or representative of miners may present additional evidence on his own behalf during any hearing held pursuant to this paragraph.

(3) Within 90 days of the receipt of a complaint filed under paragraph (2), the Secretary shall notify, in writing, the miner, applicant for employment, or representative of miners of his determination whether a violation has occurred. If the Secretary, upon investigation, determines that the provisions of this subsection have not been violated, the complainant shall have the right, within 30 days of notice of the Secretary's determination, to file an action in his own behalf before the Commission, charging discrimination or interference in violation of paragraph (1). The Commission shall afford an opportunity for a hearing (in accordance with section 554 of title 5, United States Code, but without regard to subsection (a)(3) of such section), and thereafter shall issue an order, based upon findings of fact, dismissing or sustaining the complainant's charges and, if the charges are sustained, granting such relief as it deems appropriate, including, but not limited to, an order requiring the rehiring or reinstatement of the miner to his former position with back pay and interest or such remedy as may be appropriate. Such order shall become final 30 days after its issuance. Whenever an order is issued sustaining the complainant's charges under this subsection, a sum equal to the aggregate amount of all costs and expenses (including attorney's fees) as determined by the Commission to have been reasonably incurred by the miner, applicant for employment or representative of miners for, or in connection with, the institution and prosecution of such proceedings shall be assessed against the person committing such violation. Proceedings under this section shall be expedited by the Secretary and the Commission. Any order issued by the Commission under this paragraph shall be subject to judicial review in accordance with section 106. Violations by any person of paragraph (1) shall be subject to the provisions of sections 108 and 110(a).

(d) If, within 30 days of receipt thereof, an operator of a coal or other mine notifies the Secretary that he intends to contest the issuance or modification of an order issued under section 104, or citation or a notification of proposed assessment of a penalty issued under subsection (a) or (b) of this section, or the reasonableness of the length of abatement time fixed in a citation or modification thereof issued under section 104, or any miner or representative of miners notifies the Secretary of an intention to contest the issuance, modification, or termination of any order issued under section 104, or the reasonableness of the length of time set for abatement by a citation or modification thereof issued under section 104, the Secretary shall immediately advise the Commission of such notification, and the Commission shall afford an opportunity for a hearing (in accordance with section 554 of title 5, United States Code, but without regard to subsection (a)(3) of such section), and thereafter shall issue an order, based on findings of fact, affirming, modifying, or vacating the Secretary's citation, order, or proposed penalty, or directing other appropriate relief. Such order shall become final 30 days after its issuance. The rules of procedure prescribed by the Commission shall provide affected miners or representatives of affected miners an opportunity to participate as parties to hearings under this section. The Commission shall take whatever action is necessary to expedite proceedings for hearing appeals of orders issued under section 104.

JUDICIAL REVIEW

SEC. 106. (a)(1) Any person adversely affected or aggrieved by an order of the Commission issued under this Act may obtain a review of such order in any United States court of appeals for the circuit in which the violation is alleged to have occurred or in the United States Court of Appeals for the District of Columbia Circuit, by filing in such court within 30 days following the issuance of such order a written petition praying that the order be modified or set aside. A copy of such petition shall be forthwith transmitted by the clerk of the court to the Commission and to the other parties, and thereupon the Commission shall file in the court the record in the proceeding as provided in section 2112 of title 28, United States Code. Upon such filing, the court shall have exclusive jurisdiction of the proceeding and of the questions determined therein, and shall have the power to make and enter upon the pleadings, testimony, and proceedings set forth in such record a decree affirming, modifying, or setting aside, in whole or in part, the order of the Commission and enforcing the same to the extent that such order is affirmed or modified. No objection that has not been urged before the Commission shall be considered by the court, unless the failure or neglect to urge such objection shall be excused because of extraordinary circumstances. The findings of the Commission with respect to questions of fact, if supported by substantial evidence on the record considered as a whole, shall be conclusive. If any party shall apply to the court for leave to adduce additional evidence and shall show to the satisfaction of the court that such additional evidence is material and that there were reasonable grounds for the failure to adduce such evidence in the hearing before the Commission, the court may order such additional evidence to be taken before the Commission and to be made a part of the record. The Commission may modify its findings as to the facts, or make new findings, by reason of additional evidence so taken and filed, and it shall file such modified or new findings, which findings with respect to questions of fact, if supported by substantial evidence on the record considered as a whole, shall be conclusive. The Commission may modify or set aside its original order by reason of such modified or new findings of fact. Upon the filing of the record after such remand proceedings, the jurisdiction of the court shall be exclusive and its judgment and decree shall be final, except that the same shall be subject to review by the Supreme Court of the United States, as provided in section 1254 of title 28,United States Code. Petitions filed under this subsection shall be heard expeditiously.

(2) In the case of a proceeding to review any order or decision issued by the Commission under this Act, except an order or decision pertaining to an order issued under section 107 (a) or an order or decision pertaining to a citation issued under section 104(a) or (f), the court may, under such conditions as it may prescribe, grant such temporary relief as it deems appropriate pending final determination of the proceeding, if

> (A) all parties to the proceeding have been notified and given an opportunity to be heard on a request for temporary relief;
> (B) the person requesting such relief shows that there is a substantial likelihood that he will prevail on the merits of the final determination of the proceeding; and
> (C) such relief will not adversely affect the health and safety of miners in the coal or other mine.

(3) In the case of a proceeding to review any order or decision issued by the Panel under this Act, the court may, under such conditions as it may prescribe, grant such temporary relief as it deems appropriate pending final determination of the proceeding, if--

(A) all parties to the proceeding have been notified and given an opportunity to be heard on a request for temporary relief; and
(B) the person requesting such relief shows that there is a substantial likelihood that he will prevail on the merits of the final determination of the proceeding.

(b) The Secretary may also obtain review or enforcement of any final order of the Commission by filing a petition for such relief in the United States court of appeals for the circuit in which the alleged violation occurred or in the Court of Appeals for the District of Columbia Circuit, and the provisions of subsection (a) shall govern such proceedings to the extent applicable. If no petition for review, as provided in subsection (a), is flied within 30 days after issuance of the Commission's order, the Commission's findings of fact and order shall be conclusive in connection with any petition for enforcement which is filed by the Secretary after the expiration of such 30-day period. In any such case, as well as in the case of a noncontested citation or notification by the Secretary which has become a final order of the Commission under subsection (a) or (b) of section 105, the clerk of the court, unless otherwise ordered by the court, shall forthwith enter a decree enforcing the order and shall transmit a copy of such decree to the Secretary and the operator named in the petition. In any contempt proceeding brought to enforce a decree of a court of appeals entered pursuant to this subsection or subsection (a), the court of appeals may assess the penalties provided in section 110, in addition to invoking any other available remedies.

(c) The commencement of a proceeding under this section shall not, unless specifically ordered by the court, operate as a stay of the order or decision of the Commission or the Panel.

PROCEDURES TO COUNTERACT DANGEROUS CONDITIONS

SEC. 107. (a) If, upon any inspection or investigation of a coal or other mine which is subject to this Act, an authorized representative of the Secretary finds that an imminent danger exists, such representative shall determine the extent of the area of such mine throughout which the danger exists, and issue an order requiring the operator of such mine to cause all persons, except those referred to in section 104(c), to be withdrawn from, and to be prohibited from entering, such area until an authorized representative of the Secretary determines that such imminent danger and the conditions or practices which caused such imminent danger no longer exist. The issuance of an order under this subsection shall not preclude the issuance of a citation under section 104 or the. proposing of a penalty under section 110.

(b)(1) If, upon any inspection of a coal or other mine, an authorized representative of the Secretary finds (A) that conditions exist therein which have not yet resulted in an imminent danger, (B) that such conditions cannot be effectively abated through the use of existing technology, and (C) that reasonable assurance cannot be provided that the continuance of mining operations under such conditions will not result in an imminent danger, he shall determine the area throughout which such conditions exist, and thereupon issue a notice to the operator of the mine or his agent of such conditions, and

shall file a copy thereof, incorporating his findings therein, with the Secretary and with the representative of the miners of such mine. Upon receipt of such copy, the Secretary shall cause such further investigation to be made as he deems appropriate, including an opportunity for the operator or a representative of the miners to present information relating to such notice.

(2) Upon the conclusion of an investigation pursuant to paragraph (1), and an opportunity for a public hearing upon request by any interested party, the Secretary shall make findings of fact, and shall by decision incorporating such findings therein, either cancel the notice issued under this subsection or issue an order requiring the operator of such mine to cause all persons in the area affected, except those persons referred to in subsection (c) of section 104 to be withdrawn from, and be prohibited from entering, such area until the Secretary, after a public hearing affording all interested persons an opportunity to present their views, determines that such conditions have been abated. Any hearing under this paragraph shall be of record and shall be subject to section 554 of title 5 of the United States Code.

(c) Orders issued pursuant to subsection (a) shall contain a detailed description of the conditions or practices which cause and constitute an imminent danger and a description of the area of the coal or other mine from which persons must be withdrawn and prohibited from entering.

(d) Each finding made and order issued under this section shall be given promptly to the operator of the coal or other mine to which it pertains by the person making such finding or order, and all of such findings and orders shall be in writing, and shall be signed by the person making them. Any order issued pursuant to subsection (a) may be modified or terminated by an authorized representative of the Secretary. Any order issued under subsection (a) or (b) shall remain in effect until vacated, modified, or terminated by the Secretary, or modified or vacated by the Commission pursuant to subsection (e), or by the courts pursuant to section 106(a).

(e)(1) Any operator notified of an order under this section or any representative of miners notified of the issuance, modification, or termination of such an order may apply to the Commission within 30 days of such notification for reinstatement, modification or vacation of such order. The Commission shall forthwith afford an opportunity for a hearing (in accordance with section 554 of title 5, United States Code, but without regard to subsection (a)(3) of such section) and thereafter shall issue an order, based upon findings of fact, vacating, affirming, modifying, or terminating the Secretary's order. The Commission and the courts may not grant temporary relief from the issuance of any order under subsection (a).

(2) The Commission shall take whatever action is necessary to expedite proceedings under this subsection.

INJUNCTIONS

SEC. 108. (a)(1) The Secretary may institute a civil action for relief, including a permanent or temporary injunction, restraining order, or any other appropriate order in the district court of the United States for the district in which a coal or other mine is

located or in which the operator of such mine has his principal office, whenever such operator or his agent--

(A) violates or fails or refuses to comply with any order or decision issued under this Act,
(B) interferes with, hinders, or delays the Secretary or his authorized representative, or the Secretary of Health, Education, and Welfare or his authorized representative, in carrying out the provisions of this Act,
(C) refuses to admit such representatives to the coal or other mine,
(D) refuses to permit the inspection of the coal or other mine, or the investigation of an accident or occupational disease occurring in, or connected with, such mine,
(E) refuses to furnish any information or report requested by the Secretary or the Secretary of Health, Education, and Welfare in furtherance of the provisions of this Act, or
(F) refuses to permit access to, and copying of, such records as the Secretary or the Secretary of Health, Education, and Welfare determines necessary in carrying out the provisions of this Act.

(2) The Secretary may institute a civil action for relief, including permanent or temporary injunction, restraining order, or any other appropriate order in the district court of the United States for the district in which the coal or other mine is located or in which the operator of such mine has his principal office whenever the Secretary believes that the operator of a coal or other mine is engaged in a pattern of violation of the mandatory health or safety standards of this Act, which in the judgment of the Secretary constitutes a continuing hazard to the health or safety of miners.

(b) In any action brought under subsection (a), the court shall have jurisdiction to provide (1) such relief as may be appropriate. In the case of an action under subsection (a)(2), the court shall in its order require such assurance or affirmative steps as it deems necessary to assure itself that the protection afforded to miners under this Act shall be provided by the operator. Temporary restraining orders shall be issued in accordance with rule 65 of the Federal Rules of Civil Procedure, as amended, except that the time limit in such orders, when issued without notice, shall be seven days from the date of entry. Except as otherwise provided herein, any relief granted by the court to enforce any order under paragraph (1) of subsection (a) shall continue in effect until the completion or final termination of all proceedings for review of such order under this title, unless prior thereto, the district court granting such relief sets it aside or modifies it. In any action instituted under this section to enforce an order or decision issued by the Commission or the Secretary after a public hearing in accordance with section 554 of title 5 of the United States Code, the findings of the Commission or the Secretary, as the case may be, if supported by substantial evidence on the record considered as a whole, shall be conclusive.

POSTING OF ORDERS AND DECISIONS

SEC. 109. (a) At each coal or other mine there shall be maintained an office with a conspicuous sign designating it as the office of such mine. There shall be a bulletin board at such office or located at a conspicuous place near an entrance of such mine, in such manner that orders, citations, notices and decisions required by law or regulation to be posted, may be posted thereon, and be easily visible to all persons desiring to read

them, and be protected against damage by weather and against unauthorized removal. A copy of any order, citation, notice or decision required by this Act to be given to an operator shall be delivered to the office of the affected mine, and a copy shall be immediately posted on the bulletin board of such mine by the operator or his agent.

(b) The Secretary shall (1) cause a copy of any order, citation, notice, or decision required by this Act to be given to an operator to be mailed immediately to a representative of the miners in the affected coal or other mine, and (2) cause a copy thereof to be mailed to the public official or agency of the State charged with administering State laws, if any, relating to health or safety in such mine. Such notice, order, citation, or decision shall be available for public inspection.

(c) In order to insure prompt compliance with any notice, order, citation, or decision issued under this Act, the authorized representative of the Secretary may deliver such notice order, citation, or decision to an agent of the operator, and such agent shall immediately take appropriate measures to insure compliance with such notice, order, citation, or decision.

(d) Each operator of a coal or other mine subject to this Act shall file with the Secretary the name and address of such mine and the name and address of the person who controls or operates the mine. Any revisions in such names or addresses shall be promptly filed with the Secretary. Each operator of a coal or other mine subject to this Act shall designate a responsible official at such mine as the principal officer in charge of health and safety at such mine, and such official shall receive a copy of any notice, order, citation, or decision issued under this Act affecting such mine. In any case where the mine is subject to the control of any person not directly involved in the daily operations of the coal or other mine, there shall be filed with the Secretary the name and address of such person and the name and address of a principal official of such person who shall have overall responsibility for the conduct of an effective health and safety program at any coal or other mine subject to the control of such person, and such official shall receive a copy of any notice, order, citation, or decision issued affecting any such mine. The mere designation of a health and safety official under this subsection shall not be construed as making such official subject to any penalty under this Act.

PENALTIES

SEC. 110.(a) The operator of a coal or other mine in which a violation occurs of a mandatory health or safety standard or who violates any other provision of this Act, shall be assessed a civil penalty by the Secretary which penalty shall not be more than $10,000 [currently $60,000] for each such violation. Each occurrence of a violation of a mandatory health or safety standard may constitute a separate offense.

(b) Any operator who fails to correct a violation for which a citation has been issued under section 104(a) within the period permitted for its correction may be assessed a civil penalty of not more than $1,000 [currently $5,500] for each day during which such failure or violation continues.

(c) Whenever a corporate operator violates a mandatory health or safety standard or knowingly violates or fails or refuses to comply with any order issued under this Act or any order incorporated in a final decision issued under this Act, except an order

incorporated in a decision issued under subsection (a) or section 105(c), any director, officer, or agent of such corporation who knowingly authorized, ordered, or carried out such violation, failure, or refusal shall be subject to the same civil penalties, fines, and imprisonment that may be imposed upon a person under subsections (a) and (d).

(d) Any operator who willfully violates a mandatory health or safety standard, or knowingly violates or fails or refuses to comply with any order issued under section 104 and section 107, or any order incorporated in a final decision issued under this title, except an order incorporated in a decision under subsection (a) or section 105(c), shall, upon conviction, be punished by a fine of not more than $25,000 or by imprisonment for not more than one year, or by both, except that if the conviction is for a violation committed after the first conviction of such operator under this Act, punishment shall be by a fine of not more than $50,000 , or by imprisonment for not more than five years, or both.

(e) Unless otherwise authorized by this Act, any person who gives advance notice of any inspection to be conducted under this Act shall, upon conviction, be punished by a fine of not more than $1,000 or by imprisonment for not more than six months, or both.

(f) Whoever knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to this Act shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than five years, or both.

(g) Any miner who willfully violates the mandatory safety standards relating to smoking or the carrying of smoking materials, matches, or lighters shall be subject to a civil penalty assessed by the Commission, which penalty shall not be more than $250 [currently $275] for each occurrence of such violation.

(h) Whoever knowingly distributes, sells, offers for sale, introduces, or delivers in commerce any equipment for use in a coal or other mine, including, but not limited to, components and accessories of such equipment, which is represented as complying with the provisions of this Act, or with any specification or regulation of the Secretary applicable to such equipment, and which does not so comply, shall, upon conviction, be subject to the same fine and imprisonment that may be imposed upon a person under subsection (f) of this section.

(i) The Commission shall have authority to assess all civil penalties provided in this Act. In assessing civil monetary penalties, the Commission shall consider the operator's history of previous violations, the appropriateness of such penalty to the size of the business of the operator charged, whether the operator was negligent, the effect on the operator's ability to continue in business, the gravity of the violation, and the demonstrated good faith of the person charged in attempting to achieve rapid compliance after notification of a violation. In proposing civil penalties under this Act, the Secretary may rely upon a summary review of the information available to him and shall not be required to make findings of fact concerning the above factors.

(j) Civil penalties owed under this Act shall be paid to the Secretary for deposit into the Treasury of the United States and shall accrue to the United States and may be recovered in a civil action in the name of the United States brought in the United States

district court for the district where the violation occurred or where the operator has its principal office. Interest at the rate of 8 percent per annum shall be charged against a person on any final order of the Commission, or the court. Interest shall begin to accrue 30 days after the issuance of such order.

(k) No proposed penalty which has been contested before the Commission under section 105(a) shall be compromised, mitigated, or settled except with the approval of the Commission. No penalty assessment which has become a final order of the Commission shall be compromised, mitigated, or settled except with the approval of the court.

(l) The provisions of this section shall not be applicable with respect to title IV of this Act.

Criminal Monetary Fines

Criminal monetary fines are subject to alternative sentencing provisions found at 18 USC 3571. Readers should consult that provision in the criminal code for exact legal information. However, that provision in general provides that an individual guilty of any felony or any misdemeanor resulting in death may receive a criminal fine of up to $250,000 [Reference: 18 USC 3571 (b)]; an organization found guilty of either any felony or a misdemeanor resulting in death may receive a criminal fine of up to $500,000 [Reference: 18 USC 3571 (c)]. An individual guilty of a misdemeanor not resulting in death is subject to a fine up to $100,000; an organization found guilty of misdemeanor not resulting in death is subject to a fine of $200,000 [same references].

Alternate Sentence Provisions

the maximum criminal fine exposure is significantly greater than reflected in the amounts stated in the Mine Act legislation. The Alternative Sentence provisions are found at 18 United States Code section 3571 which provides in pertinent part:

> (b) Fines for Individuals: an individual who has been found guilty of an offense may not be fined not more than the greatest of-
>
> > (1) the amount specified in the law setting forth the offense
> > (3) for a felony, not more than $250,000
> > (4) for a misdemeanor resulting in death, not more than $250,000
> > (5) for a Class A misdemeanor not resulting in death, not more than $100,000
>
> (c) Fines for organizations:
> > (1) the amount specified in the law setting forth the offense
> > (3) for a felony not more than $500,000
> > (4) for a misdemeanor resulting in death, not more than $500,000
> > (5) for a Class A misdemeanor that does not result in death, not more then $200,000
>
> Class A misdemeanors are misdemeanors subject to maximum imprisonment of less than a year but more than six months. Mine Act misdemeanors are Class A misdemeanors. Any provision which has a maximum term of imprisonment of over one year is a felony.

ENTITLEMENT OF MINERS

SEC. 111. If a coal or other mine or area of such mine is closed by an order issued under section 103, section 104, or section 107, all miners working during the shift when such order was issued who are idled by such order shall be entitled, regardless of the result of any review of such order, to full compensation by the operator at their regular rates of pay for the period they are idled, but for not more than the balance of such shift. If such order is not terminated prior to the next working shift, all miners on that shift who are idled by such order shall be entitled to full compensation by the operator at their regular rates of pay for the period they are idled, but for not more than four hours of such shift. If a coal or other mine or area of such mine is closed by an order issued under section 104 or section 107 of this title for a failure of the operator to comply with any mandatory health or safety standards, all miners who are idled due to such order shall be fully compensated after all interested parties are given an opportunity for a public hearing, which shall be expedited in such cases, and after such order is final, by the operator for lost time at their regular rates of pay for such time as the miners are idled by such closing, or for one week, whichever is the lesser. Whenever an operator violates or fails or refuses to comply with any order issued under section 103, section 104, or section 107 of this Act, all miners employed at the affected mine who would have been withdrawn from, or prevented from entering, such mine or area thereof as a result of such order shall be entitled to full compensation by the operator at their regular rates of pay, in addition to pay received for work performed after such order was issued, for the period beginning when such order was issued and ending when such order is complied with, vacated, or terminated. The Commission shall have authority to order compensation due under this section upon the filing of a complaint by a miner or his representative and after opportunity for hearing subject to section 554 of title 5, United States Code.

MANDATORY HEALTH AND SAFETY TRAINING

SEC. 115. (a) Each operator of a coal or other mine shall have a health and safety training program which shall be approved by the Secretary. The Secretary shall promulgate regulations with respect to such health and safety training programs not more than 180 days after the effective date of the Federal Mine Safety and Health Amendments Act of 1977. Each training program approved by the Secretary shall provide as a minimum that--

(1) new miners having no underground mining experience shall receive no less than 40 hours of training if they are to work underground. Such training shall include instruction in the statutory rights of miners and their representatives under this Act, use of the self-rescue device and use of respiratory devices, hazard recognition, escapeways, walk around training, emergency procedures, basic ventilation, basic roof control, electrical hazards, first aid, and the health and safety aspects of the task to which he will be assigned;

(2) new miners having no surface mining experience shall receive no less than 24 hours of training if they are to work on the surface. Such training shall include instruction in the statutory rights of miners and their representatives under this Act, use of the self-rescue device where appropriate and use of respiratory devices where appropriate, hazard recognition, emergency procedures, electrical hazards, first aid, walk around training and the health and safety aspects of the task to

which he will be assigned;
(3) all miners shall receive no less than eight hours of refresher training no less frequently than once each 12 months, except that miners already employed on the effective date of the Federal Mine Safety and Health Amendments Act of 1977 shall receive this refresher training no more than 90 days after the date of approval of the training plan required by this section;
(4) any miner who is reassigned to a new task in which he has had no previous work experience shall receive training in accordance with a training plan approved by the Secretary under this subsection in the safety and health aspects specific to that task prior to performing that task;
(5) any training required by paragraphs (1), (2) or (4) shall include a period of training as closely related as is practicable to the work in which the miner is to be engaged.

(b) Any health and safety training provided under subsection (a) shall be provided during normal working hours. Miners shall be paid at their normal rate of compensation while they take such training, and new miners shall be paid at their starting wage rate when they take the new miner training. If such training shall be given at a location other than the normal place of work, miners shall also be compensated for the additional costs they may incur in attending such training sessions.

(c) Upon completion of each training program, each operator shall certify, on a form approved by the Secretary, that the miner has received the specified training in each subject area of the approved health and safety training plan. A certificate for each miner shall be maintained by the operator, and shall be available for inspection at the mine site, and a copy thereof shall be given to each miner at the completion of such training. When a miner leaves the operator's employ, he shall be entitled to a copy of his health and safety training certificates. False certification by an operator that training was given shall be punishable under section 110(a) and (f); and each health and safety training certificate shall indicate on its face, in bold letters, printed in a conspicuous manner the fact that such false certification is so punishable.

(d) The Secretary shall promulgate appropriate standards for safety and health training for coal or other mine construction workers.

(e) Within 180 days after the effective date of the Federal Mine Safety and Health Amendments Act of 1977, the Secretary shall publish proposed regulations which shall provide that mine rescue teams shall be available for rescue and recovery work to each underground coal or other mine in the event of an emergency. The costs of making advance arrangements for such teams shall be borne by the operator of each such mine.

Title 30
Code of Federal Regulation
Part 48 - Training

30 CFR § 48.5
Training of new miners; minimum courses of instruction; hours of instruction.

(a) Each new miner shall receive no less than 40 hours of training as prescribed in this section before such miner is assigned to work duties. Such training shall be conducted in conditions which as closely as practicable duplicate actual underground conditions, and approximately 8 hours of training shall be given at the minesite.

(b) The training program for new miners shall include the following courses:

(1) *Instruction in the statutory rights of miners and their representatives under the Act; authority and responsibility of supervisors.* The course shall include instruction in the statutory rights of miners and their representatives under the Act, including a discussion of section 2 of the Act; a review and description of the line of authority of supervisors and miners' representatives and the responsibilities of such supervisors and miners' representatives; and an introduction to the operator's rules and the procedures for reporting hazards.

(2) *Self-rescue and respiratory devices*. The course shall be given before a new miner goes underground and shall include--

(i) Instruction and demonstration in the use, care, and maintenance of self-rescue and respiratory devices used at the mine;

(ii) Hands-on training in the complete donning of all types of self-contained self-rescue devices used at the mine, which includes assuming a donning position, opening the device, activating the device, inserting the mouthpiece, and putting on the nose clip; and

(iii) Hands-on training in transferring between all applicable self-rescue devices.

(3) *Entering and leaving the mine; transportation; communications.* The course shall include instruction on the procedures in effect for entering and leaving the mine; the check-in and checkout system in effect at the mine; the procedures for riding on and in mine conveyances; the controls in effect for the transportation of miners and

materials; and the use of the mine communication systems, warning signals, and directional signs.

(4) *Introduction to the work environment.* The course shall include a visit and tour of the mine, or portions of the mine which are representative of the entire mine. A method of mining utilized at the mine shall be observed and explained.

(5) *Mine map; escapeways; emergency evacuation; barricading*. The program of instruction for mine emergency evacuation and firefighting approved by the District Manager under 30 CFR 75.1502 or the escape and evacuation plan under 30 CFR 57.11053, as applicable, shall be used for this course. The course shall include--

(i) A review of the mine map; the escapeway system; the escape, firefighting, and emergency evacuation plans in effect at the mine; and the location of abandoned areas; and

(ii) An introduction to the methods of barricading and the locations of the barricading materials, where applicable.

(6) *Roof or ground control and ventilation plans.* The course shall include an introduction to and instruction on the roof or ground control plan in effect at the mine and procedures for roof and rib or ground control; and an introduction to and instruction on the ventilation plan in effect at the mine and the procedures for maintaining and controlling ventilation.

(7) *Health.* The course shall include instruction on the purpose of taking dust, noise, and other health measurements, and any health control plan in effect at the mine shall be explained. The health provisions of the act and warning labels shall also be explained.

(8) *Cleanup; rock dusting.* The course shall include instruction on the purpose of rock dusting and the cleanup and rock dusting program in effect at the mine, where applicable.

(9) *Hazard recognition.* The course shall include the recognition and avoidance of hazards present in the mine, particularly any hazards related to explosives where explosives are used or stored at the mine.

(10) *Electrical hazards.* The course shall include recognition and avoidance of electrical hazards.

(11) *First aid.* The course shall include instruction in first aid methods acceptable to MSHA.

(12) *Mine gases.* The course shall include instruction in the detection and avoidance of hazards associated with mine gases.

(13) *Health and safety aspects of the tasks to which the new miner will be assigned.* The course shall include instruction in the health and safety aspects of the

tasks to be assigned, including the safe work procedures of such tasks, the mandatory health and safety standards pertinent to such tasks, information about the physical and health hazards of chemicals in the miner's work area, the protective measures a miner can take against these hazards, and the contents of the mine's HazCom program.

(14) Such other courses as may be required by the District Manager based on circumstances and conditions at the mine.

(c) Methods, including oral, written, or practical demonstration, to determine successful completion of the training shall be included in the training plan. The methods for determining such completion shall be administered to the miner before he is assigned work duties.

(d) A newly employed miner who has less than 12 months of mining experience and has received the courses and hours of instruction in paragraphs (a) and (b) of this section, within 36 months preceding employment at a mine, does not have to repeat this training. Before the miner starts work, the operator must provide the miner with the experienced miner training in § 48.6(b) of this part and, if applicable, the new task training in § 48.7 of this part. The operator must also provide the miner with annual refresher training and additional new task training, as applicable.

30 CFR § 48.6
Experienced miner training.

(a) Except as provided in paragraph (e), this section applies to experienced miners who are--

(1) Newly employed by the operator;

(2) Transferred to the mine;

(3) Experienced underground miners transferred from surface to underground; or

(4) Returning to the mine after an absence of more than 12 months.

(b) Experienced miners must complete the training prescribed in this section before beginning work duties. Each experienced miner returning to mining following an absence of 5 years or more, must receive at least 8 hours of training. The training must include the following instruction:

(1) *Introduction to work environment.* The course shall include a visit and tour of the mine. The methods of mining utilized at the mine shall be observed and explained.

(2) *Mandatory health and safety standards.* The course shall include the mandatory health and safety standards pertinent to the tasks to be assigned.

(3) *Authority and responsibility of supervisors and miners' representatives.* The course shall include a review and description of the line of authority of supervisors and miners' representatives and the responsibilities of such supervisors and miners' representatives; and an introduction to the operator's rules and the procedures for reporting hazards.

(4) *Entering and leaving the mine; transportation; communications.* The course shall include instruction in the procedures in effect for entering and leaving the mine; the check-in and checkout system in effect at the mine; the procedures for riding on and in mine conveyances; the controls in effect for the transportation of miners and materials; and the use of the mine communication systems, warning signals, and directional signs.

(5) *Mine map; escapeways; emergency evacuation; barricading*. The program of instruction for mine emergency evacuation and firefighting approved by the District Manager under 30 CFR 75.1502 or the escape and evacuation plan under 30 CFR 57.11053, as applicable, shall be used for this course. The course shall include--

(i) A review of the mine map; the escapeway system; the escape, firefighting, and emergency evacuation plans in effect at the mine; and the location of abandoned areas; and

(ii) Methods of barricading and the locations of barricading materials, where applicable.

(6) *Roof or ground control and ventilation plans.* The course shall include an introduction to and instruction on the roof or ground control plan in effect at the mine and procedures for roof and rib or ground control; and an introduction to and instruction on the ventilation plan in effect at the mine and the procedures for maintaining and controlling ventilation.

(7) *Hazard recognition*. The course must include the recognition and avoidance of hazards present in the mine.

(8) *Prevention of accidents*. The course must include a review of the general causes of accidents applicable to the mine environment, causes of specific accidents at the mine, and instruction in accident prevention in the work environment.

(9) *Emergency medical procedures*. The course must include instruction on the mine's emergency medical arrangements and the location of the mine's first aid equipment and supplies.

(10) *Health*. The course must include instruction on the purpose of taking dust, noise, and other health measurements, where applicable; must review the health provisions of the Act; and must explain warning labels and any health control plan in effect at the mine.

(11) *Health and safety aspects of the tasks to which the experienced miner is*

assigned. The course must include instruction in the health and safety aspects of the tasks assigned, including the safe work procedures of such tasks, information about the physical and health hazards of chemicals in the miner's work area, the protective measures a miner can take against these hazards, and the contents of the mine's HazCom program. Experienced miners who must complete new task training under §48.7 do not need to take training under this paragraph.

(12) *Self-rescue and respiratory devices*. The course shall be given before the miner goes underground and shall include--

(i) Instruction and demonstration in the use, care, and maintenance of self-rescue and respiratory devices used at the mine;

(ii) Hands-on training in the complete donning of all types of self-contained self-rescue devices used at the mine, which includes assuming a donning position, opening the device, activating the device, inserting the mouthpiece, and putting on the nose clip; and

(iii) Hands-on training in transferring between all applicable self-rescue devices.

(13) Such other courses as may be required by the District Manager based on circumstances and conditions at the mine.

(c) The operator may include instruction on additional safety and health subjects based on circumstances and conditions at the mine.

(d) The training time spent on individual subjects must vary depending upon the training needs of the miners.

(e) Any miner returning to the same mine, following an absence of 12 months or less, must receive training on any major changes to the mine environment that have occurred during the miner's absence and that could adversely affect the miner's health or safety.

(1) A person designated by the operator who is knowledgeable of these changes must conduct the training in this paragraph. An MSHA approved instructor is not required to conduct the training outlined in this paragraph.

(2) No record of this training is required.

(3) The miner must also complete annual refresher training as required in § 48.8, if the miner missed taking that training during the absence.

(f) Coal miners receiving training under this section shall participate in the next drill as required in § § 75.383(b) or 75.1502(c)of this chapter, as applicable.

30 CFR § 48.7
Training of miners assigned to a task in which they have had no previous experience; minimum courses of instruction.

(a) Miners assigned to new work tasks as mobile equipment operators, drilling machine operators, haulage and conveyor systems operators, roof and ground control machine operators, and those in blasting operations shall not perform new work tasks in these categories until training prescribed in this paragraph and paragraph (b) of this section has been completed. This training shall not be required for miners who have been trained and who have demonstrated safe operating procedures for such new work tasks within 12 months preceding assignment. This training shall also not be required for miners who have performed the new work tasks and who have demonstrated safe operating procedures for such new work tasks within 12 months preceding assignment. The training program shall include the following:
(1)*Health and safety aspects and safe operating procedures for work tasks, equipment, and machinery.* The training shall include instruction in the health and safety aspects and the safe operating procedures related to the assigned tasks, including information about the physical and health hazards of chemicals in the miner's work area, the protective measures a miner can take against these hazards, and the contents of the mine's HazCom program. The training shall be given in an on-the-job environment; and
(2)(i) *Supervised practice during nonproduction.* The training shall include supervised practice in the assigned tasks, and the performance of work duties at times or places where production is not the primary objective; on
(a)(2)(ii) *Supervised operation during production.* The training shall include, while under direct and immediate supervision and production is in progress, operation of the machine or equipment and the performance of work duties.
(3) *New or modified machines and equipment.* Equipment and machine operators shall be instructed in safe operating procedures applicable to new or modified machines or equipment to be installed or put into operation in the mine, which require new or different operating procedures.
(4) Such other courses as may be required by the District Manager based on circumstances and conditions at the mine.

(b) Miners under paragraph (a) of this section shall not operate the equipment or machine or engage in blasting operations without direction and immediate supervision until such miners have demonstrated safe operating procedures for the equipment or machine or blasting operation to the operator or the operator's agent.

(c) Miners assigned a new task not covered in paragraph (a) of this section shall be instructed in the safety and health aspects and safe work procedures of the task, including information about the physical and health hazards of chemicals in the miner's work area, the protective measures a miner can take against these hazards, and the contents of the mine's HazCom program, prior to performing such task.

(d) Any person who controls or directs haulage operations at a mine shall receive and complete training courses in safe haulage procedures related to the haulage

system, ventilation system, firefighting procedures, and emergency evacuation procedures in effect at the mine before assignment to such duties.

(e) All training and supervised practice and operation required by this section shall be given by a qualified trainer, or a supervisor experienced in the assigned tasks, or other person experienced in the assigned tasks.

30 CFR § 48.8
Annual refresher training of miners; minimum courses of instruction; hours of instruction.

(a) Each miner shall receive a minimum of 8 hours of annual refresher training as prescribed in this section.

(b) The annual refresher training program for all miners shall include the following courses of instruction:

(1) *Mandatory health and safety standards.* The course shall include mandatory health and safety standard requirements which are related to the miner's tasks.

(2) *Transportation controls and communication systems.* The course shall include instruction on the procedures for riding on and in mine conveyances; the controls in effect for the transportation of miners and materials; and the use of the mine communication systems, warning signals, and directional signs.

(3) *Barricading.* The course shall include a review of the methods of barricading and locations of barricading materials, where applicable.

(4) Roof or ground control, ventilation, emergency evacuation and firefighting plans. The course shall include a review of roof or ground control plans in effect at the mine and the procedures for maintaining and controlling ventilation. In addition, for underground coal mines, except for miners who receive this training under 30 CFR 75.1504, the course shall include a review of the emergency evacuation and firefighting program of instruction in effect at the mine.

(5) *First aid.* The course shall include a review of first aid methods acceptable to MSHA.

(6) *Electrical hazards.* The course shall include recognition and avoidance of electrical hazards.

(7) *Prevention of accidents.* The course shall include a review of accidents and causes of accidents, and instruction in accident prevention in the work environment.

(8) Self-rescue and respiratory devices. The course shall include instruction and demonstration in the use, care, and maintenance of self-rescue and respiratory devices used at the mine. In addition, except for miners who receive this training under 30 CFR 75.1504, the training for self-contained self-rescue (SCSR) devices

shall include:
(i) Hands-on training in the complete donning of all types of self- contained self-rescue devices used at the mine, which includes assuming a donning position, opening the device, activating the device, inserting the mouthpiece, and putting on the nose clip; and
(ii) Hands-on training in transferring between all applicable self- rescue devices.

(9) *Explosives.* The course shall include a review and instruction on the hazards related to explosives. The only exception to this course component is when there are no explosives used or stored on the mine property.

(10) *Mine gases.* The course shall include instruction in the detection and avoidance of hazards associated with mine gases.

(11) *Health.* The course shall include instruction on the purpose of taking dust, noise, and other health measurements and any health control plan in effect at the mine shall be explained. The health provisions of the Act and warning labels shall also be explained.

(12) Such other courses as may be required by the District Manager based on circumstances and conditions at the mine.

(c) Refresher training may include other health and safety subjects that are relevant to mining operations at the mine. Recommended subjects include, but are not limited to, information about the physical and health hazards of chemicals in the miner's work area, the protective measures a miner can take against these hazards, and the contents of the mine's HazCom program.

(d) All persons employed as shaft or slope construction workers on June 28, 2006 must receive annual refresher training within 12 months of June 2006.

(e) Where annual refresher training is conducted periodically, such sessions shall not be less than 30 minutes of actual instruction time and the miners shall be notified that the session is part of annual refresher training.

Title 30
Code of Federal Regulation
Part 50

30 CFR § 50.2
Definitions.

As used in this part:

(a) *Mine* means: (1) An area of land from which minerals are extracted in nonliquid form or, if in liquid form, are extracted with workers underground (2) private ways and roads appurtenant to such area, and (3) 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 such minerals 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 such minerals, or the work of preparing coal or other minerals, and includes custom coal preparation facilities.

(b) *Work of preparing the coal* means the breaking, crushing, sizing, cleaning, washing, drying, mixing, storing, and loading of bituminous coal, lignite, or anthracite, and such other work of preparing such coal as is usually done by the operator of the coal mine.

(c) *Operator* means

(1) Any owner, lessee, or other person who operates, controls, or supervises a coal mine; or,

(2) The person, partnership, association, or corporation, or subsidiary of a corporation operating a metal or nonmetal mine, and owning the right to do so, and includes any agent thereof charged with responsibility for the operation of such mine.

(d) *Miner* means any individual working in a mine.

(e) *Occupational injury* means any injury to a miner which occurs at a mine for which medical treatment is administered, or which results in death or loss of consciousness, inability to perform all job duties on any day after an injury, temporary assignment to other duties, or transfer to another job.

(f) *Occupational illness* means an illness or disease of a miner which may have resulted from work at a mine or for which an award of compensation is made.

(g) *First aid* means one-time treatment, and any follow-up visit for observational purposes, of a minor injury.

(h) *Accident* means

(1) A death of an individual at a mine;

(2) An injury to an individual at a mine which has a reasonable potential to cause death;

(3) An entrapment of an individual for more than 30 minutes or which has a reasonable potential to cause death;

(4) An unplanned inundation of a mine by a liquid or gas;

(5) An unplanned ignition or explosion of gas or dust;

(6) In underground mines, an unplanned fire not extinguished within 10 minutes of discovery; in surface mines and surface areas of underground mines, an unplanned fire not extinguished within 30 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; or, an unplanned roof or rib fall in active workings that impairs ventilation or impedes passage;

(9) A coal or rock outburst that causes withdrawal of miners or which disrupts regular mining activity for more than one hour;

(10) An unstable condition at an impoundment, refuse pile, or culm bank which requires emergency action in order to prevent failure, or which causes individuals to evacuate an area; or, failure of an impoundment, refuse pile, or culm bank;

(11) Damage to hoisting equipment in a shaft or slope which endangers an individual or which interferes with use of the equipment for more than thirty minutes; and

(12) An event at a mine which causes death or bodily injury to an individual not at the mine at the time the event occurs.

30 CFR § 50.10
Immediate notification.

The operator shall immediately contact MSHA at once without delay and within 15 minutes at the toll-free number, 1-800-746-1553, once the operator knows or should know that an accident has occurred involving:

(a) A death of an individual at the mine;

(b) An injury of an individual at the mine which has a reasonable potential to cause death;

(c) An entrapment of an individual at the mine which has a reasonable potential to cause death; or

(d) Any other accident.

30 CFR § 50.11
Investigation.

(a) After notification of an accident by an operator, the MSHA District Manager will promptly decide whether to conduct an accident investigation and will promptly inform the operator of his decision. If MSHA decides to investigate an accident, it will initiate the investigation within 24 hours of notification.

(b) Each operator of a mine shall investigate each accident and each occupational injury at the mine. Each operator of a mine shall develop a report of each investigation. No operator may use Form 7000-1 as a report, except that an operator of a mine at which fewer than twenty miners are employed may, with respect to that mine, use Form 7000-1 as an investigation report respecting an occupational injury not related to an accident. No operator may use an investigation or an investigation report conducted or prepared by MSHA to comply with this paragraph. An operator shall submit a copy of any investigation report to MSHA at its request. Each report prepared by the operator shall include,

(1) The date and hour of occurrence;

(2) The date the investigation began;

(3) The names of individuals participating in the investigation;

(4) A description of the site;

(5) An explanation of the accident or injury, including a description of any equipment involved and relevant events before and after the occurrence, and any explanation of the cause of any injury, the cause of any accident or cause of any other event which caused an injury;

(6) The name, occupation, and experience of any miner involved;

(7) A sketch, where pertinent, including dimensions depicting the occurrence;

(8) A description of steps taken to prevent a similar occurrence in the future; and

(9) Identification of any report submitted under §50.20 of this part.

30 CFR § 50.12
Preservation of evidence.

Unless granted permission by a MSHA District Manager, no operator may alter an accident site or an accident related area until completion of all investigations pertaining to the accident except to the extent necessary to rescue or recover an individual, prevent or eliminate an imminent danger, or prevent destruction of mining equipment.

30 CFR § 50.20
Preparation and submission of MSHA Report Form 7000-1--Mine Accident, Injury, and Illness Report.

(a) Each operator shall maintain at the mine office a supply of MSHA Mine Accident, Injury, and Illness Report Form 7000-1. These may be obtained from the MSHA District Office. Each operator shall report each accident, occupational injury, or occupational illness at the mine. The principal officer in charge of health and safety at the mine or the supervisor of the mine area in which an accident or occupational injury occurs, or an occupational illness may have originated, shall complete or review the form in accordance with the instructions and criteria in §§50.20-1 through 50.20-7. If an occupational illness is diagnosed as being one of those listed in §50.20-6(b)(7), the operator must report it under this part. The operator shall mail completed forms to MSHA within ten working days after an accident or occupational injury occurs or an occupational illness is diagnosed. When an accident specified in §50.10 occurs, which does not involve an occupational injury, sections A, B, and items 5 through 12 of section C of Form 7000-1 shall be completed and mailed to MSHA in accordance with the instructions in §50.20-1 and criteria contained in §§50.20-4 through 50.20-6.

(b) Each operator shall report each occupational injury or occupational illness on one set of forms. If more than one miner is injured in the same accident or is affected simultaneously with the same occupational illness, an operator shall complete a separate set of forms for each miner affected. To the extent that the form is not self-explanatory, an operator shall complete the form in accordance with the instructions in §50.20-1 and criteria contained in §§50.20-2 through 50.20-7.

30 CFR § 50.20-1
General instructions for completing MSHA Form 7000-1.

Each Form 7000-1 consists of four sheets, an original and three copies. The original form shall be mailed to: MSHA Office of Injury and Employment Information, P.O. Box 25367, Denver Federal Center, Denver, Colo. 80225, within ten working days after an accident, occupational injury or occupational illness. At the same time, the first copy shall be mailed to the appropriate local MSHA district. If the first copy does

not contain a completed Section D--Return to Duty Information--the second copy shall be retained by the operator until the miner returns to work or a final disposition is made respecting the miner. When the miner returns to work or a final disposition is made, the operator shall, within five days, complete Section D and mail the second copy to the MSHA Office of Injury and Employment Information. A third copy, containing all the information in the first and second copies shall be retained at the mine office closest to the mine for a period of five years.

You may also submit reports by facsimile, 888-231-5515. To **file electronically**, follow the instructions on the MSHA Internet site, http://www.msha.gov. For assistance in electronic filing, contact the MSHA help desk at 877-778- 6055.

30 CFR § 50.40
Maintenance of records.

(a) Each operator of a mine shall maintain a copy of each investigation report required to be prepared under §50.11 at the mine office closest to the mine for five years after the concurrence.

(b) Each operator shall maintain a copy of each report submitted under §50.20 or §50.30 at the mine office closest to the mine for five years after submission. Upon request by the Mine Safety and Health Administration, an operator shall make a copy of any report submitted under §50.20 or §50.30 available to MSHA for inspection or copying.

30 CFR § 50.41
Verification of reports.

Upon request by MSHA, an operator shall allow MSHA to inspect and copy information related to an accident, injury or illnesses which MSHA considers relevant and necessary to verify a report of investigation required by §50.11 of this part or relevant and necessary to a determination of compliance with the reporting requirements of this part.

Title 30
Code of Federal Regulation
Part 77

30 CFR § 77.2
Definitions.
for the purpose of this part 77, the term:

(a) *Active workings* means any place in a coal mine where miners are normally required to work or travel;

(b) *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;

(c) *Barricaded* means to obstruct passage of persons, vehicles, or flying materials;

(d) *Berm* means a pile or mound of material capable of restraining a vehicle;

(e) *Blasting agent* means any material consisting of a mixture of a fuel and oxidizer which--
(1) Is used or intended for use in blasting;
(2) Is not classed as an explosive by the Department of Transportation;
(3) Contains no ingredient classed as an explosive by the Department of Transportation; and,
(4) Cannot be detonated by a No. 8 blasting cap when tested as recommended in Bureau of Mines Information Circular 8179.

(f) *Blasting area* means the area near blasting operations in which concussion or flying material can reasonably be expected to cause injury.

(g) *Blasting cap* means a detonator containing a charge of detonating compound, which is ignited by electric current, or the spark of a fuse. Used for detonating explosives.

(h) *Blasting circuit* means electric circuits used to fire electric detonators or to ignite an igniter cord by means of an electric starter.

(i) *Blasting switch* means a switch used to connect a power source to a blasting circuit.

(j) *Box-type magazine* means a small, portable magazine used to store limited quantities of explosives or detonators for short periods of time in locations at the mine which are convenient to the blasting sites at which they will be used.

(k) *Capped fuse* means a length of safety fuse to which a detonator has been attached.

(l) *Capped primer* means a package or cartridge of explosives which is specifically designed to transmit detonation to other explosives and which contains a detonator.

(m) *Certified or registered*, as applied to any person means a person certified or registered by the State in which the coal mine is located to perform duties prescribed by this Part 77, except that, in a State where no program of certification or registration is provided or where the program does not meet at least minimum Federal standards established by the Secretary, such certification or registration shall be by the Secretary.

(n) *Detonating cord or detonating fuse* means a flexible cord containing a core of high explosive.

(o) *Detonator* means a device containing a small detonating charge that is used for detonating an explosive, including, but not limited to blasting caps, exploders, electric detonators, and delay electric blasting caps.

(p) *Electrical grounding* means to connect with the ground to make the earth part of the circuit.

(q) *Explosive* means any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. Explosives include, but are not limited to black powder, dynamite, nitroglycerin, fulminate, ammonium nitrate when mixed with a hydrocarbon, and other blasting agents.

(r) *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.

(s) *Low voltage* means up to and including 660 volts, medium voltage means voltages from 661 to 1,000 volts, and high voltage means more than 1,000 volts.

(t) *Misfire* means the complete or partial failure of a blasting charge to explode as planned.

(u) *Primer or Booster* means a package or cartridge of explosive which is designed specifically to transmit detonation to other explosives and which does not contain a detonator.

(v) *Qualified person* means, as the context requires,

(1) An individual deemed qualified by the Secretary and designated by the operator

to make tests and examinations required by this Part 77; and,
(2) An individual deemed, in accordance with the minimum requirements to be established by the Secretary, qualified by training, education, and experience, to perform electrical work, to maintain electrical equipment, and to conduct examinations and make tests of all electrical equipment.

(w) *Roll protection* means a framework, safety canopy, or similar protection for the operator when equipment overturns.

(x) *Safety can* means an approved container, of not over 5 gallons capacity, having a spring-closing lid and spout cover.

(y) *Safety fuse* means a train of powder enclosed in cotton, jute yarn, and waterproofing compounds, which burns at a uniform rate; used for firing a cap containing the detonating compound which in turn sets off the explosive charge.

(z) *Safety switch* means a sectionalizing switch that also provides shunt protection in blasting circuits between the blasting switch and the shot area.

(aa) *Secretary* means the Secretary of Labor or his delegate.

30 CFR § 77.100
Certified person.

(a)(1) The provisions of this Part 77 require that certain examinations and tests be made by a certified person. A certified person within the meaning of these provisions is a person who has been certified in accordance with the provisions of paragraph (b) of this §77.100 to perform the duties, and make the examinations and tests which are required by this Part 77to be performed by a certified person.

(2) A person who has been so certified shall also be considered to be a qualified person within the meaning of those provisions of this Part 77 which require that certain examinations, tests and duties be performed by a qualified person, except those provisions in Subparts F, G, H, I, and J of this part relating to performance of electrical work.

(b) Pending issuance of Federal standards, a person will be considered, to the extent of the certification, a certified person to make examinations, tests and perform duties which are required by this Part 77 to be performed by a certified person:

(1) If he has been certified for such purpose by the State in which the coal mine is located; or

(2) If this person has been certified for such purpose by the Secretary. A person's initial certification is valid for as long as the person continues to satisfy the requirements necessary to obtain the certification and is employed at the same coal mine or by the same independent contractor. The mine operator or independent contractor shall make an application which satisfactorily shows that each such person

has had at least 2 years experience at a coal mine or equivalent experience, and that each such person demonstrates to the satisfaction of an authorized representative of the Secretary that such person is able and competent to test for oxygen deficiency with a permissible flame safety lamp, or any other device approved by the Secretary and to test for methane with a portable methane detector approved by the Bureau of Mines, MESA, or MSHA, under Part 22 of this Chapter (Bureau of Mines Schedule 8C), and to perform such other duties for which application for certification is made. Applications for certification by the Secretary should be submitted in writing to the Mine Safety and Health Administration, Certification and Qualification Center, P.O. Box 25367, Denver Federal Center, Denver, Colorado 80225.

30 CFR § 77.101
Tests for methane and for oxygen deficiency; qualified person.

(a) The provisions of Subparts C, P, R, and T of this Part 77 require that tests for methane and for oxygen deficiency be made by a qualified person. A person is a qualified person for these purposes if he is a certified person for such purposes under§77.100.

(b) Pending issuance of Federal standards, a person will be considered a qualified person for testing for methane and oxygen deficiency:

(1) If he has been qualified for this purpose by the State in which the coal mine is located; or

(2) If he has been qualified by the Secretary for these purposes upon a satisfactory showing by the operator of the coal mine that each such person has been trained and designated by the operator to test for methane and oxygen deficiency. Applications for Secretarial qualification should be submitted in writing to the Mine Safety and Health Administration, Certification and Qualification Center, P.O. Box 25367, Denver Federal Center, Denver, Colo. 80225

30 CFR § 77.102
Tests for methane; oxygen deficiency; qualified person, additional requirement.

Notwithstanding the provisions of §77.101, on and after December 30, 1971, no person shall be a qualified person for testing for methane and oxygen deficiency unless he has demonstrated to the satisfaction of an authorized representative of the Secretary that he is able and competent to make such tests and the Mine Safety and Health Administration has issued him a current card which qualifies him to make such tests.

30 CFR § 77.106
Records of certified and qualified persons.

The operator of each coal mine shall maintain a list of all certified and qualified persons designated to perform duties under this Part 77.

30 CFR § 77.200
Surface installations; general.

All mine structures, enclosures, or other facilities (including custom coal preparation) shall be maintained in good repair to prevent accidents and injuries to employees.

30 CFR § 77.201
Methane content in surface installations.

The methane content in the air of any structure, enclosure or other facility shall be less than 1.0 volume per centum.

30 CFR § 77.201-1
Tests for methane; qualified person; use of approved device.

Tests for methane in structures, enclosures, or other facilities, in which coal is handled or stored shall be conducted by a qualified person with a device approved by the Secretary at least once during each operating shift, and immediately prior to any repair work in which welding or an open flame is used, or a spark may be produced.

30 CFR § 77.201-2
Methane accumulations; change in ventilation.

If, at any time, the air in any structure, enclosure or other facility contains 1.0 volume per centum or more of methane changes or adjustments in the ventilation of such installation shall be made at once so that the air shall contain less than 1.0 volume per centum of methane.

30 CFR § 77.202
Dust accumulations in surface installations.

Coal dust in the air of, or in, or on the surfaces of, structures, enclosures, or other facilities shall not be allowed to exist or accumulate in dangerous amounts.

30 CFR § 77.203
Use of material or equipment overhead; safeguards.

Where overhead repairs are being made at surface installations and equipment or material is taken into such overhead work areas, adequate protection shall be provided for all persons working or passing below the overhead work areas in which such equipment or material is being used.

30 CFR § 77.204
Openings in surface installations; safeguards.

Openings in surface installations through which men or material may fall shall be protected by railings, barriers, covers or other protective devices.

30 CFR § 77.205
Travelways at surface installations.

(a) Safe means of access shall be provided and maintained to all working places.

(b) Travelways and platforms or other means of access to areas where persons are required to travel or work, shall be kept clear of all extraneous material and other stumbling or slipping hazards.

(c) Inclined travelways shall be constructed of nonskid material or equipped with cleats.

(d) Regularly used travelways shall be sanded, salted, or cleared of snow and ice as soon as practicable.

(e) 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.

(f) Crossovers shall be provided where it is necessary to cross conveyors.

(g) Moving conveyors shall be crossed only at designated crossover points.

30 CFR § 77.206
Ladders; construction; installation and maintenance.

(a) Ladders shall be of substantial construction and maintained in good condition.

(b) Wooden members of ladders shall not be painted.

(c) Steep or vertical ladders which are used regularly at fixed locations shall be anchored securely and provided with backguards extending from a point not more than 7 feet from the bottom of the ladder to the top of the ladder.

(d) Fixed ladders shall not incline backwards at any point unless provided with backguards.

(e) Fixed ladders shall be anchored securely and installed to provide at least 3 inches of toe clearance.

(f) Fixed ladders shall project at least 3 feet above landings, or substantial handholds shall be provided above the landings.

30 CFR § 77.207
Illumination.

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.

30 CFR § 77.208
Storage of materials.

(a) Materials shall be stored and stacked in a manner which minimizes stumbling or fall-of-material hazards.
(b) Materials that can create hazards if accidentally liberated from their containers shall be stored in a manner that minimizes the dangers.
(c) Containers holding hazardous materials must be of a type approved for such use by recognized agencies.

(d) Compressed and liquid gas cylinders shall be secured in a safe manner.
(e) 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.

30 CFR § 77.209
Surge and storage piles.

No person shall be permitted to walk or stand immediately above a reclaiming area or in any other area at or near a surge or storage pile where the reclaiming operation may expose him to a hazard.

30 CFR § 77.210
Hoisting of materials.

(a) Hitches and slings used to hoist materials shall be suitable for handling the type of materials being hoisted.

(b) Men shall stay clear of hoisted loads.

(c) Taglines shall be attached to hoisted materials that require steadying or guidance.

30 CFR § 77.211
Draw-off tunnels; stockpiling and reclaiming operations; general.

(a) Tunnels located below stockpiles, surge piles, and coal storage silos shall be ventilated so as to maintain concentrations of methane below 1.0 volume per centum.

(b) In addition to the tests for methane required by §77.201 such tests shall also be made before any electric equipment is energized or repaired, unless equipped with a continuous methane monitoring device installed and operated in accordance with the provisions of §77.211-1. Electric equipment shall not be energized, operated, or repaired until the air contains less than 1.0 volume per centum of methane.

30 CFR § 77.211-1
Continuous methane monitoring device; installation and operation; automatic deenergization of electric equipment.

Continuous methane monitoring devices shall be set to deenergize automatically electric equipment when such monitor is not operating properly and to give a warning automatically when the concentration of methane reaches a maximum percentage determined by an authorized representative of the Secretary which shall not be more than 1.0 volume per centum of methane. An authorized representative of the Secretary shall require such monitor to deenergize automatically electric equipment when the concentration of methane reaches a maximum percentage determined by such representative which shall not be more than 2.0 volume per centum of methane.

30 CFR § 77.212
Draw-off tunnel ventilation fans; installation.

When fans are used to ventilate draw-off tunnels the fans shall be:

(a) Installed on the surface;

(b) Installed in fireproof housings and connected to the tunnel openings with fireproof air ducts; and,

(c) Offset from the tunnel opening.

30 CFR § 77.213
Draw-off tunnel escapeways.

When it is necessary for a tunnel to be closed at one end, an escapeway not less than 30 inches in diameter (or of the equivalent, if the escapeway does not have a circular cross section) shall be installed which extends from the closed end of the tunnel to a safe location on the surface; and, if the escapeway is inclined more than 30 degrees from the horizontal it shall be equipped with a ladder which runs the full length of the inclined portion of the escapeway.

30 CFR § 77.214
Refuse piles; general.

(a) Refuse piles constructed on or after July 1, 1971, shall be located in areas which are a safe distance from all underground mine airshafts, preparation plants, tipples, or other surface installations and such piles shall not be located over abandoned openings or steamlines.

(b) Where new refuse piles are constructed over exposed coal beds the exposed coal shall be covered with clay or other inert material as the piles are constructed.

(c) A fireproof barrier of clay or inert material shall be constructed between old and

new refuse piles.

(d) Roadways to refuse piles shall be fenced or otherwise guarded to restrict the entrance of unauthorized persons.

30 CFR § 77.216
Water, sediment, or slurry impoundments and impounding structures; general.

(a) Plans for the design, construction, and maintenance of structures which impound water, sediment, or slurry shall be required if such an existing or proposed impounding structure can:

(1) Impound water, sediment, or slurry to an elevation of five feet or more above the upstream toe of the structure and can have a storage volume of 20 acre-feet or more; or

(2) Impound water, sediment, or slurry to an elevation of 20 feet or more above the upstream toe of the structure; or

(3) As determined by the District Manager, present a hazard to coal miners.

(b) Plans for the design and construction of all new water, sediment, or slurry impoundments and impounding structures which meet the requirements of paragraph (a) of this section shall be submitted in triplicate to and be approved by the District Manager prior to the beginning of any work associated with construction of the impounding structure.

(c) Before May 1, 1976, a plan for the continued use of an existing water, sediment, or slurry impoundment and impounding structure which meets the requirements of paragraph (a) of this section shall be submitted in triplicate to the District Manager for approval.

(d) The design, construction, and maintenance of all water, sediment, or slurry impoundments and impounding structures which meet the requirements of paragraph (a) of this section shall be implemented in accordance with the plan approved by the District Manager.

(e) All fires in impounding structures shall be extinguished, and the method used shall be in accordance with a plan approved by the District Manager. The plan shall contain as a minimum, provisions to ensure that only those persons authorized by the operator, and who have an understanding of the procedures to be used, shall be involved in the extinguishing operation.

30 CFR § 77.1000
Highwalls, pits and spoil banks; plans.

Each operator shall establish and follow a ground control plan for the safe control of all highwalls, pits and spoil banks to be developed after June 30, 1971, which shall be consistent with prudent engineering design and will insure safe working conditions. The mining methods employed by the operator shall be selected to insure highwall and spoil bank stability.

30 CFR § 77.1001
Stripping; loose material.

Loose hazardous material shall be stripped for a safe distance from the top of pit or highwalls, and the loose unconsolidated material shall be sloped to the angle of repose, or barriers, baffle boards, screens, or other devices be provided that afford equivalent protection.

30 CFR § 77.1002
Box cuts; spoil material placement.

When box cuts are made, necessary precautions shall be taken to minimize the possibility of spoil material rolling into the pit.

30 CFR § 77.1003
Benches.

To insure safe operation, the width and height of benches shall be governed by the type of equipment to be used and the operation to be performed.

30 CFR § 77.1004
Ground control; inspection and maintenance; general.

(a) Highwalls, banks, benches, and terrain sloping into the working areas shall be examined after every rain, freeze, or thaw before men work in such areas, and such examination shall be made and recorded in accordance with §77.1713.

(b) Overhanging highwalls and banks shall be taken down and other unsafe ground conditions shall be corrected promptly, or the area shall be posted.

30 CFR § 77.1005
Scaling highwalls; general.

(a) Hazardous areas shall be scaled before any other work is performed in the hazardous area. When scaling of highwalls is necessary to correct conditions that are hazardous to persons in the area, a safe means shall be provided for performing such work.

(b) Whenever it becomes necessary for safety to remove hazardous material from

highwalls by hand, the hazardous material shall be approached from a safe direction and the material removed from a safe location.

30 CFR § 77.1006
Highwalls; men working.

(a) Men, other than those necessary to correct unsafe conditions, shall not work near or under dangerous highwalls or banks.

(b) Except as provided in paragraph (c) of this section, men shall not work between equipment and the highwall or spoil bank where the equipment may hinder escape from falls or slides.

(c) Special safety precautions shall be taken when men are required to perform repair work between immobilized equipment and the highwall or spoil bank and such equipment may hinder escape from falls or slides.

30 CFR § 77.1007
Drilling; general.

(a) Equipment that is to be used during a shift shall be inspected each shift by a competent person. Equipment defects affecting safety shall be reported.

(b) Equipment defects affecting safety shall be corrected before the equipment is used.

30 CFR § 77.1008
Relocation of drills; safeguards.

(a) 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.

(b) When a drill helper is used his location shall be made known to the operator at all times when the drill is being moved.

30 CFR § 77.1009
Drill; operation.

(a) While in operation drills shall be attended at all times.

(b) Men shall not drill from positions that hinder their access to the control levers, or from insecure footing or staging, or from atop equipment not designed for this purpose.

(c) Men shall not be on a mast while the drill bit is in operation unless a safe platform is provided and safety belts are used.

(d) 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.

(e) In the event of power failure, drill controls shall be placed in the neutral position until power is restored.

(f) When churn drills or vertical rotary drills are used, drillers shall not be permitted to work under suspended tools, and when collaring holes, inspecting, or during any operation in which tools are removed from the hole, all tools shall be lowered to the ground or platform.

30 CFR § 77.1010
Collaring holes.

(a) Starter steels shall be used when collaring holes with hand-held drills.

(b) Men shall not hold the drill steel while collaring holes, or rest their hands on the chuck or centralizer while drilling.

30 CFR § 77.1011
Drill holes; guarding.

Drill holes large enough to constitute a hazard shall be covered or guarded.

30 CFR § 77.1012
Jackhammers; operation; safeguards.

Men operating or working near jackhammers or jackleg drills, or other drilling machines shall position themselves so that they will not be struck or lose their balance if the drill steel breaks or sticks.

30 CFR § 77.1013
Air drills; safeguards.

Air shall be turned off and bled from the air hoses before hand-held air drills are moved from one working area to another.

30 CFR § 77.1700
Communications in work areas.

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.

30 CFR § 77.1701
Emergency communications; requirements.

(a) Each operator of a surface coal mine shall establish and maintain a communication system from the mine to the nearest point of medical assistance for

use in an emergency.

(b) The emergency communication system required to be maintained under paragraph (a) of this section may be established by telephone or radio transmission or by any other means of prompt communication to any facility (for example, the local sheriff, the State highway patrol, or local hospital) which has available the means of communication with the person or persons providing emergency medical assistance or transportation in accordance with the provisions of paragraph (a) of this section.

30 CFR § 77.1702
Arrangements for emergency medical assistance and transportation for injured persons; reporting requirements; posting requirements.

(a) Each operator of a surface coal mine shall make arrangements with a licensed physician, medical service, medical clinic, or hospital to provide 24-hour emergency medical assistance for any person injured at the mine.

(b) Each operator shall make arrangements with an ambulance service, or otherwise provide for 24-hour emergency transportation for any person injured at the mine.

(c) Each operator shall, on or before September 30, 1971, report to the Coal Mine Health and Safety District Manager for the district in which the mine is located the name, title and address of the physician, medical service, medical clinic, hospital, or ambulance service with whom arrangements have been made, or otherwise provided, in accordance with the provisions of paragraphs (a) and (b) of this section.

(d) Each operator shall, within 10 days after any change of the arrangements required to be reported under the provisions of this section, report such changes to the Coal Mine Health and Safety District Manager. If such changes involve a substitution of persons, the operator shall provide the name, title, and address of the person substituted together with the name and address of the medical service, medical clinic, hospital, or ambulance service with which such person or persons are associated.

(e) Each operator shall, immediately after making an arrangement required under the provisions of paragraphs (a) and (b) of this section, or immediately after any change, of such agreement, post at appropriate places at the mine the names, titles, addresses, and telephone numbers of all persons or services currently available under such arrangements to provide medical assistance and transportation at the mine.

30 CFR § 77.1708
Safety program; instruction of persons employed at the mine.

On or before September 30, 1971, each operator of a surface coal mine shall establish and maintain a program of instruction with respect to the safety regulations and procedures to be followed at the mine and shall publish and distribute to each

employee, and post in conspicuous places throughout the mine, all such safety regulations and procedures established in accordance with the provisions of this section.

30 CFR § 77.1710
Protective clothing; requirements.

Each employee working in a surface coal mine or in the surface work areas of an underground coal mine shall be required to wear protective clothing and devices as indicated below:

(a) Protective clothing or equipment and face-shields or goggles shall be worn when welding, cutting, or working with molten metal or when other hazards to the eyes exist.

(b) Suitable protective clothing to cover the entire body when handling corrosive or toxic substances or other materials which might cause injury to the skin.

(c) Protective gloves when handling materials or performing work which might cause injury to the hands; however, gloves shall not be worn where they would create a greater hazard by becoming entangled in the moving parts of equipment.

(d) A suitable hard hat or hard cap when in or around a mine or plant where falling objects may create a hazard. If a hard hat or hard cap is painted, nonmetallic based paint shall be used.

(e) Suitable protective footwear.

(f) Snug-fitting clothing when working around moving machinery or equipment.

(g) Safety belts and lines where there is danger of falling; a second person shall tend the lifeline when bins, tanks, or other dangerous areas are entered.

(h) Lifejackets or belts where there is danger from falling into water.

(i) Seatbelts in a vehicle where there is a danger of overturning and where roll protection is provided.

30 CFR § 77.1710-1
Distinctively colored hard hats or hard caps; identification for newly employed, inexperienced miners.

Hard hats or hard caps distinctively different in color from those worn by experienced miners shall be worn at all times by each newly employed, inexperienced miner when working in or around a mine or plant for at least one year from the date of his initial employment as a miner or until he has been qualified or certified as a miner by the State in which he is employed.

30 CFR § 77.1711
Smoking prohibition.

No person shall smoke or use an open flame where such practice may cause a fire or explosion.

30 CFR § 77.1713
Daily inspection of surface coal mine; certified person; reports of inspection.

(a) At least once during each working shift, or more often if necessary for safety, each active working area and each active surface installation shall be examined by a certified person designated by the operator to conduct such examinations for hazardous conditions and any hazardous conditions noted during such examinations shall be reported to the operator and shall be corrected by the operator.

(b) If any hazardous condition noted during an examination conducted in accordance with paragraph (a) of this section creates an imminent danger, the person conducting such examination shall notify the operator and the operator shall withdraw all persons from the area affected, except those persons referred to in section 104(d) of the Act, until the danger is abated.

(c) After each examination conducted in accordance with the provisions of paragraph (a) of this section, each certified person who conducted all or any part of the examination required shall enter with ink or indelible pencil in a book approved by the Secretary the date and a report of the condition of the mine or any area of the mine which he has inspected together with a report of the nature and location of any hazardous condition found to be present at the mine. The book in which such entries are made shall be kept in an area at the mine designated by the operator to minimize the danger of destruction by fire or other hazard.

(d) All examination reports recorded in accordance with the provisions of paragraph (c) of this section shall include a report of the action taken to abate hazardous conditions and shall be signed or countersigned each day by at least one of the following persons:

(1) The surface mine foreman;

(2) The assistant superintendent of the mine;

(3) The superintendent of the mine; or,

(4) The person designated by the operator as responsible for health and safety at the mine.

(5) An equivalent mine official.

30 CFR § 77.1915
Storage and handling of combustible materials.

(a) Compressed and liquefied gas, oil, gasoline, and other petroleum products shall not be stored within 100 feet of any slope or shaft opening.

(b) Other combustible material and supplies shall not be stored within 25 feet of any slope or shaft opening.

(c) Pyritic slates, bony coal, culm or other material capable of spontaneous combustion shall not be used for fill or as surfacing material within 100 feet of any slope or shaft opening.

(d) Areas surrounding the opening of each slope or shaft shall be constructed to insure the drainage of flammable liquids away from the slope or shaft in the event of spillage.

(e) Oily rags, waste, waste paper, and other combustible waste material disposed of in the vicinity of any slope or shaft opening shall be stored in closed containers until removed from the area.

30 CFR § 77.1916
Welding, cutting, and soldering; fire protection.

(a) One portable fire extinguisher shall be provided where welding, cutting, or soldering with arc or flame is performed.

(b) Welding, cutting, or soldering with arc or flame within or in the vicinity of any slope or shaft, except where such operations are performed in fireproof enclosures, shall be done under the supervision of a qualified person who shall make a diligent search within or in the vicinity of the slope or shaft for fire during and after such operations.

(c) Before welding, cutting, or soldering is performed in any slope or shaft designed to penetrate into any coalbed below the surface, an examination for methane shall be made by a qualified person with a device approved by the Secretary for detecting methane. Examination for methane shall be made immediately before and periodically during welding, cutting, or soldering and such work shall not be permitted to commence or continue in air which contains 1.0 volume per centum or more of methane.

(d) Noncombustible barriers shall be installed below welding, cutting, or soldering operations in or over a shaft.

Utah Code Title 40 - Chapter 2
Utah Administrative Code
Rule R-616-1 and R-616-4

UTAH CODE: Title 40 – Chapter 2 – Coal Mine Safety Act

40-2-101. Title.
This chapter is known as the "Coal Mine Safety Act."

40-2-102. Definitions.
As used in this chapter:

(1) "Adverse action" means to take any of the following actions against a person in a manner that affects the person's employment or contractual relationships:

(a) discharge the person;

(b) threaten the person;

(c) coerce the person;

(d) intimidate the person; or

(e) discriminate against the person, including to discriminate in:

(i) compensation;
(ii) terms;
(iii) conditions;
(iv) location;
(v) rights;
(vi) immunities;
(vii) promotions; or
(viii) privileges.

(2) "Coal mine" means:

(a) the following used in extracting coal from its natural deposits in the earth by any means or method:

(i) the land;
(ii) a structure;
(iii) a facility;
(iv) machinery;
(v) a tool;
(vi) equipment;

(vii) a shaft;
(viii) a slope;
(ix) a tunnel;
(x) an excavation; and
(xi) other property; and

(b) the work of preparing extracted coal, including a coal preparation facility.

(3) "Commission" means the Labor Commission created in Section 34A-1-103.

(4) "Commissioner" means the commissioner appointed under Section 34A-1-201.

(5) "Council" means the Mine Safety Technical Advisory Council created in Section 40-2-203.

(6) "Director" means the director of the Utah Office of Coal Mine Safety appointed under Section 40-2-202.

(7) "Major coal mine accident" means any of the following at a coal mine located in Utah:

(a) a mine explosion;

(b) a mine fire;

(c) the flooding of a mine;

(d) a mine collapse; or

(e) the accidental death of an individual at a mine.

(8) "Mine Safety and Health Administration" means the federal Mine Safety and Health Administration within the United States Department of Labor.

(9) "Office" means the Utah Office of Coal Mine Safety created in Section 40-2-201.

(10) "Panel" means the Coal Miner Certification Panel created in Section 40-2-204.

(11) "Unsafe condition" means a danger that reasonably could be expected to cause serious harm to a person or property.

40-2-103. Scope and administration of chapter.
(1) This chapter applies to any coal mine located in the state.

(2) The commission:

(a) shall administer this chapter with the assistance of the office; and

(a) has jurisdiction over a coal mine in this state as set forth in this chapter.

40-2-104. Rulemaking authority.
In accordance with Title 63G, Chapter 3, Utah Administrative Rulemaking Act, the commission may make rules necessary to implement this chapter.

40-2-201. Utah Office of Coal Mine Safety created.
(1) There is created within the commission the "Utah Office of Coal Mine Safety."

(2) The office, under the direction of the commissioner, shall assist the commission in administering this chapter.

40-2-202. Appointment of director.
1) The director is the chief officer of the office and serves as the executive and administrative head of the office.

(2) (a) The commissioner shall appoint the director.

(b) The director may be removed from that position at the will of the commissioner.

(3) The director shall receive compensation as provided by Title 67, Chapter 19, Utah State Personnel Management Act.

(4) The director shall be experienced in administration and possess such additional qualifications as determined by the commissioner.

40-2-203. Mine Safety Technical Advisory Council created -- Duties.
(1) Within the office there is created the "Mine Safety Technical Advisory Council" consisting of 13 voting members and 5 nonvoting members as provided in this section.

(2) (a) The commissioner shall appoint the voting members of the council as follows:

(i) one individual who represents a coal miner union;

(ii) two individuals with coal mining experience;

(iii) two individuals who represent coal mine operators;

(iv) one individual who represents an industry trade association;

(v) two individuals from local law enforcement agencies or emergency medical service providers;

(vi) three individuals who have expertise in one or more of the following:
(A) seismology;
(B) mining engineering;
(C) mine safety; or
(D) another related subject; and

(vii) two individuals from entities that provide mine safety training.

(b) The nonvoting members of the council are:

(i) the commissioner or the commissioner's designee;

(ii) the executive director of the Department of Natural Resources or the executive director's designee;

(iii) the commissioner of the Department of Public Safety or the commissioner's designee;

(iv) a representative of the Mine Safety and Health Administration selected by the Mine Safety and Health Administration; and

(v) a representative of the federal Bureau of Land Management selected by the federal Bureau of Land Management.

(3) (a) Except as required by Subsection (3)(b), a voting member shall serve a four-year term beginning July 1 and ending June 30.

(b) Notwithstanding the requirements of Subsection (3)(a), the commission shall, at the time of appointment of the initial voting members of the council, adjust the length of terms of the voting members to ensure that the terms of voting members are staggered so that approximately half of the voting members are appointed every two years.

(4) (a) The commissioner shall terminate the term of a voting member who ceases to be representative as designated by the voting member's original appointment.

(b) If a vacancy occurs in the voting members, the commissioner shall appoint a replacement for the unexpired term after soliciting recommendations from the council members.

(5) (a) The council shall meet at least quarterly.

(b) A majority of the voting members constitutes a quorum.

(c) A vote of the majority of the members of the council when a quorum is present constitutes an action of the council.

(6) (a) The commissioner or the commissioner's designee is the chair of the council.

(b) The commission shall staff the council.

(7) (a) (i) A member who is not a state or local government employee may not receive compensation or benefits for the member's service, but may receive per diem and expenses incurred in the performance of the member's official duties at the

rates established by the Division of Finance under Sections 63A-3-106 and 63A-3-107.

(ii) A member who is not a state or local government employee may decline to receive per diem and expenses for the member's service.

(b) (i) A state government officer and employee member who does not receive salary, per diem, or expenses from the agency the member represents for the member's service may receive per diem and expenses incurred in the performance of the member's official duties at the rates established by the Division of Finance under Sections 63A-3-106 and 63A-3-107.

(ii) A state government officer and employee member may decline to receive per diem and expenses for the member's service.

(c) (i) A local government member who does not receive salary, per diem, or expenses from the entity that the member represents for the member's service may receive per diem and expenses incurred in the performance of the member's official duties at the rates established by the Division of Finance under Sections 63A-3-106 and 63A-3-107.
(ii) A local government member may decline to receive per diem and expenses for the member's service.

(8) The council shall advise and make recommendations to the commission, the office, and the Legislature regarding:

(a) safety of coal mines located in Utah;

(b) prevention of coal mine accidents;

(c) effective coal mine emergency response;

(d) coal miner certification and recertification; and

(e) other topics reasonably related to safety of coal mines located in Utah.

40-2-204. Coal Miner Certification Panel created -- Duties.
(1) There is created within the office the "Coal Miner Certification Panel."

(2) The panel consists of:

(a) the commissioner or the commissioner's designee; and

(b) at least eight other members appointed by the commissioner with equal representation and participation from:
(i) management of coal mine operations;
(ii) hourly coal mining employees.

(3) A member appointed by the commissioner shall:

(a) have at least five years' experience in coal mining in this state;

(b) administer the certification test to an applicant referred to in Section 40-2-402;

c) consult with the commission about applicant qualifications specified in Section 40-2-402;

(d) meet when directed by the commissioner or the commissioner's designee; and

(e) hold office at the pleasure of the commissioner.

(4) A panel member who is not a government employee may not receive compensation or benefits for the member's services, but may receive per diem and expenses incurred in the performance of the member's official duties at the rates established by the Division of Finance under Sections 63A-3-106 and 63A-3-107.

40-2-301. Commission and office responsibilities.
(1) The commissioner shall:

(a) direct the state's efforts to promote coal mine safety; and

(b) participate with the Mine Safety and Health Administration in an investigation of a major coal mine accident in Utah.

(2) The commission shall establish by rule, made in accordance with Title 63G, Chapter 3, Utah Administrative Rulemaking Act:

(a) a system consistent with Section 40-2-302 to receive, evaluate, and act on a report of an alleged unsafe condition at a coal mine; and

(b) requirements for a coal mine operator regarding notification of a coal mine accident as part of a coal mine operator's emergency response plan.

(3) The office may:

(a) conduct one or more studies to promote coal mine safety;

(b) cooperate with educational and other organizations to promote mining engineering and mine safety training;

(c) establish a cooperative relationship with the Mine Safety and Health Administration to promote coal mine safety in Utah;

(d) serve as the lead state agency in developing and implementing state and local response and communication plans for major coal mine accidents in Utah; and

(e) implement the notification requirements established under Subsection (2)(b).

40-2-302. Reporting of an unsafe condition in coal mines -- Adverse action prohibited.
(1) Subject to the other provisions of this section, upon the office's receipt of information from a person of a possible unsafe condition in a coal mine located in Utah, the office may:

(a) notify the federal Mine Safety and Health Administration;

(b) notify another appropriate federal, state, or local government agency;

(c) contact the operator of the coal mine;

(d) refer the information to the council on a confidential basis; or

(e) take any other authorized action.

(2) The commission, council, or office may not disclose or otherwise make public the identity of a person who reports a possible unsafe condition in a coal mine located in Utah unless that person authorizes the commission, council, or office to disclose the person's identity.

(3) A coal mine operator may not take adverse action against a person because that person:

(a) reports an alleged unsafe mine condition; or

(b) testifies, assists, or participates in any manner in an investigation, proceeding, or hearing under this chapter.

40-2-303. Annual report on coal mine safety.
(1) By October 1 of each year, the commission, office, and council shall compile and submit to the governor and the Legislature a comprehensive report of the status of coal mine safety within the state for the immediately preceding calendar year.

(2) The report required by this section shall include:

(a) a compilation of major coal mine accidents or other coal mine emergencies within the state during the calendar year;

(b) a statement of actions by the commission, office, or council to implement this chapter;

(c) without a breach in confidentiality, a summary of reports of alleged unsafe conditions received by the office, with a statement of the office's responses;

(d) recommendations for additional action to promote coal mine safety; and

(e) any other items the commission, office, and council consider appropriate.

40-2-401. Necessity of certificate.

(1) A person may not work in an occupation referred to in Section 40-2-402 unless granted a certificate by the commission.

(2) (a) (i) The commission may grant a temporary coal mine foreman certificate or a temporary coal mine surface foreman certificate to an applicant who is:

(A) recommended by a coal mine; and

(B) interviewed and found competent by two panel members.

(ii) A certificate granted under Subsection (2)(a)(i) remains in effect until:

(A) the next scheduled certification test;

(B) the person is retested; or

(C) the commission terminates the certificate.

(b) (i) The commission may grant a surface foreman certificate to a current holder of an underground mine foreman certificate, if the applicant has three years of varied surface mining experience.

(ii) A surface foreman certificate applicant may receive credit for surface experience in any other industry that has substantially equivalent surface facilities, if the applicant has performed or is presently performing the duties normally required of a surface foreman.

(3) (a) The commission shall collect a fee described in Subsection (3)(b) for each temporary certificate.

(b) The commission shall establish the fee by following Section 63J-1-303.

(4) (a) An owner, operator, contractor, lessee, or agent may not employ a worker in any occupation referred to in Section 40-2-402 who is uncertified.

(b) The certificate shall be on file and available for inspection to interested persons in the office of the coal mine.

(5) The commission shall grant a certificate to an applicant referred to in Section 40-2-402 who:

(a) passes the certification test administered by the panel; and

(b) meets the qualifications specified in Section 40-2-402.

(6) (a) The commission may grant a certificate to an applicant involved in gilsonite or other hydrocarbon mining as provided by rule.

(b) The commission shall enact rules governing the certification procedure, test, and qualifications for applicants involved in gilsonite or other hydrocarbon mining.

(7) The commission may by rule require certification and recertification of other coal mine occupations, including the certification of a new coal miner.

40-2-402. Certification requirements.

(1) The commission shall collect a fee for:

(a) the taking of a certification test; or

(b) the retaking of one or more sections of a certification test.

(2) (a) The commission shall establish fees by following Section 63J-1-303.

(b) Notwithstanding Subsection 63J-1-303(2)(e), the commission:

(i) shall retain the fees as dedicated credits; and

(ii) may only use the fees to administer the certification test.

(3) An applicant who fails any section of the certification test may retake that section of the test.

(4) (a) An applicant who wishes to obtain a mine foreman certificate shall have at least four years varied underground coal mining experience, of which:

(i) two years' experience may be credited to a mining engineering graduate of an accredited four-year college; or

(ii) one year's experience may be credited to a graduate of a two-year course in mining technology.

(b) An applicant who wishes to obtain a surface foreman certificate shall have at least three years of varied surface experience.

(i) The commission may grant a surface foreman certificate applicant credit for surface experience in any other industry that has substantially equivalent surface facilities.

(c) An applicant who wishes to obtain a fire boss certificate shall have at least two years of underground coal mining experience, of which:

(i) one year's experience may be credited to a mining engineering graduate of an accredited four-year college; or
(ii) six months' experience may be credited to a graduate of a two-year course in mining technology.

(d) An applicant who wishes to obtain an underground mine electrician certificate shall have at least one year of varied electrical experience as specified in 30 C.F.R. Sec. 75.153.

(e) An applicant who wishes to obtain a surface mine electrician certificate shall have at least one year of varied surface electrical experience as specified in 30 C.F.R. Sec. 77.103.

(5) A certificate granted under Section 40-2-401 and this section shall expire if the certificate holder ceases to work in the mining industry or a mine related industry for more than five consecutive years.

R616. Labor Commission, Boiler and Elevator Safety.

R616-1. Coal, Gilsonite, or other Hydrocarbon Mining Certification.

R616-1-1. Authority and Purpose.
This rule is established pursuant to Section 40-2-1.1 and Section 40-2-14, which authorize the Labor Commission to enact rules governing the certification of individuals to work in the positions of underground mine foreman, surface mine foreman, fire boss, underground electrician or surface electrician in coal mines, gilsonite mines or other hydrocarbon mines in Utah.

R616-1-2.Definitions.

A. "Commission" means the Labor Commission created in Section 34A-1-103.

B. "Division" means the Division of Boiler and Elevator Safety of the Labor Commission.

C. "Certification" means a person being judged competent and qualified by the Division for a mining position identified in Section 40-2-15 by meeting standards established by the Division and the examining panel pursuant to the requirements in Sections 40-2-14 through 16.

R616-1-3. Fees.
As required by Section 40-2-15, the Labor Commission shall establish and collect fees for certification sufficient to fund the Commission's miner certification process. The Commission's fees schedule shall be submitted to the Legislature for approval pursuant to Section 63-38-3(2).

R616-1-4. Code of Federal Regulations.
The provisions of 30 CFR, sections 1 through 199, "Federal Underground Coal Mine Safety Standards," 11th ed., July 1, 1996, are hereby incorporated by reference.

R616-1-5. Initial Agency Action.
Division action either granting or denying an applicant's application for certification are classified as informal adjudicative actions pursuant to Section 63-46b-4 of the Utah Administrative Procedures Act and shall be adjudicated accordingly.

Authorizing, and Implemented or Interpreted Law: 34A-1-104; 40-2-1 et seq.

R616-4. Coal Mine Safety.

R616-4-1. Authority and Purpose.
This rule is established pursuant to authority granted the Commission by 40-2-104 and 40-2-301(2) for the purpose of improving coal mine safety, preventing coal mine accidents, and improving coal mine accident response consistent with the Coal Mine Safety Act.

R616-4-3. Examining Coal Mines.
(1) Pursuant to 34A-1-406 and other provisions of Utah Law, representatives of the Utah Labor Commission are authorized to enter places of employment, including coal mines, for purposes of "examining the provisions made for the health and safety of the employees in the place of employment."

(2) If the Director of the Office of Coal Mine Safety determines that the safety of an employee is or will be endangered by activities or conditions in a coal mine, the Director may:

(a) notify the employee and mine management of the danger and specify actions necessary to remedy the danger;

(b) notify the Mine Safety and Health Administration of the danger;

(c) notify other appropriate federal, state, and local government agencies; and

(d) take such other action as authorized by law to eliminate or mitigate the danger.

R616-4-4. Accident Notification Requirements.
(1) After the occurrence of any coal mine accident that is required by MSHA or regulations 30 CFR Part 50 to be immediately reported to MSHA, a coal mine operator shall first notify MSHA of the accident. Immediately after completing its report to MSHA, the coal mine operator shall then report the accident to the Office of Coal Mine Safety at telephone number 1-888-988-6463.

R616-4-5. Emergency Response Training.
(1) Beginning with the 2010 calendar year, each coal mine operator shall annually hold an in person meeting with law enforcement, public safety and health care providers for the purpose of reviewing and refining coal mine emergency response plans. The Office of Coal Mine Safety shall be notified of and arrange to participate in each such meeting, but the inability of the Office or any local, state, and federal emergency response personnel to attend such a meeting shall not prevent the operator from proceeding with the meeting as scheduled.

MINE LAW
Questions for Review

Q: When do highwalls, benches and banks have to be examined?
A: CFR 77.1004

Q: How often must drilling equipment be inspect?
A: CFR 77.1007

Q: You should never do what, when collaring a drill hole?
A: CFR 77.1011

Q: What must be done before moving hand-held drills?
A: CFR 77.1013

Q: What protective clothing and equipment must be worn when welding?
A: CFR 77.1710

Q: What is the permissible methane content in the air of any surface structure facility or enclosure?
A: CFR 77.201

Q: How often do active working areas and surface installations have to be examined?
A: CFR 77.1713

Q: All examination reports that that include a report of action taken to abate hazardous conditions must be signed each day by whom?
A: CFR 77.1713 (d)

Q: No employee shall be assigned, or allowed, to work in an area where:
A: CFR 77.1700

Q: All mine structures, enclosures and facilities shall be maintained how?
A: CFR 77.200

Q: Openings in surface installations, where men or material may fall, must be protected by what?
A: CFR 77.204

Q: Fans that used to ventilate draw-off tunnels shall be install how?
A: CFR 77.212

Q: What should be used to seal the surface of a refuse pile where a spontaneous ignition has occurred?
A: CFR 77.215 (c)

Q: What is a refuse pile?
A: CFR 77.217 (e)

Q: Coal dust is not allowed to accumulate where?
A: CFR 77.202

Q: How should travelways and platforms be maintained?
A: CFR 77.205

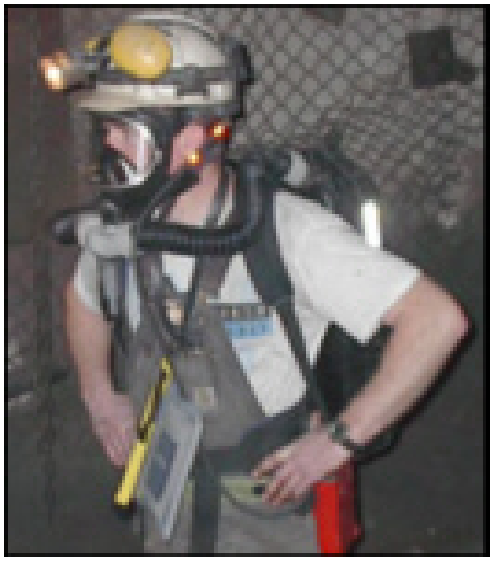
Q: Fixed ladders shall be anchored securely and installed how?
A: CFR 77.206 (e)

CHAPTER THREE

GENERAL MINING AND MECHANICAL

1. Hazardous Material - CFR Part 47
2. Occupational Noise Exposure – CFR Part 62
3. General Mining - CFR Part 71
4. Safeguards for Mechanical Equipment - CFR Part 77
5. Questions and Review

HARZARDOUS MATERIAL



Hazardous Materials Management

A hazardous material is any material (biological, chemical, physical) which has the potential to cause harm to humans, animals, or the environment. CFR 1910.1200 defines hazardous materials as any substance or chemical which is a health hazard or physical hazard, including chemicals which are carcinogens, toxic agents, irritants, corrosive, sensitizers; agents which damage the lungs, skin, eyes, or mucous membranes; chemicals which are combustible, explosive, flammable, oxidizers; and chemicals which in the course of normal handling, use, or storage may produce toxic dusts, gases, fumes, vapors, mists, or smoke.

Miners are often exposed to toxic substances on the job. Lack of awareness of such materials is the frequent cause of many mishaps. Workers need to be told the names of substances with which they are working, if there are any potential health hazards, and what control measures are available. This should include receiving general information about how chemicals enter and affect the body.

Information and pictures for Hazardous Materials was obtained from the following publications/websites:

- NIOSH Office of Mine Safety and Health Research

Title 30
Code of Federal Regulation
Part 47 – HazCom

30 CFR § 47.1
Purpose of a HazCom standard; applicability.

The purpose of this part is to reduce injuries and illnesses by ensuring that each operator--

(a) Identifies the chemicals at the mine,
(b) Determines which chemicals are hazardous,
(c) Establishes a HazCom program, and
(d) Informs each miner who can be exposed, and other on-site operators whose miners can be exposed, about chemical hazards and appropriate protective measures.
(e) As of September 23, 2002, all mines employing six or more miners are required to comply with this part.
(f) As of March 21, 2003, all mines employing five or fewer miners are required to comply with this part.

30 CFR § 47.2
Operators and chemicals covered; initial miner training.

(a) This part applies to any operator producing or using a hazardous chemical to which a miner can be exposed under normal conditions of use or in a foreseeable emergency. (Subpart J of this part lists exemptions from coverage.)

(b) Operators of mines which employ six or more miners must instruct each miner with information about the physical and health hazards of chemicals in the miner's work area, the protective measures a miner can take against these hazards, and the contents of the mine's HazCom program by September 23, 2002. Operators of mines that employ five or fewer miners must instruct each miner with information about the physical and health hazards of chemicals in the miner's work area, the protective measures a miner can take against these hazards, and the contents of the mine's HazCom program by March 21, 2003.

30 CFR § 47.11
Definitions of terms used in this part.
The definitions in Table 47.11 apply in this part as follows:

Table 47.11--Definitions

Term	Definition for purposes of HazCom
Access	The right to examine and copy records.
Article	A manufactured item, other than a fluid or particle, that-- (1) Is formed to a specific shape or design during manufacture, and (2) Has end-use functions dependent on its shape or design.
Chemical	Any element, chemical compound, or mixture of these.
Chemical name	(1) The scientific designation of a chemical in accordance with the nomenclature system of either the International Union of Pure And Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS), or (2) A name that will clearly identify the chemical for the purpose of conducting a hazard evaluation.
Common name	Any designation or identification (such as a code name, code number, trade name, brand name, or generic name) used to identify a chemical other than by its chemical name.
Consumer product	A product or component of a product that is packaged, labeled, and distributed in the same form and concentration as it is sold for use by the general public.
Container	(1) Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like. (2) The following are not considered to be containers for the purpose of compliance with this part: (i) Pipes or piping systems; (ii) Conveyors; and (iii) Engines, fuel tanks, or other operating systems or parts in a vehicle.
Cosmetics and drugs	(1) Cosmetics are any article applied to the human body for cleansing, beautifying, promoting attractiveness, or altering appearance.

(2) Drugs are any article used to affect the structure or any function of the body of humans or other animals.

CPSC..... The U.S. Consumer Product Safety Commission.

Designated representative..... (1) Any individual or organization to whom a miner gives written authorization to exercise the miner's rights under this part, or

(2) A representative of miners under part 40 of this chapter.

EPA..... The U.S. Environmental Protection Agency.

Exposed..... Subjected, or potentially subjected, to a physical or health hazard in the course of employment. ``Subjected,'' in terms of health hazards, includes any route of entry, such as through the lungs (inhalation), the stomach (ingestion), or the skin (skin absorption).

Foreseeable emergency..... Any potential occurrence that could result in an uncontrolled release of a hazardous chemical into the mine.

Hazard warning..... Any words, pictures, or symbols, appearing on a label or other form of warning, that convey the specific physical and health hazards of the chemical. (See the definitions for physical hazard and health hazard for examples of the hazards that the warning must convey.)

Hazardous chemical..... Any chemical that can present a physical or health hazard.

Hazardous substance..... Regulated by CPSC under the Federal Hazardous Substances Act or EPA under the Comprehensive Environmental Response, Compensation, and Liability Act.

Hazardous waste..... Chemicals regulated by EPA under the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act.

Health hazard..... A chemical for which there is statistically significant evidence that it can cause acute or chronic health effects in exposed persons. Health hazard includes chemicals which--

(1) Cause cancer;

	(2) Damage the reproductive system or cause birth defects; (3) Are irritants, corrosives, or sensitizers; (4) Damage the liver; (5) Damage the kidneys; (6) Damage the nervous system; (7) Damage the blood or lymphatic systems; (8) Damage the stomach or intestines; (9) Damage the lungs, skin, eyes, or mucous membranes; or (10) Are toxic or highly toxic agents.
Health professional.....	A physician, physician's assistant, nurse, emergency medical technician, or other person qualified to provide medical or occupational health services.
Identity.....	A chemical's common name or chemical name.
Label.....	Any written, printed, or graphic material displayed on or affixed to a container to identify its contents and convey other relevant information.
Material safety data sheet (MSDS).	Written or printed material concerning a hazardous chemical which-- (1) An operator prepares in accordance with Table 47.52-- Contents of MSDS; or (2) An employer prepares in accordance with 29 CFR 1910.1200, 1915.1200, 1917.28, 1918.90, 1926.59, or 1928.21 (OSHA Hazard Communication regulations); or (3) An independent source prepares which contains equivalent information, such as International Chemical Safety Cards (ICSC) and Workplace Hazardous Material Information Sheets (WHMIS).
Mixture.....	Any combination of two or more chemicals which is not the result of a chemical reaction.
Ordinary consumer use.....	Household, family, school, recreation, or other personal use or enjoyment, as opposed to business use.
OSHA.....	The Occupational Safety and Health Administration, U.S. Department of Labor.
Physical hazard.....	A chemical for which there is scientifically valid evidence that it is--

(1) Combustible liquid: (i) A liquid having a flash point at or above 100 deg.F (37.8 deg.C) and below 200 deg.F (93.3 deg.C); or (ii) A liquid mixture having components with flashpoints of 200 deg.F (93.3 deg.C) or higher, the total volume of which make up 99% or more of the mixture.

(2) Compressed gas: (i) A contained gas or mixture of gases with an absolute pressure exceeding: (A) 40 psi (276 kPa) at 70 deg.F (21.1 deg.C); or (B) 104 psi (717 kPa) at 130 deg.F (54.4 deg.C) Regardless of pressure at 70 deg.F. (ii) A liquid having a vapor pressure exceeding 40 psi (276 kPa) at 100 deg.F (37.8 deg.C) as determined by ASTM D-323-82.

(3) Explosive: A chemical that undergoes a rapid chemical change causing a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

(4) Flammable: A chemical that will readily ignite and, when ignited, will burn persistently at ambient temperature and pressure in the normal concentration of oxygen in the air.

(5) Organic peroxide: An explosive, shock sensitive, organic compound or an oxide that contains a high proportion of oxygen-superoxide.

(6) Oxidizer: A chemical, other than an explosive, that initiates or promtes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

(7) Pyrophoric: Capable of igniting spontaneously in air at a temperature of 130 deg.F (54.4 deg.C) or below.

(8) Unstable (reactive): A chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, or temperature.

	(9) Water-reactive: A chemical that reacts with water to release a gas that is either flammable or a health hazard.
Produce	To manufacture, process, formulate, generate, or repackage.
Raw material	Ore, valuable minerals, worthless material or gangue, overburden, or a combination of these, that is removed from natural deposits by mining or is upgraded through milling.
Trade secret	Any confidential formula, pattern, process, device, information, or compilation of information that is used by the operator and that gives the operator an opportunity to obtain an advantage over competitors who do not know about it or use it.
Use	To package, handle, react, or transfer.
Work area	Any place in or about a mine where a miner works.

30 CFR § 47.21
Identifying hazardous chemicals.

The operator must evaluate each chemical brought on mine property and each chemical produced on mine property to determine if it is hazardous as specified in Table 47.21 as follows:

Table 47.21--Identifying Hazardous Chemicals

Category	Basis for determining if a chemical is hazardous
(a) Chemical brought to the mine	The chemical is hazardous when its MSDS or container label indicates it is a physical or health hazard; or the operator may choose to evaluate the chemical using the criteria in paragraphs (b) and (c) of this table.
(b) Chemical produced at the mine	The chemical is hazardous if any one of the following that it is a hazard: (1) Available evidence concerning its physical or health hazards. (2) MSHA standards in 30 CFR chapter I. (3) Occupational Safety and Health Administration (OSHA), 29 CFR part 1910, subpart Z, Toxic and Hazardous Substances.

	(4) American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values and Biological Exposure Indices (2001. (5) U.S. Department of Health & Human Services Services, National Toxicology Program (NTP), Ninth Annual Report on Carcinogens, January 2001. (6) International Agency for Research on Cancer (IARC), Monographs and related supplements, Volumes 1 through 77.
(c) Mixture produced at the mine..	(1) If a mixture has been tested as a whole to determine its hazards, use the results of that testing. (2) If a mixture has not been tested as a whole to determine its hazards- - (i) Use available, scientifically valid evidence to determine its physical hazard potential; (ii) Assume that it presents the same health hazard as a non-carcinogenic component that makes up 1% or more (by weight or volume) of the mixture; and (iii) Assume that it presents a carcinogenic health hazard if a component considered carcinogenic by NTP or IARC makes up 0.1% or more (by weight or volume) of the mixture. (3) If evidence indicates that a component could Be released from a mixture in a concentration that could present a health risk to miners, assume that the mixture presents the same hazard.

---

30 CFR § 47.31
Requirement for a HazCom program.

Each operator must--

(a) Develop and implement a written HazCom program,

(b) Maintain it for as long as a hazardous chemical is known to be at the mine, and

(c) Share relevant HazCom information with other on-site operators whose miners can be affected.

30 CFR § 47.32
HazCom program contents.

The HazCom program must include the following:
(a) How this part is put into practice at the mine through the use of-
(1) Hazard determination,
(2) Labels and other forms of warning,
(3) Material safety data sheets (MSDSs), and
(4) Miner training.
(b) A list or other record identifying all hazardous chemicals known to be at the mine. The list must-
(1) Use a chemical identity that permits cross-referencing between the list, a chemical's label, and its MSDS; and
(2) Be compiled for the whole mine or by individual work areas.
(c) At mines with more than one operator, the methods for-
(1) Providing other operators with access to MSDSs, and
(2) Informing other operators about-
(i) Hazardous chemicals to which their miners can be exposed,
(ii) The labeling system on the containers of these chemicals, and
(iii) Appropriate protective measures.

30 CFR § 47.41
Requirement for container labels.

(a) The operator must ensure that each container of a hazardous chemical has a label. If a container is tagged or marked with the appropriate information, it is labeled.

(1) The operator must replace a container label immediately if it is missing or if the hazard information on the label is unreadable.
(2) The operator must not remove or deface existing labels on containers of hazardous chemicals.

(b) For each hazardous chemical produced at the mine, the operator must prepare a container label and update this label with any significant, new information about the chemical's hazards within 3 months of becoming aware of this information.
(c) For each hazardous chemical brought to the mine, the operator must replace an outdated label when a revised label is received from the chemical's manufacturer or supplier. The operator is not responsible for an inaccurate label obtained from the chemical's manufacturer or supplier.

30 CFR § 47.42
Label contents.

When an operator must make a label, the label must--
(a) Be prominently displayed, legible, accurate, and in English;
(b) Display appropriate hazard warnings;
(c) Use a chemical identity that permits cross-referencing between the list of

hazardous chemicals, a chemical's label, and its MSDS; and

(d) Include on labels for customers, the name and address of the operator or another responsible party who can provide additional information about the hazardous chemical.

30 CFR § 47.43
Label alternatives.

The operator may use signs, placards, process sheets, batch tickets, operating procedures, or other label alternatives for individual, stationary process containers, provided that the alternative--

(a) Identifies the container to which it applies,

(b) Communicates the same information as required on the label, and

(c) Is readily available throughout each work shift to miners in the work area.

30 CFR § 47.44
Temporary, portable containers.

(a) The operator does not have to label a temporary, portable container if he or she ensures that the miner using the portable container--

(1) Knows the identity of the chemical, its hazards, and any protective measures needed, and

(2) Leaves the container empty at the end of the shift.

(b) Otherwise, the operator must mark the temporary, portable container with at least the common name of its contents.

30 CFR § 47.51
Requirement for an MSDS.

Operators must have an MSDS for each hazardous chemical which they produce or use. The MSDS may be in any medium, such as paper or electronic, that does not restrict availability.

(a) For each hazardous chemical produced at the mine, the operator must prepare an MSDS, and update it with significant, new information about the chemical's hazards or protective measures within 3 months of becoming aware of this information.

(b) For each hazardous chemical brought to the mine, the operator must rely on the MSDS received from the chemical manufacturer or supplier, develop their own MSDS, or obtain one from another source.

(c) Although the operator is not responsible for an inaccurate MSDS obtained from the chemical's manufacturer, supplier, or other source, the operator must-

(1) Replace an outdated MSDS upon receipt of an updated revision, and
(2) Obtain an accurate MSDS as soon as possible after becoming aware of an inaccuracy.

(d) The operator is not required to prepare an MSDS for an intermediate chemical or by-product resulting from mining or milling if its hazards are already addressed on the MSDS of the source chemical.

30 CFR § 47.52
MSDS contents.

When an operator must prepare an MSDS for a hazardous chemical produced at the mine, the MSDS must--

(a) Be legible, accurate, and in English;

(b) Use a chemical identity that permits cross-referencing between the list of hazardous chemicals, the chemical's label, and its MSDS; and

(c) Contain information, or indicate if no information is available, for the categories listed in Table 47.52 as follows:

Table 47.52--Contents of MSDS

Category	Requirements, descriptions, and exceptions
(1) Identity	The identity of the chemical or, if the chemical is a mixture, the identities of all hazardous ingredients. See § 47.21 (Identifying hazardous chemicals).
(2) Properties	The physical and chemical characteristics of the chemical, such as vapor pressure and solubility in water.
(3) Physical	The physical hazards of the chemical including the potential for fire, explosion, and reactivity.
(4) Health hazards	The health hazards of the chemical including-- (i) Signs and symptoms of exposure, (ii) Any medical conditions which are generally recognized as being aggravated by exposure to the chemical, and (iii) The primary routes of entry for the chemical, such as lungs, stomach, or skin.

(5) Exposure limits.....	For the chemical or the ingredients of a mixture--(i) The MSHA or OSHA permissible limit, if there is one, and (ii) Any other exposure limit recommended by the preparer of the MSDS.
(6) Carcinogenicity.....	Whether the chemical or an ingredient in the mixture is a carcinogen or potential carcinogen. See the sources specified in § 47.21 (Identifying hazardous chemicals).
(7) Safe use.....	Precautions for safe handling and use including--(i) Appropriate hygienic practices, (ii) Protective measures during repair and maintenance of contaminated equipment, and (iii) Procedures for clean-up of spills and leaks.
(8) Control measures.....	Generally applicable control measures such as engineering controls, work practices, and personal protective equipment.
(9) Emergency information.....	(i) Emergency medical and first-aid procedures; and (ii) The name, address, and telephone number of the operator or other responsible party who can provide additional information on the hazardous chemical and appropriate emergency procedures.
(10) Date prepared.....	The date the MSDS was prepared or last changed.

30 CFR § 47.53
Alternative for hazardous waste.

If the mine produces or uses hazardous waste, the operator must provide potentially exposed miners and designated representatives access to available information for the hazardous waste that--

(a) Identifies its hazardous chemical components,
(b) Describes its physical or health hazards, or
(c) Specifies appropriate protective measures.

30 CFR § 47.54
Availability of an MSDS.

The operator must make MSDSs accessible to miners during each work shift for each hazardous chemical to which they may be exposed either--

(a) At each work area where the hazardous chemical is produced or used, or

(b) At an alternative location, provided that the MSDS is readily available to miners in an emergency.

30 CFR § 47.55
Retaining an MSDS.

The operator must--

(a) Retain its MSDS for as long as the hazardous chemical is known to be at the mine, and

(b) Notify miners at least 3 months before disposing of the MSDS.

30 CFR § 47.91
Exemptions from the HazCom standard.

A hazardous chemical is exempt from this part under the conditions described in Table 47.91 as follows:

Table 47.91.--Chemicals and Products Exempt from this HazCom Standard

Exemption	Conditions for exemption
Article.....	If, under normal conditions of use, it-- (1) Releases no more than insignificant amounts of a hazardous chemical, and (2) Poses no physical or health risk to exposed miners.
Biological hazards.....	All biological hazards, such as poisonous plants, insects, and micro-organisms.
Consumer product or hazardous substance regulated by CPSC.	(1) If the miner uses it for the purpose the manufacturer intended; and (2) Such use does not expose the miner more often and for longer periods than ordinary consumer use.
Cosmetics, drugs, food, food additive, color additive, drinks, alcoholic beverages, tobacco and tobacco products, or medical or	When intended for personal consumption or use.

veterinary device or product, including materials intended for use as ingredients in such products (such as flavors and fragrances).	
Radiation.....	All ionizing or non-ionizing radiation, such as alpha or gamma, microwaves, or x-rays.
Wood or wood products, including lumber.	If they do not release or otherwise result in exposure to a hazardous chemical under normal conditions of use. For example, wood is not exempt if it is treated with a hazardous chemical or if it will be subsequently cut or sanded.

30 CFR § 47.92
Exemptions from labeling.

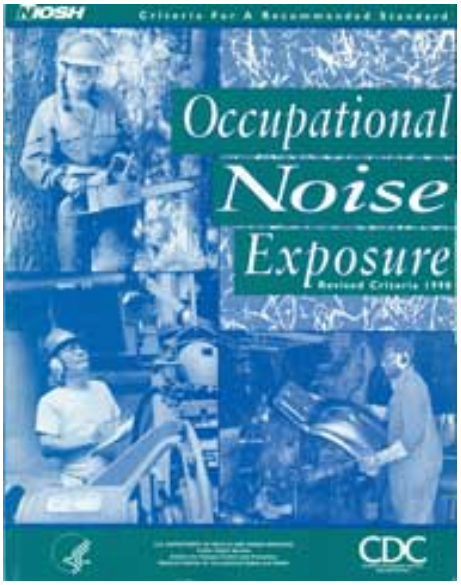
A hazardous chemical is exempt from subpart E of this part under the conditions described in Table 47.92 as follows:

Table 47.92--Hazardous Chemicals Exempt from Labeling

Exemption	Conditions for exemption
Chemical substance, consumer product, hazardous substance, or pesticide.	When kept in its manufacturer's or supplier's original packaging labeled under other federal labeling requirements.
Hazardous substance.....	When the subject of remedial or removal action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) in accordance with EPA regulations.
Hazardous waste.....	When regulated by EPA under the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act.
Raw material being mined or processed.	While on mine property, except when the container holds a mixture of the raw material and another hazardous chemical and the mixture is found to be hazardous under § 47.21 - Identifying hazardous chemicals.
Wood or wood products, including lumber.	Wood or wood products are always exempt from labeling.

OCCUPATIONAL NOISE EXPOSURE

.



Noise is both a health and safety threat to miners. The main health effect of overexposure to loud noise is permanent hearing loss cause by damage to the sensory cells in the inner ear. Noise is also an indirect safety hazard because it can "mask" important sounds like backup alarms and spoken warnings. These hazards are well known and beyond scientific dispute. Still, noise remains a significant problem in mining. The use of heavy equipment, the drilling of rock and the confined work environment are just a few factors that contribute to high levels of noise exposure in mining.

Hearing loss is the most prevalent occupational illness for miners, but it is also highly preventable. Workers, their families, managers, equipment designers, and health professionals can all make a big difference in reducing exposures to hazardous noise.

Information and pictures for Occupational Noise Exposure was obtained from the following publications/websites:

- NIOSH Office of Mine Safety and Health Research

Title 30
Code of Federal Regulation
Part 62 – Occupational Noise Exposure

30 CFR § 62.100

Purpose and Scope; effective date

The purpose of these standards is to prevent the occurrence and reduce the progression of occupational noise-induced hearing loss among miners. This part sets forth mandatory health standards for each surface and underground metal, nonmetal, and coal mine subject to the Federal Mine Safety and Health Act of 1977. The provisions of this part become effective September 13, 2000.

30 CFR § 62.101

Definitions

The following definitions apply in this part:

Access. The right to examine and copy records.

Action level. An 8-hour time-weighted average sound level (TWA_8) of 85 dBA, or equivalently a dose of 50%, integrating all sound levels from 80 dBA to at least 130 dBA.

Audiologist. A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association (ASHA) or licensed by a state board of examiners.

Baseline audiogram. The audiogram recorded in accordance with §62.170(a) of this part against which subsequent audiograms are compared to determine the extent of hearing loss.

Criterion level. The sound level which if constantly applied for 8 hours results in a dose of 100% of that permitted by the standard.

Decibel (dB). A unit of measure of sound pressure levels, defined in one of two ways, depending upon the use:

(1) For measuring sound pressure levels, the decibel is 20 times the common

logarithm of the ratio of the measured sound pressure to the standard reference sound pressure of 20 micropascals (µPa), which is the threshold of normal hearing sensitivity at 1000 Hertz (Hz).
(2) For measuring hearing threshold levels, the decibel is the difference between audiometric zero (reference pressure equal to 0 hearing threshold level) and the threshold of hearing of the individual being tested at each test frequency.

Dual Hearing Protection Level. A TWA8 of 105 dBA, or equivalently, a dose of 800% of that permitted by the standard, integrating all sound levels from 90 dBA to at least 140 dBA.

Exchange rate. The amount of increase in sound level, in decibels, which would require halving of the allowable exposure time to maintain the same noise dose. For the purposes of this part, the exchange rate is 5 decibels (5 dB).

Hearing protector. Any device or material, capable of being worn on the head or in the ear canal, sold wholly or in part on the basis of its ability to reduce the level of sound entering the ear, and which has a scientifically accepted indicator of noise reduction value.

Hertz (Hz). Unit of measurement of frequency numerically equal to cycles per second.

Medical pathology. A condition or disease affecting the ear. Miner's designee. Any individual or organization to whom a miner gives written authorization to exercise a right of access to records.

Qualified technician. A technician who has been certified by the Council for Accreditation in Occupational Hearing Conservation (CAOHC), or by another recognized organization offering equivalent certification.

Permissible exposure level. A TWA_8 of 90 dBA or equivalently a dose of 100% of that permitted by the standard, integrating all sound levels from 90 dBA to at least 140 dBA.

Reportable hearing loss. A change in hearing sensitivity for the worse, relative to the miner's baseline audiogram, or the miner's revised baseline audiogram where one has been established in accordance with §62.170(c)(2), of an average of 25 dB or more at 2000, 3000, and 4000 Hz in either ear.

Revised baseline audiogram. An annual audiogram designated to be used in lieu of a miner's original baseline audiogram in measuring changes in hearing sensitivity as a result of the circumstances set forth in § §62.170(c)(1) or 62.170(c)(2) of this part.

Sound level. The sound pressure level in decibels measured using the A-weighting network and a slow response, expressed in the unit dBA.

Standard threshold shift. A change in hearing sensitivity for the worse relative to the miner's baseline audiogram, or relative to the most recent revised baseline audiogram

where one has been established, of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear.

Time-weighted average- 8 hour (TWA_8). The sound level which, if constant over 8 hours, would result in the same noise dose as is measured.

30 CFR § 62.110

Noise exposure assessment

(a) The mine operator must establish a system of monitoring that evaluates each miner's noise exposure sufficiently to determine continuing compliance with this part.
(b) The mine operator must determine a miner's noise dose (D, in percent) by using a noise dosimeter or by computing the formula: $D = 100(C_1/T_1 + C_2/T_2 + ... + C_n/T_n)$, where C_n is the total time the miner is exposed at a specified sound level, and T_n is the reference duration of exposure at that sound level shown in Table 62-1.

(1) The mine operator must use Table 62-2 when converting from dose readings to equivalent TWA8 readings.

(2) A miner's noise dose determination must:

(i) be made without adjustment for the use of any hearing protector;

(ii) integrate all sound levels over the appropriate range;

(iii) reflect the miner's full work shift;

(iv) use a 90-dB criterion level and a 5-dB exchange rate; and

(v) use the A-weighting and slow response instrument settings.

(c) Observation of monitoring. The mine operator must provide affected miners and their representatives with an opportunity to observe noise exposure monitoring required by this section and must give prior notice of the date and time of intended exposure monitoring to affected miners and their representatives.

(d) Miner notification. The mine operator must notify a miner of his or her exposure when the miner's exposure is determined to equal or exceed the action level, exceed the permissible exposure level, or exceed the dual hearing protection level, provided the mine operator has not notified the miner of an exposure at such level within the prior 12 months. The mine operator must base the notification on an exposure evaluation conducted either by the mine operator or by an authorized representative of the Secretary of Labor. The mine operator must notify the miner in writing within 15 calendar days of:

(1) the exposure determination; and

(2) the corrective action being taken.

(e) The mine operator must maintain a copyof any such miner notification, or a list on which the relevant information about that miner's notice is recorded, for the duration of the affected miner's exposure at or above the action level and for at least 6 months thereafter.

30 CFR § 62.120

Action level

If during any work shift a miner's noise exposure equals or exceeds the action level the mine operator must enroll the miner in a hearing conservation program that complies with §62.150 of this part.

30 CFR § 62.130

Permissible exposure level

(a) The mine operator must assure that no miner is exposed during any work shift to noise that exceeds the permissible exposure level. If during any work shift a miner's noise exposure exceeds the permissible exposure level, the mine operator must use all feasible engineering and administrative controls to reduce the miner's noise exposure to the permissible exposure level, and enroll the miner in a hearing conservation program that complies with §62.150 of this part. When a mine operator uses administrative controls to reduce a miner's exposure, the mine operator must post the procedures for such controls on the mine bulletin board and provide a copy to the affected miner.

(b) If a miner's noise exposure continues to exceed the permissible exposure level despite the use of all feasible engineering and administrative controls, the mine operator must continue to use the engineering and administrative controls to reduce the miner's noise exposure to as low a level as is feasible.

(c) The mine operator must assure that no miner is exposed at any time to sound levels exceeding 115 dBA, as determined without adjustment for the use of any hearing protector.

30 CFR § 62.140

Dual hearing protection level

If during any work shift a miner's noise exposure exceeds the dual hearing protection level, the mine operator must, in addition to the actions required for noise exposures that exceed the permissible exposure level, provide and ensure the concurrent use of both an ear plug and an ear muff type hearing protector. The following table sets out mine operator actions under MSHA's noise standard.

Provision	Condition	Action Required by the Mine Operator
§62.120	Miner's noise exposure is less than the action level	None
§62.120	Miner's exposure equals or exceeds the action level, but does not exceed the permissible exposure level (PEL)	Operator enrolls the miner in hearing conservation program (HCP) which includes (1) a system of monitoring, (2) voluntary ,with two exceptions, use of operator-provided hearing protectors, (3) voluntary audiometric testing, (4) training, and (5) record keeping.
§62.130	Miner's exposure exceeds the PEL	Operator uses/continues to use all feasible engineering and administrative controls to reduce exposure to PEL; enrolls the miner in a HCP including ensured use of operator-provided hearing protectors; posts administrative controls and provides copy to affected miner; must never permit a miner to be exposed to sound levels exceeding 115 dBA.
§62.140	Miner's exposure exceeds the dual hearing protection level	Operator enrolls the miner in a HCP, continues to meet all the requirements of §62.130, ensures concurrent use of earplug and earmuff.

30 CFR §62.160

Hearing protectors

(a) A mine operator must provide a hearing protector to a miner whose noise exposure equals or exceeds the action level under §62.120 of this part. In addition, the mine operator must:

(1) train the miner in accordance with §62.180 of this part;

(2) allow the miner to choose a hearing protector from at least two muff types and two plug types, and in the event dual hearing protectors are required, to choose one of each type;

(3) ensure that the hearing protector is in good condition and is fitted and maintained in accordance with the manufacturer's instructions;

(4) provide the hearing protector and necessary replacements at no cost to the miner; and

(5) allow the miner to choose a different hearing protector(s), if wearing the selected hearing protector(s) is subsequently precluded due to medical pathology of the ear.

(b) The mine operator must ensure, after satisfying the requirements of paragraph (a) of this section, that a miner wears a hearing protector whenever the miner's noise exposure exceeds the permissible exposure level before the implementation of engineering and administrative controls, or if the miner's noise exposure continues to exceed the permissible exposure level despite the use of all feasible engineering and administrative controls.

(c) The mine operator must ensure, after satisfying the requirements of paragraph (a) of this section, that a miner wears a hearing protector when the miner's noise exposure is at or above the action level, if:

(1) the miner has incurred a standard threshold shift; or

(2) more than 6 months will pass before the miner can take a baseline audiogram.

30 CFR §62.170

Audiometric testing

The mine operator must provide audiometric tests to satisfy the requirements of this part at no cost to the miner. A physician or an audiologist, or a qualified technician under the direction or supervision of a physician or an audiologist must conduct the tests.

(a) Baseline audiogram. The mine operator must offer miners the opportunity for audiometric testing of the miner's hearing sensitivity for the purpose of establishing a valid baseline audiogram to compare with subsequent annual audiograms. The mine operator may use an existing audiogram of the miner's hearing sensitivity as the baseline audiogram if it meets the audiometric testing requirements of §62.171 of this part.

(1) The mine operator must offer and provide within 6 months of enrolling the miner in a hearing conservation program, audiometric testing which results in a valid baseline audiogram, or offer and provide the testing within 12 months where the operator uses mobile test vans to do the testing.

(2) The mine operator must notify the miner to avoid high levels of noise for at least 14 hours immediately preceding the baseline audiogram. The mine operator must not expose the miner to workplace noise for the 14-hour quiet period before conducting the audiometric testing to determine a baseline audiogram. The operator may substitute the use of hearing protectors for this quiet period.

(3) The mine operator must not establish a new baseline audiogram or a new revised baseline audiogram, where one has been established, due to changes in enrollment status in the hearing conservation program. The mine operator may establish a new baseline or revised baseline audiogram for a miner who is away from the mine for more than 6 consecutive months.

(b) Annual audiogram. After the baseline audiogram is established, the mine operator must continue to offer subsequent audiometric tests at intervals not exceeding 12 months for as long as the miner remains in the hearing conservation program.

(c) Revised baseline audiogram. An annual audiogram must be deemed to be a revised baseline audiogram when, in the judgment of the physician or audiologist:

(1) a standard threshold shift revealed by the audiogram is permanent; or

(2) the hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.

30 CFR §62.171

Audiometric test procedures

(a) All audiometric testing under this part must be conducted in accordance with scientifically validated procedures. Audiometric tests must be pure tone, air conduction, hearing threshold examinations, with test frequencies including 500, 1000, 2000, 3000, 4000, and 6000 Hz. Each ear must be tested separately.

(b) The mine operator must compile an audiometric test record for each miner tested. The record must include:

(1) name and job classification of the miner tested;
(2) a copy of all of the miner's audiograms conducted under this part;
(3) evidence that the audiograms were conducted in accordance with paragraph (a) of this section;
(4) any exposure determination for the miner conducted in accordance with §62.110 of this part; and
(5) the results of follow-up examination(s), if any.

(c) The operator must maintain audiometric test records for the duration of the affected miner's employment, plus at least 6 months, and make the records available for inspection by an authorized representative of the Secretary of Labor.

30 CFR §62.174

Follow-up corrective measures when a standard threshold shift is detected

The mine operator must, within 30 calendar days of receiving evidence or confirmation of a standard threshold shift, unless a physician or audiologist determines the standard threshold shift is neither work-related nor aggravated by occupational noise exposure:

(a) retrain the miner, including the instruction required by §62.180 of this part;

(b) provide the miner with the opportunity to select a hearing protector, or a different hearing protector if the miner has previously selected a hearing protector, from among those offered by the mine operator in accordance with §62.160 of this part; and

(c) review the effectiveness of any engineering and administrative controls to identify and correct any deficiencies.

30 CFR §62.175

Notification of Results; reporting requirements

(a) The mine operator must, within 10 working days of receiving the results of an audiogram, or receiving the results of a follow-up evaluation required

under §62.173 of this part, notify the miner in writing of:
(1) the results and interpretation of the audiometric test, including any finding of a standard threshold shift or reportable hearing loss; and
(2) the need and reasons for any further testing or evaluation, if applicable.
(b) When evaluation of the audiogram shows that a miner has incurred a reportable hearing loss as defined in this part, the mine operator must report such loss to MSHA as a noise-induced hearing loss in accordance with part 50 of this title, unless a physician or audiologist has determined that the loss is neither work-related nor aggravated by occupational noise exposure.

30 CFR §62.180

Training

(a) The mine operator must, within 30 days of a miner's enrollment into a hearing conservation program, provide the miner with training. The mine operator must give training every 12 months thereafter if the miner's noise exposure continues to equal or exceed the action level. Training must include:

(1) the effects of noise on hearing;
(2) the purpose and value of wearing hearing protectors;
(3) the advantages and disadvantages of the hearing protectors to be offered;
(4) the various types of hearing protectors offered by the mine operator and the care, fitting, and use of each type;
(5) the general requirements of this part;
(6) the mine operator's and miner's respective tasks in maintaining mine noise controls; and
(7) the purpose and value of audiometric testing and a summary of the procedures.

(b) The mine operator must certify the date and type of training given each miner, and maintain the miner's most recent certification for as long as the miner is enrolled in the hearing conservation program and for at least 6 months thereafter.

30 CFR §62.190

Records.

(a) The authorized representatives of the Secretaries of Labor and Health and Human Services must have access to all records required under this part. Upon written request, the mine operator must provide, within 15 calendar days of the request, access to records to:

(1) the miner, or with the miner's written consent, the miner's designee, for all records that the mine operator must maintain for that individual miner under this part;
(2) any representative of miners designated under part 40 of this title, to training certifications compiled under §62.180(b) of this part and to any notice of exposure determination under §62.110(d) of this part, for the miners whom he or she represents; and

(3) any former miner, for records which indicate his or her own exposure.
(b) When a person with access to records under paragraphs (a)(1), (a)(2), or (a)(3) of this section requests a copy of a record, the mine operator must provide the first copy of such record at no cost to that person, and any additional copies requested by that person at reasonable cost.
(c) Transfer of records.
(1) The mine operator must transfer all records required to be maintained by this part, or a copy thereof, to a successor mine operator who must maintain the records for the time period required by this part.
(2) The successor mine operator must use the baseline audiogram, or revised baseline audiogram, as appropriate, obtained by the original mine operator to determine the existence of a standard threshold shift or reportable hearing loss. Appendix to part 62

Appendix to Part 62

Table 62-1--Reference Duration

dBA	T (hours)
80	32.0
85	16.0
86	13.9
87	12.1
88	10.6
89	9.2
90	8.0
91	7.0
92	6.1
93	5.3
94	4.6
95	4.0
96	3.5
97	3.0
98	2.6
99	2.3
100	2.0
101	1.7
102	1.5
103	1.3
104	1.1
105	1.0
106	0.87
107	0.76
108	0.66
109	0.57
110	0.50
111	0.44
112	0.38
113	0.33
114	0.29
115	0.25

At no time shall any excursion exceed 115 dBA. For any value, the

reference duration (T) in hours is computed by: $T = 8/2^{(L-90)/5}$ where L is the measured A-weighted, slow-response sound pressure level.

Table 62-2--``Dose''TWA $_8$ Equivalent

Dose	TWA\8\ (percent)
25	80
29	81
33	82
38	83
44	84
50	85
57	86
66	87
76	88
87	89
100	90
115	91
132	92
152	93
174	94
200	95
230	96
264	97
303	98
350	99
400	100
460	101
530	102
610	103
700	104
800	105
920	106
1056	107
1213	108
1393	109
1600	110
1838	111
2111	112
2425	113
2786	114
3200	115

Interpolate between the values found in this Table, or extend the Table, by using the formula: TWA8 = 16.61 log10 (D/100) + 90.

Table 62-3--Age Correction Value in Decibels for Males (Selected Frequencies)

Age (years)	kHz		
	2	3	4
20 or less	3	4	5
21	3	4	5
22	3	4	5
23	3	4	6
24	3	5	6
25	3	5	7
26	4	5	7
27	4	6	7
28	4	6	8
29	4	6	8
30	4	6	9
31	4	7	9
32	5	7	10
33	5	7	10
34	5	8	11
35	5	8	11
36	5	9	12
37	6	9	12
38	6	9	13
39	6	10	14
40	6	10	14
41	6	10	14
42	7	11	16
43	7	12	16
44	7	12	17
45	7	13	18
46	8	13	19
47	8	14	19
48	8	14	20
49	9	15	21
50	9	16	22
51	9	16	23
52	10	17	24
53	10	18	25
54	10	18	26
55	11	19	27
56	11	20	28
57	11	21	29
58	12	22	31
59	12	22	32
60 or more	13	23	33

Table 62-4--Age Correction Value in Decibels for Females (Selected Frequencies)

Age (years)	kHz		
	2	3	4
20 or less	4	3	3
21	4	4	3
22	4	4	4
23	5	4	4
24	5	4	4
25	5	4	4
26	5	5	4
27	5	5	5
28	5	5	5
29	5	5	5
30	6	5	5
31	6	6	5
32	6	6	6
33	6	6	6
34	6	6	6
35	6	7	7
36	7	7	7
37	7	7	7
38	7	7	7
39	7	8	8
40	7	8	8
41	8	8	8
42	8	9	9
43	8	9	9
44	8	9	9
45	8	10	10
46	9	10	10
47	9	10	11
48	9	11	11
49	9	11	11
50	10	11	12
51	10	11	12
52	10	12	13
53	10	13	13
54	11	13	14
55	11	14	14
56	11	14	15
57	11	15	15
58	12	15	16
59	12	16	16
60 or more	12	16	17

Title 30
Code of Federal Regulation
Part 71 – General Mining

30 CFR § 71.1
Scope.

This part 71 sets forth mandatory health standards for each surface coal mine and for the surface work areas of each underground coal mine subject to the Federal Mine Safety and Health Act of 1977.

30 CFR § 71.2
Definitions.

For the purpose of this part 71, the term:

(a) *Act* means the Federal Mine Safety and Health Act of 1977, Pub. L. 91-173, as amended by Pub. L. 95-164.

(b) *Active workings* means any place in a surface coal mine or the surface work area of an underground coal mine where miners are normally required to work or travel.

(c) *Certified person* means an individual certified by the Secretary in accordance with §71.202 (Certified person; sampling) to take respirable dust samples required by this part or certified in accordance with §71.203 (Certified person; maintenance and calibration) to perform the maintenance and calibration of respirable dust sampling equipment as required by this part.

(d) *Concentration* means a measure of the amount of a substance contained per unit volume of air.

(e) *Designated work position* means a work position designated under §71.208 (Bimonthly sampling; designated work positions).

(f) *District Manager* means the manager of the Coal Mine Safety and Health District in which the mine is located.

(g) *MRE instrument* means the gravimetric dust sampler with a four channel horizontal elutriator developed by the Mining Research Establishment of the National Coal Board, London, England.

(h) *MSHA* means the Mine Safety and Health Administration of the Department of Labor.

(i) *Normal work shift* means (1) a shift during which the regular duties of the designated work position are performed while routine day-to-day mining activities are occurring in the rest of the mine and (2) a shift during which there is no rain, or, if rain occurs, the rain does not suppress the respirable dust to the extent that sampling results will be measurably lower, in the judgment of the person certified under this part to conduct sampling.

(j) *Quartz* means crystalline silicon dioxide (SiO(sub)2) not chemically combined with other substances and having a distinctive physical structure.

(k) *Respirable dust* means dust collected with a sampling device approved by the Secretary and the Secretary of Health and Human Services in accordance with part 74 (Coal Mine Dust Personal Sampler Units) of this title. Sampling device approvals issued by the Secretary of the Interior and Secretary of Health, Education and Welfare are continued in effect.

(l) *Secretary* means the Secretary of Labor or a delegate.

(m) *Surface area* means a specific physical portion of a surface coal mine or surface area of an underground coal mine. These areas are assigned a four digit identification number by MSHA.

(n) *Surface coal* mine means a surface area of land and all structures, facilities, machinery, tools, equipment, excavations, and other property, real or personal, placed upon or above the surface of such land by any person, used in, or to be used in, or resulting from, the work of extracting in such area bituminous coal, lignite, or anthracite from its natural deposits in the earth by any means or method, and the work of preparing the coal so extracted, including custom coal preparation facilities.

(o) *Surface installation* means any structure in which miners work at a surface coal mine or surface work area of an underground coal mine.

(p) *Surface work area of an underground coal mine* means the surface areas of land and all structures, facilities, machinery, tools, equipment, shafts, slopes, excavations, and other property, real or personal, placed in, upon or above the surface of such land by any person, used in, or to be used in, or resulting from, the work of extracting bituminous coal, lignite, or anthracite from its natural deposits underground by any means or method, and the work of preparing the coal so extracted, including custom coal preparation facilities.

(q) *Surface worksite* means any area in which miners work at a surface coal mine or surface work area of an underground coal mine.

(r) *Valid respirable dust sample* means a respirable dust sample collected and submitted as required by this part, and not voided by MSHA.

(s) *Work position* means an occupation identified by an MSHA code number describing a location to which a miner is assigned in the performance of his or her normal duties.

30 CFR § 71.400
Bathing facilities; change rooms; sanitary flush toilet facilities.

Each operator of a surface coal mine shall provide bathing facilities, clothing change rooms, and sanitary flush toilet facilities, as hereinafter prescribed, for the use of miners employed in the surface installations and at the surface worksites of such mine. (Note: Sanitary facilities at surface work areas of underground mines are subject to the provisions of §75.1712 of this chapter et seq.)

30 CFR § 71.401
Location of facilities.

Bathhouses, change rooms, and sanitary flush toilet facilities shall be in a location convenient for the use of the miners. Where these facilities are designed to serve more than one mine, they shall be centrally located so as to be convenient for the use of all miners served by the facilities.

30 CFR § 71.402
Minimum requirements for bathing facilities, change rooms, and sanitary flush toilet facilities.

(a) All bathing facilities, change rooms, and sanitary flush toilet facilities shall be provided with adequate light, heat, and ventilation so as to maintain a comfortable air temperature and to minimize the accumulation of moisture and odors, and the facilities shall be maintained in a clean and sanitary condition.

(b) Bathing facilities, change rooms, and sanitary flush toilet facilities shall be constructed and equipped so as to comply with applicable State and local building codes. *However,* Where no State or local building codes apply to these facilities, or where no State or local building codes exist, the facilities shall be constructed and equipped so as to meet the minimum construction requirements in the National Building Code (1967 edition) and the plumbing requirements in the National Plumbing Code (ASA A40.8 1955) which documents are hereby incorporated by reference and made a part hereof. These documents are available for examination at the Mine Safety and Health Administration, Department of Labor, 1100 Wilson Boulevard Room 2424, Arlington, Virginia 22209-3939; at every MSHA Coal Mine Safety and Health district office; at the National Institute for Occupational Safety and Health, 5600 Fishers Lane, Rockville, Md.; and at the Public Health Service Information Centers as listed in 45 CFR 5.31. Copies of the National Building Code

(1967 edition) may be purchased from the American Insurance Association, 85 John Street, New York, NY 10038, and copies of the National Plumbing Code (ASA A40.8 1955) may be purchased from the American National Standards Institute, Inc., 25 W. 43rd Street, 4th Floor, New York, NY 10036;http://www.ansi.org. An official historic file of the National Building Code (1967 edition) and of the National Plumbing Code (ASA A40.8 1955) will be maintained at the National Institute for Occupational Safety and Health, 5600 Fishers Lane, Rockville, Md.

(c) In addition to the minimum requirements specified in paragraphs (a) and (b) of this section, facilities maintained in accordance with §71.400 shall include the following:

(1) *Bathing facilities.* (i) Showers shall be provided with both hot and cold water.

(c)(1)(ii) At least one shower head shall be provided where five or less miners use such showers.

(c)(1)(iii) Where five or more miners use such showers, sufficient showers shall be furnished to provide approximately one shower head for each five miners.

(c)(1)(iv) A suitable nonirritating cleansing agent shall be provided for use at each shower.

(2) *Sanitary flush toilet facilities.* (i) At least one sanitary flush toilet shall be provided where 10 or less miners use such toilet facilities.

(c)(2)(ii) Where 10 or more miners use such toilet facilities, sufficient flush toilets shall be furnished to provide approximately one sanitary flush toilet for each 10 miners.

(c)(2)(iii) Where 30 or more miners use toilet facilities, one urinal may be substituted for one flush toilet, however, where such substitutions are made they shall not reduce the number of toilets below a ratio of two flush toilets to one urinal.

(c)(2)(iv) An adequate supply of toilet paper shall be provided with each toilet.

(c)(2)(v) Adequate handwashing facilities or hand lavatories shall be provided in or adjacent to each toilet facility.

(3) *Change rooms.* (i) Individual clothes storage containers or lockers shall be provided for storage of miners' clothing and other incidental personal belongings during and between shifts.

(c)(3)(ii) Change rooms shall be provided with sample space to permit the use of such facilities by all miners changing clothes prior to and after each shift.

30 CFR § 71.403
Waiver of surface facilities requirements; posting of waiver.

(a) The Coal Mine Health and Safety District Manager for the district in which the mine is located, after consultation with the appropriate Regional Program Director, National Institute for Occupational Safety and Health, may, upon written application by the operator, and after consideration of any comments filed within 30 days after receipt of the application, waive any or all of the requirements for §§71.400 through 71.402 for a period not to exceed 1 year if he determines that

(1) The operator is providing or making available, under arrangements with one or more third parties, facilities which are at least equivalent to those required by the standards, or

(2) It is impractical for the operator to meet the requirement(s) or provide the facility (facilities) for which the waiver is sought.

(b) The waiver shall be in writing and shall set forth the requirement(s) which the operator will not be required to meet or the facilities which the operator will not be required to provide and the specific reason or reasons for such waiver.

(c) Upon receipt of any waiver, the operator shall post a copy of the waiver for at least 30 days on the mine bulletin board required by section 107(a) of the Act.

(d) An extension of the waiver at the end of 1 year may be sought by the operator by filing an application pursuant to §71.404no later than 30 days nor more than 60 days prior to the expiration date of the waiver.

30 CFR § 71.404
Application for waiver of surface facilities requirements.

(a) Application for waivers of any requirements of §§71.400 through 71.402 shall be in writing, filed with the appropriate Coal Mine Health and Safety District Manager, and shall contain the following information:

(1) The name and address of the mine operator,

(2) The name and location of the mine, and

(3) A detailed statement of the grounds upon which the waiver is requested and the period of time for which it is requested.

(b) At the same time the application is sent to the District Manager, a copy of the application shall be forwarded to the appropriate Regional Program Director, National Institute for Occupational Safety and Health by the operator, and a copy showing the addresses of the appropriate District Manager and Regional Program

Director shall be posted by the operator for at least 30 days on the mine bulletin board required by section 107(a) of the Act.

30 CFR § 71.500
Sanitary toilet facilities at surface worksites; approved sanitary toilets; installation requirements.

(a) Each operator of a surface coal mine shall provide and install at least one sanitary toilet in a location convenient to each surface work site. A single sanitary toilet may serve two or more surface work sites in the same surface mine where the sanitary toilet is convenient to each such work site.

(b) Where 10 or more miners use such toilet facilities, sufficient toilets shall be furnished to provide approximately one sanitary toilet for each 10 miners.

(c) Sanitary toilets shall have an attached toilet seat with a hinged lid and a toilet paper holder together with an adequate supply of toilet tissue.

(d) Only flush or nonflush chemical or biological toilets, combustion or incinerating toilets, sealed bag toilets, and vault toilets meet the requirements of this section. Privies are prohibited.

(Note to paragraph (d): Sanitary toilet facilities for surface work areas of underground mines are subject to the provisions of § 75.1712-3 of this chapter.)

30 CFR § 71.501
Sanitary toilet facilities; maintenance.

Sanitary toilets provided in accordance with the provisions of §71.500 shall be regularly maintained in a clean and sanitary condition. Holding tanks shall be serviced and cleaned when full and in no case less than once each week when in use by draining or pumping or by removing them for cleaning and recharging. Transfer tanks and transfer equipment, if used, shall be equipped with suitable fittings to permit complete draining without spillage and allow for the sanitary transportation of wastes. Waste shall be disposed of in accordance with State and local laws and regulations.

30 CFR § 71.600
Drinking water; general.

An adequate supply of potable water shall be provided for drinking purposes in each surface installation and at each surface worksite of the mine.

30 CFR § 71.601
Drinking water; quality.

(a) Potable water provided in accordance with the provisions of §71.600 shall meet the applicable minimum health requirements for drinking water established by the State or community in which the mine is located.

(b) Where no such requirements are applicable, the drinking water provided shall conform to the Public Health Service Drinking Water Standards, 42 CFR part 72, subpart J.

30 CFR § 71.602
Drinking water; distribution.

(a) Water shall be piped or transported in sanitary containers. Water systems and appurtenances thereto shall be constructed and maintained in accordance with State and local requirements. Where no such requirements are applicable, water systems and appurtenances shall be constructed and maintained in accordance with the National Plumbing Code (ASA A40.8 1955) which is hereby incorporated by reference and made a part hereof. (For information as to the availability of this code, see§71.402(b).)

(b) Water transported to the site shall be carried, stored and otherwise protected in sanitary containers constructed of smooth, impervious, heavy gauge, corrosion resistant materials. The containers shall be marked with the words "Drinking Water."

30 CFR § 71.603
Drinking water; dispensing requirements.

(a) Water shall be dispensed through a drinking fountain or from a water storage container with an adequate supply of single service cups stored in a clean, sanitary manner. Water shall not be dipped from inside water storage containers. Use of a common drinking cup is prohibited.

(b) Water containers shall remain sealed at all times during use and shall not be refilled with water for reuse without first being cleaned and disinfected with the use of heat or sanitizers.

(c) Drinking fountains from which water is dispensed shall be thoroughly cleaned once each week.

(d) Ice used for cooling drinking water shall not be immersed or in direct contact with the water to be cooled, unless it has been handled in a sanitary manner and unless the ice is made from the same source as the drinking water or from water of a quality equal to the source of the drinking water.

30 CFR § 71.700
Inhalation hazards; threshold limit values for gases, dust, fumes, mists, and vapors.

(a) No operator of an underground coal mine and no operator of a surface coal mine may permit any person working at a surface installation or surface worksite to be exposed to airborne contaminants (other than respirable coal mine dust, respirable dust containing quartz, and asbestos dust) in excess of, on the basis of a time-weighted average, the threshold limit values adopted by the American Conference of Governmental Industrial Hygienists in "Threshold Limit Values of Airborne Contaminants" (1972) which is hereby incorporated by reference and made a part hereof. Excursions above the listed threshold limit values shall not be of greater magnitude than is characterized as permissible by the conference. This paragraph does not apply to airborne contaminants given a "C" designation by the conference in the document. This document is available for examination at the Mine Safety and Health Administration, Department of Labor, 1100 Wilson Boulevard Room 2424, Arlington, Virginia 22209-3939; at every MSHA Coal Mine Safety and Health district office; at the National Institute for Occupational Safety and Health, 5600 Fishers Lane, Rockville, MD; and at the Public Health Service Information Centers listed in 45 CFR 5.31. Copies of the document may be purchased from the American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Attn: Customer Service, Cincinnati, OH 45240; http://www.acgih.org.

(b) All persons, including employees, shall be withdrawn from any area in which there is a concentration of an airborne contaminant given a "C" designation by the Conference which exceeds the threshold limit value (ceiling "C" limit) listed for that contaminant.

30 CFR § 71.701
Sampling; general requirements.

(a) Air samples will be taken by the Secretary and will be analyzed to determine the concentrations of noxious or poisonous gases, dusts, fumes, mists, and vapors in surface installations and at surface worksites.

(b) Upon written notification by the Secretary to the operator of an underground coal mine or of a surface coal mine, the operator shall conduct any additional air sampling tests and analyses as the Secretary may from time to time require in order to ensure compliance with the standards set forth in §71.700 in each surface installation and at each surface worksite.

(c) Where concentrations of airborne contaminants in excess of the applicable threshold limit values, permissible exposure limits, or permissible excursions are known by the operator to exist in a surface installation or at a surface worksite, the operator shall immediately provide necessary control measures to assure compliance with § 71.700 or § 71.702, as applicable.

(d) Where the operator has reasonable grounds to believe that concentrations of airborne contaminants in excess of the applicable threshold limit values, permissible exposure limits, or permissible excursions exist, or are likely to exist, the operator shall promptly conduct appropriate air sampling tests to determine the concentration of any airborne contaminant which may be present and immediately provide the necessary control measures to assure compliance with § 71.700 or § 71.702, as applicable.

30 CFR § 71.702
Asbestos standard.

(a) *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. As used in this part--

Asbestos means chrysotile, cummingtonite-grunerite asbestos (amosite), crocidolite, anthophylite 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 ([mu]m) with a length-to-diameter ratio of at least 3-to-1.

(b) Permissible Exposure Limits (PELs)-- (1) 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).

(2) 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.

(c) *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.

Title 30
Code of Federal Regulation
Part 77 – Subpart E
Safeguards for Mechanical Equipment

30 CFR § 77.400
Mechanical equipment guards.

(a) Gears; sprockets; chains; drive, head, tail, and takeup pulleys; flywheels; couplings; shafts; sawblades; fan inlets; and similar exposed moving machine parts which may be contacted by persons, and which may cause injury to persons shall be guarded.

(b) Overhead belts shall be guarded if the whipping action from a broken line would be hazardous to persons below.

(c) Guards at conveyor-drive, conveyor-head, and conveyor-tail pulleys shall extend a distance sufficient to prevent a person from reaching behind the guard and becoming caught between the belt and the pulley.

(d) Except when testing the machinery, guards shall be securely in place while machinery is being operated.

30 CFR § 77.401
Stationary grinding machines; protective devices.

(a) Stationary grinding machines other than special bit grinders shall be equipped with:

(1) Peripheral hoods (less than 90° throat openings) capable of withstanding the force of a bursting wheel.

(2) Adjustable tool rests set as close as practical to the wheel.

(3) Safety washers.

(b) Grinding wheels shall be operated within the specifications of the manufacturer of the wheel.

(c) Face shields or goggles, in good condition, shall be worn when operating a grinding wheel.

30 CFR § 77.402
Hand-held power tools; safety devices.

Hand-held power tools shall be equipped with controls requiring constant hand or finger pressure to operate the tools or shall be equipped with friction or other equivalent safety devices.

30 CFR § 77.403
Mobile equipment; falling object protective structures (FOPS).

(a) When necessary to protect the operator of the equipment, all rubber-tired or crawler-mounted self-propelled scrapers, front-end loaders, dozers, graders, loaders, and tractors, with or without attachments, that are used in surface coal mines or the surface work areas of underground coal mines shall be provided with substantial falling object protective structures (FOPS). FOPS which meet the requirements of the Society of Automotive Engineers (SAE) Standard J 231 shall be considered to be a "substantial" FOPS. An authorized representative of the Secretary may approve a FOPS which provides protection equivalent to SAE J 231.

(b) When necessary to protect the operator of the equipment, forklift or powered industrial trucks shall be provided with substantial FOPS. Such FOPS shall meet the requirements of the State of California, Division of Industrial Safety, General Safety Orders, Register 72, Number 6, February 8, 1972, Article 25, Section 3655--"Overhead Guards for High-Lift Rider Trucks."

30 CFR § 77.403-1
Mobile equipment; rollover protective structures (ROPS).

(a) All rubber-tired or crawler-mounted self-propelled scrapers, front-end loaders, dozers, graders, loaders, and tractors, with or without attachments, that are used in surface coal mines or the surface work areas of underground coal mines shall be provided with rollover protective structures (hereinafter referred to as ROPS) in accordance with the requirements of paragraphs (b) through (f) of this section, as applicable.

(b) *Mobile equipment manufactured on and after September 1, 1974.* All mobile equipment described in paragraph (a) of this section manufactured on and after September 1, 1974 shall be equipped with ROPS meeting the requirements of the Department of Labor specified in §§1926.1001 and 1926.1002 of Part 1926, Title 29, Code of Federal Regulations--Safety and Health Regulations for Construction.

(c) *Mobile equipment manufactured prior to September 1, 1974.* All mobile equipment described in paragraph (a) of this section manufactured prior to September 1, 1974 shall be equipped with ROPS meeting the requirements of

paragraphs (d) through (f) of this section, as appropriate, no later than the dates specified in paragraphs (1), (2), and (3) of this paragraph (c), unless an earlier date is required by an authorized representative of the Secretary under paragraph (c)(4) of this section:

(1) Mobile equipment manufactured between July 1, 1971, and September 1, 1974, shall be equipped with ROPS no later than March 1, 1975.

(2) Mobile equipment manufactured between July 1, 1970, and June 30, 1971, shall be equipped with ROPS no later than July 1, 1975.

(3) Mobile equipment manufactured between July 1, 1969, and June 30, 1970, shall be equipped with ROPS no later than January 1, 1976.

(4) Irrespective of the time periods specified in paragraph (c) (1) through (3) of this section an authorized representative of the Secretary may require such mobile equipment to be equipped with ROPS at an earlier date when necessary to protect the operator of the equipment under the conditions in which the mobile equipment is, or will be operated. The authorized representative of the Secretary shall in writing advise the operator that the equipment shall be equipped with a ROPS and shall fix a time within which the operator shall provide and install the ROPS. If such ROPS is not provided and installed within the time fixed a notice shall be issued to the operator pursuant to section 104 of the Act.

(5) Nothing in this §77.403-1 shall preclude the issuance of a withdrawal order because of imminent danger.

(d) Except as provided in paragraph (e) of this section, mobile equipment described in paragraph (a) of this section, manufactured prior to September 1, 1974, shall be deemed in compliance with this section if the ROPS is installed in accordance with the recommendations of the ROPS manufacturer or designer. The coal mine operator shall exhibit certification from the ROPS manufacturer or designer in the form of a label attached to the equipment, indicating the manufacturer's or fabricator's name and address, the ROPS model number, if any, the machine make, model or series number that the structure is designed to fit, and compliance with the applicable specification listed in paragraph (c)(1) or (2) of this section, or he shall, upon request of the authorized representative of the Secretary, furnish certification from a registered professional engineer that:

(1) The ROPS complies with the Society of Automotive Engineers (SAE) Standard J 397, "Critical Zone--Characteristics and Dimensions for Operators of Construction and Industrial Machinery" or SAE J 397a, "Deflection Limiting Volume for Laboratory Evaluation of Rollover Protective Structures (ROPS) and Falling Object Protective Structures (FOPS) of Construction and Industrial Vehicles" and the following applicable SAE Standards:

(d)(1)(i) J 320a, "Minimum Performance Criteria for Rollover Protective Structure

for Rubber-Tired Self-Propelled Scrapers" or J 320b, "Minimum Performance Criteria for Rollover Protective Structures for Prime Movers"; or

(d)(1)(ii) J 394, "Minimum Performance Criteria for Rollover Protective Structure for Rubber-Tired Front-End Loaders and Rubber-Tired Dozers" or J 394a, "Minimum Performance Criteria for Rollover Protective Structures for Wheeled Front-End Loaders and Wheeled Dozers"; or

(d)(1)(iii) J 395, "Minimum Performance Criteria for Rollover Protective Structure for Crawler Tractors and Crawler-Type Loaders" or J 395a, "Minimum Performance Criteria for Rollover Protective Structures for Track-Type Tractors and Track-Type Front-End Loaders"; or

(d)(1)(iv) J 396 or J 396a, "Minimum Performance Criteria for Rollover Protective Structures for Motor Graders"; or

(d)(1)(v) J 167, "Protective Frame with Overhead Protection--Test Procedures and Performance Requirements"; or

(d)(1)(vi) J 334a, "Protective Frame Test Procedures and Performance Requirements"; or

(2) The ROPS and supporting attachments will:

(d)(2)(i) Show satisfactory performance by actual test of a prototype involving a roll of 720° or more; or

(d)(2)(ii) Support not less than the weight of the vehicle applied as a uniformly distributed horizontal load at the top of the structure and perpendicular to a vertical plane through the longitudinal axis of the prime mover, and support two times the weight of the vehicle applied as a uniformly distributed vertical load to the top of the structure;1 or

1 Paragraph (d) of § 77.403-1 is based on the ROPS criteria of the U.S. Army Corps of Engineers, Safety General Safety--Requirements EM 385-1-1, Change 1, No. 21, Para. 18.A.20 (March 27, 1972), except that subparagraph (2)(ii) of this paragraph (d) is substituted for Para. 18.A.20e(2) of the Corps requirements.

(d)(2)(iii) Support the following separately applied minimum loads:

(d)(2)(iii)(A) 125 percent of the weight of the vehicle applied as a uniformly distributed horizontal load at the top of the ROPS and perpendicular to a critical plane through the longitudinal axis of the prime mover; and

(d)(2)(iii)(B) A load of twice the weight of the vehicle applied as a uniformly distributed vertical load to the top of the ROPS after complying with paragraph (d)(1)(iii)(A) of this section. Stresses shall not exceed the ultimate strength. Steel

used in the ROPS must have capability to perform at 0° F., or exhibit Charpy V-notch impact strength at 8 ft.-lb. at -20° F. with a standard Charpy V-notch Type A specimen and provide 20 percent elongation over two inches in a standard two inch gauge length on a 0.505 inch diameter tensile specimen. Bolts and nuts shall be SAE grade 8 (reference SAE J 429d, J 429e, J 429f or J 429g and J 995, J 995a or J 995b).

(e) *Mobile equipment manufactured prior to September 1, 1974 meeting certain existing governmental requirements for ROPS.* Mobile equipment described in paragraph (a) of this section, manufactured prior to September 1, 1974 and already equipped with ROPS, shall be deemed in compliance with this section if it meets the ROPS requirements of the State of California, the U.S. Army Corps of Engineers, the Bureau of Reclamation of the U.S. Department of the Interior in effect on April 5, 1972, or the Occupational Safety and Health Administration, U.S. Department of Labor. The requirements in effect are:

(1) State of California: Construction Safety Orders 1591(i), 1596, and Logging and Sawmill Safety Order 5243, issued by the Department of Industrial Relations pursuant to Division 5, Labor Code §6312, State of California;

(2) U.S. Army Corps of Engineers: Safety--General Safety Requirements, EM-385-1-1 (March 1967);

(3) Bureau of Reclamation, U.S. Department of the Interior: Safety and Health Regulations for Construction, Part II (September 1971); and

(4) Occupational Safety and Health Administration, U.S. Department of Labor: Safety and Health Regulations for Construction, 29 CFR 1926.1001 and 1926.1002.

(f) Field welding on ROPS shall be performed by welders who are certified by the coal mine operator or equipment distributor as being qualified in accordance with the American Welding Society Structural Welding Code AWS D1.1-73, or Military Standard MIL-STD 248, or the equivalent thereof.

(g) Seat belts required by §77.1710(i) shall be worn by the operator of mobile equipment required to be equipped with ROPS by §77.403-1.

30 CFR § 77.404
Machinery and equipment; operation and maintenance.

(a) Mobile and stationary machinery and equipment shall be maintained in safe operating condition and machinery or equipment in unsafe condition shall be removed from service immediately.

(b) Machinery and equipment shall be operated only by persons trained in the use of and authorized to operate such machinery or equipment.

(c) Repairs or maintenance shall not be performed on machinery until the power is off and the machinery is blocked against motion, except where machinery motion is necessary to make adjustments.

(d) Machinery shall not be lubricated while in motion where a hazard exists, unless equipped with extended fittings or cups.

30 CFR § 77.405
Performing work from a raised position; safeguards.

(a) Men shall not work on or from a piece of mobile equipment in a raised position until it has been blocked in place securely. This does not preclude the use of equipment specifically designed as elevated mobile work platforms.

(b) No work shall be performed under machinery or equipment that has been raised until such machinery or equipment has been securely blocked in position.

30 CFR § 77.406
Drive belts.

(a) Drive belts shall not be shifted while in motion unless the machines are provided with mechanical shifters.

(b) Belt dressing shall not be applied while belts are in motion except where it can be applied without endangering a person.

30 CFR § 77.407
Power-driven pulleys.

(a) Belts, chains, and ropes shall not be guided onto power-driven moving pulleys, sprockets, or drums with the hands except on slow moving equipment especially designed for hand feeding.

(b) Pulleys of conveyors shall not be cleaned manually while the conveyor is in motion.

30 CFR § 77.408
Welding operations.

Welding operations shall be shielded and the area shall be well-ventilated.

30 CFR § 77.409
Shovels, draglines, and tractors.

(a) Shovels, draglines, and tractors shall not be operated in the presence of any person exposed to a hazard from its operation and all such equipment shall be

provided with an adequate warning device which shall be sounded by the operator prior to starting operation.

(b) Shovels and draglines shall be equipped with handrails along and around all walkways and platforms.

30 CFR § 77.410
Mobile equipment; automatic warning devices.

(a) Mobile equipment such as front-end loaders, forklifts, tractors, graders, and trucks, except pickup trucks with an unobstructed rear view, shall be equipped with a warning device that--

(1) Gives an audible alarm when the equipment is put in reverse; or

(2) Uses infrared light, ultrasonic waves, radar, or other effective devices to detect objects or persons at the rear of the equipment, and sounds an audible alarm when a person or object is detected. This type of discriminating warning device shall--

(a)(2)(i) Have a sensing area of a sufficient size that would allow endangered persons adequate time to get out of the danger zone.

(a)(2)(ii) Give audible and visual alarms inside the operator's compartment and a audible alarm outside of the operator's compartment when a person or object is detected in the sensing area; and

(a)(2)(iii) When the equipment is put in reverse, activate and give a one-time audible and visual alarm inside the operator's compartment and a one-time audible alarm outside the operator's compartment.

(b) Alarms shall be audible above the surrounding noise levels.

(c) Warning devices shall be maintained in functional condition.

(d) An automatic reverse-activated strobe light may be substituted for an audible alarm when mobile equipment is operated at night.

30 CFR § 77.411
Compressed air and boilers; general.

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.

30 CFR § 77.412
Compressed air systems.

(a) Compressors and compressed-air receivers shall be equipped with automatic pressure-relief valves, pressure gages, and drain valves.

(b) Repairs involving the pressure system of compressors, receivers, or compressed-air-powered equipment shall not be attempted until the pressure has been relieved from that part of the system to be repaired.

(c) 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.

(d) Safety chains or suitable locking devices shall be used at connections to machines of high-pressure hose lines of 1-inch inside diameter or larger, and between high-pressure hose lines of 1-inch inside diameter or larger, where a connection failure would create a hazard.

30 CFR § 77.413
Boilers.

(a) Boilers shall be equipped with guarded, well-maintained water gages and pressure gages placed so that they can be observed easily. Water gages and pipe passages to the gages shall be kept clean and free of scale and rust.

(b) Boilers shall be equipped with automatic pressure-relief valves; valves shall be opened manually at least once a week to determine that they will function properly.

(c) Blowoff valves shall be piped outside the building and shall have outlets so located or protected that persons passing by, near, or under them will not be scalded.

(d) Boiler installations shall be provided with safety devices, acceptable to the Mine Safety and Health Administration, to protect against hazards of flameouts, fuel interruptions, and low-water level.

(e) Boilers shall be inspected internally at least once a year by a licensed inspector and a certificate of inspection signed by the inspector shall be displayed in the vicinity of the boiler.

General Mining and Mechanical
Questions for Review

Q: How often must a label be updated for a hazardous chemical?
A: CFR 47.41 (2)(b)

Q: If a mine uses/produces hazardous waste, what information must the operator provide to exposed miners?
A: CFR 47.53

Q: What products are exempt for the HazCom standard?
A: CFR 47.91

Q: No miner should be exposed to sound levels exceeding what level, without adjustment for use of hearing protection?
A: CFR 62-130 (c)

Q: How should you determine a miner's noise dose?
A: CFR 62.110 (b)

Q: What does TWA_8 stand for?
A: CFR 62.101

Q: What is "Duel Hearing Protection Level"?
A: CFR 62.101

Q: What is a MSDS?

Q: All mobile equipment must be equipped with what?

A: CFR 77.403-1

Q: Machinery guards shall be securely in place when machinery is being operated. What is the one exception?
A: CFR 77.400

Q: Hand-held power tools must be equipped with what?
A: CFR 77.402

Q: What must happen before repairs or maintenance can be done on machinery?
A: CFR 77.404

Q: Can men work under machinery or equipment in a raised position?
A: CFR 77.405

Q: Compressor must be equipped with what?
A: CFR 77.412

Q: How often must boiler pressure –relief valves be opened manually?
A: CFR 77.413

Q: How shall mobile and stationary machinery be maintained?
A: CFR 77.404

CHAPTER FOUR

FIRST AID

1. MSHA Safety Manual – First Aid
2. Code of Federal Regulations – First Aid
3. Questions and Review

FIRST AID

INFECTION CONTROL

In addition to rendering first aid treatment, you must be concerned with preventing the spread of communicable diseases. As a first aider, you may come into close contact with people who may be carrying infectious or communicable diseases. You need to be concerned about preventing the spread of these diseases to yourself and others.

Barriers to infectious diseases are the chief methods of infection control. Intact skin is an effective barrier, but pathogens (infectious organisms) will pass through mucus membranes and cuts.

Blood and all body fluids of all persons should be regarded as potentially infectious. The primary methods for guarding against infection are:

- Using protective equipment and clothing such as:
  - ✓ Latex gloves
  - ✓ Masks
  - ✓ Eye protection – goggles or face shields
  - ✓ Gowns
- Properly disposing of contaminated sharp objects
- Using a pocket face mask with a one-way valve or bag-valve-mask unit to deliver artificial ventilation
- Hand washing
- Proper decontamination of surfaces, equipment and clothing

Remember to care for yourself. Remove and place your clothing in a plastic bag. Launder this clothing separately as soon as possible using disinfecting soap. Be certain to clean your fingernails and wash your hair.

BASIC PROCEDURE FOR FIRST AID

When you arrive on the scene to care for an injured or ill person, you must make several decisions regarding not only the patient, but also the surrounding area. They are:

- Scene Size-up
  - ➢ Scene Safety – As you approach the scene, begin to observe the scene to endure personal, patient and bystander safety. Do not move the injured person unless absolutely necessary – you and/or the patient are exposed to further danger at the accident site.
  - ➢ Body Substance Isolation Precautions (BSI) - Determine and don the appropriate personal protective equipment that will be needed prior to patient contact.
  - ➢ Mechanism of Injury – If possible, determine what forces caused the injury or the evidence of a medical problem. Consider what witnesses tell about the patient, and what the patient (if conscious) can tell you.
  - ➢ Determine the Number of Patients – Call or have someone else cal for assistance.
  - ➢ Stabilization of Spine – During the initial assessment, avoid unnecessary movement or rough handling of the patient because it might aggravate undetected fractures or spinal injuries.

- Initial Assessment
  - ➢ Form a general impression
    - ✓ Look at and listen to the patient

- Assess mental status
  - ➢ Determine if patient is alert and responsive or nonresponsive

- Access airway
  - ➢ Ensure the airway is open, the patient is breathing, and that the breathing is adequate. (If patient is talking or crying, you know the airway is open.)

- Assess circulation
  - ➢ Check carotid pulse. If absent, a trained person starts cardiopulmonary resuscitation (CPR); if a pulse is present, control serious bleeding by using BSI.

- Determine the priority of patients (if more than one) and transport as soon as possible.

Once life-threatening conditions are under control and obvious injuries have been treated, continue with the head-to-toe (detailed) examination. Look for any type of abnormalities such as swelling, discoloration, lumps and tenderness that might indicate a hidden injury. Also check for medical identification devices which are usually necklaces or wrist or ankle bracelets. The detailed examination should include the:

- Head
- Neck
- Chest
- Abdomen
- Pelvis
- Arms
- Leg
- Back surfaces

FIRST AID PROCEDURE FOR LIFE-THREATENING CONDITIONS

The most important concern is immediate recognition and correction of life-threatening conditions and taking action to prevent death or further injury, to relieve pain and to counteract shock.

Treat life-threatening conditions in the following order:

- Restore breathing
- Restore circulation – Cardiopulmonary Resuscitation (if necessary)
- Control bleeding
- Treat for shock

Respiratory Arrest

If you determine that the patient is not breathing or breathing efforts are minimal, you must provide artificial ventilation by mouth-to-mask, mouth-to-mouth or mouth-to-nose.

When giving artificial ventilation, always use a barrier, such as a pocket face mask when possible. The pocket face mask is made of soft, collapsible material and is small enough to be carried in a

pocket or purse. It has a chimney with a one-way valve that allows your ventilation to enter but prevents the patient's exhaled air from coming back through the valve and into contact with you.

A patient not breathing is a life-threatening condition, and artificial ventilation must begin at once.

Causes

- Suffocation
- Gas poisoning
- Electrical shock
- Drowning
- Heart failure

Signs/Symptoms

- The chest or abdomen does not rise and fall
- Air cannot be felt coming form the nose or mouth
- Skin color is blue or gray

Mouth-to-Mask

- Establish if the patient is unresponsive (tap the shoulder and ask, Are you OK?")
- If the adult patient is unresponsive and you are alone, immediately call 911 (if a telephone is reasonably close.)
- Determine that breathing is absent or inadequate
- Position patient on back. If necessary, roll patient as a single unit, keeping the back and neck straight avoiding the aggravation of any possible spinal injury.
- Take 3-5 seconds to listen and feel for air exchange and look for chest movements.
- If no breathing is present, position the mask on the patient's face so that the apex (top of the triangle) is over the bridge of the nose and the base is between the lower lip and prominence of the chin.
- For modified jaw-thrust maneuver, hold the mask firmly in place while maintaining the proper head tilt by placing:
    - Both thumbs on the sides of the mask.
    - Index, third and fourth fingers of each hand grasping the lower jaw on each side between the angle of the jaw and the ear lobe to lift the jaw forward.
    - Take a deep breath and exhale two times into the one-way valve at the top of the mask port. Each ventilation should be delivered over 1 ½ to 2 seconds in adults and 1 to 1 ½ seconds in children and infants. Watch for patient's chest to rise.
    - Remove your mouth from the port and allow for passive exhalation.
    - If the attempt to ventilate is unsuccessful, reposition the patient's head and try again.
    - If the patient does not begin spontaneous breathing after these initial breaths, begin Cardiopulmonary Resuscitation (CPR) if you have been trained.

If you have not been training in CPR, continue with rescue breathing.

- Repeat breathing 10 to 12 times per minute for an adult, 15 times per minute for a child and 20 times per minute for an infant.
- Use deep breaths for an adult, less for a child and gentle puffs for infants.
- Break contact with the mask after each breath to allow air to escape.
- Air should be passively released from the patient's lungs while you watch the patient's chest fall and listen and feel for return of air.
- Take another deep breath and begin the cycle again.
- As the patient begins to breathe, maintain an open airway.

Mouth-to-Mouth (Nose)

- Establish if the patient is unresponsive (tap the shoulder and ask, Are you OK?")
- If the adult patient is unresponsive and you are alone, immediately call 911 (if a telephone is reasonably close.)
- Determine that breathing is absent or inadequate
- Position patient on back. If necessary, roll patient as a single unit, keeping the back and neck straight avoiding the aggravation of any possible spinal injury.
- Open airway by using the head-tilt/chin-lift method, if no spinal injuries are present, or use modified jaw-thrust maneuver if a spinal injury is suspected.
- Take 3-5 seconds to listen and feel for air exchange and look for chest movements.
- If no breathing is present, pinch the nose closed with your fingers, form an airtight seal by placing your mouth over the patient's mouth and breathe into the patient's mouth two times. (If using the mouth-to-nose method, seal the patient's mouth with your hand and breathe into his/her nose. Use a mask id one is available.)
- Each ventilation should be delivered over 1 ½ to 2 seconds in adults and 1 to ½ seconds in children and infants.
- If the attempt to ventilate is unsuccessful, reposition the patient's head and try again.
- If the patient does not begin spontaneous breathing after two initial breaths, begin CPR if you have been trained.

If you have not been training in CPR, continue with rescue breathing.

- Repeat breathing 10 to 12 times per minute for an adult, 15 times per minute for a child and 20 times per minute for an infant.
- Use deep breaths for an adult, less for a child and gentle puffs for infants.
- Break contact with the either the mouth or the nose after each breath to allow air to escape.
- Air should be passively released from the patient's lungs while you watch the patient's chest fall and listen and feel for return of air.
- Take another deep breath and begin the cycle again.
- As the patient begins to breathe, maintain an open airway.

DO NOT STOP! Continue artificial ventilation until patient is revived, a doctor pronounces the patient dead, another person relieves you or you are physically unable to continue. If patient must be moved, continue artificial ventilation.

Foreign Objects in the Throat
(Conscious Patient – Heimlich maneuver)

Signs/Symptoms

- Gasps for breath
- Has violent fits of coughing
- Quickly turns pale then blue
- Can not talk or breathe

First Aid Treatment

- Determine if airway obstruction is partial or complete.
- If obstruction is partial (air exchange) **encourage patient to cough.**
- If there is no air exchange, stand behind the patient and place your arms around the patient's waist.

- Grasp one fist in your other hand and position the thumb side of your fist against the middle of the patient's abdomen between the lower tip (xiphoid process) of the sternum and the navel.
- Press your fist into the patient's abdomen with a quick upward thrust.
- Repeat the procedure if necessary ensuring that each new thrust is separate and distinct movement.
- Repeat thrusts until the foreign body is expelled or the patient becomes unconscious.

Foreign Objects in the Throat (Unconscious Patient)

First Aid Treatment

- Position patient on back.
- Straddle the patient's hips.
- Place the heel of one hand against the middle of the patient's abdomen between the lower tip (xiphoid process) of the sternum and navel with fingers pointing toward the patient's chest.
- Place your other hand on top of the first.
- Press into the patient's abdominal area with a quick upward thrust.
- Open patient's mouth and grasp dislodged foreign object with fingers to remove obstruction.
- Repeat the procedure if necessary ensuring that each new thrust is separate and distinct movement.
- Repeat thrusts until the foreign body is expelled.

CARDIOPULMONARY RESUSCITATION

Cardiopulmonary Resuscitation (CPR) must be learned through training and supervised practice. Courses are available through the American Heart Association.

CONTROL OF BLEEDING

Hemorrhaging or bleeding is a flow of blood from an artery, vein or capillary. The best all around method for controlling bleeding is applying pressure directly to the wound.

Signs/Symptoms

- Artery – spurting blood, bright red in color
- Vein – continuous flow of blood, dark red in color
- Capillary – blood oozing from a wound

First Aid Treatment

Direct Pressure – Cover wound with a clean cloth of your gloved hand and apply direct pressure on the wound. Most bleeding can be stopped with direct pressure.

Elevation – If the would is on the arm or leg and there is no fracture, elevate extremity above heart level as you apply pressure.

Digital Pressure – Use digital pressure at a pressure point, when necessary, to control arterial bleeding from a wound (bright red spurting blood.) Place your fingers on the appropriate pressure

point between the heart and the wound. Hold pressure point tightly until bleeding is controlled. Since digital pressure shuts off the supply of oxygenated blood to the brain, use the pressure points in the head and neck for only brief periods.

Tourniquets

A tourniquet is a device that restricts all blood flow to and from an extremity. It is to be used **ONLY AS A LAST RESORT**, when all other methods fail, since the use of the tourniquet often results in the loss of a limb. Apply a tourniquet between the wound and the heart as close to the wound as possible, but never over a joint. Tighten the tourniquet to the point where bleeding is controlled.

For an improvised tourniquet, wrap the material around the extremity and tie it in a half knot. Place a stick or similar object on the half knot and tie a full knot. Twist the stick to tighten the tourniquet only until the bleeding is controlled. Secure the stick in place with the loose ends of the tourniquet, another strip of cloth, or other improvised material.

Once the tourniquet is in place, **DO NOT LOOSEN**. Make note of time applied, mark a “T” or “TK” on the patient’s forehead, and get him/her to a medical facility as soon as possible.

NOTE: Improvise a tourniquet from a strap, belt, handkerchief, necktie, cravat bandage etc. (Never us wire, cord or anything that will cut into the flesh.)

Internal Bleeding

Signs/Symptoms

- Pale, cool and clammy skin
- Profuse sweating
- Rapid shallow breathing
- Weak and Rapid pulse
- Dull eyes and enlarged pupils
- Possible thirst
- Nausea and vomiting
- Pain in affected area

TREATMENT FOR SHOCK

Shock may accompany any serious injury: Blood loss, breathing impairment, heart failure, burns etc.

Shock can kill; therefore, treat as soon as possible and continue until medical aid is available.

Signs/Symptoms

- Shallow breathing
- Rapid and weak pulse
- Nausea, collapse, vomiting
- Shivering
- Pale, moist skin
- Mental confusion
- Drooping eyelids, dilated pupils

First Aid Treatment

- Establish and maintain an open airway.
- Control bleeding.
- Keep patient lying down.
- Elevate foot of stretcher unless an injury will be aggravated by the position such as head and chest injuries, heart attack, stroke and sun stroke. If there is no spinal injury, patient may be more comfortable and breathe better in a semi reclining position. If in doubt, keep patient lying flat.
- Place blankets under and over patient.
- Do not give anything by mouth.

BANDAGES AND DRESSINGS

Never tie a tight bandage around the neck as it may cause strangulation.

A bandage should be tight enough to prevent slipping, but not so tight as to cut off circulation. Leave uninjured fingers and toes exposed and watch for swelling or changes of color and coldness which signal poor circulation.

Loosen bandages immediately if patient complains or numbness or tingling sensation.

Once dressing is in place do not remove it. If blood saturates the dressing, put another on top of it.

WOUNDS

An open wound is any break in the skin. A first aider caring for an open wound must stop or control the bleeding and prevent germs from entering the wound.

First Aid Treatment

- Expose the wound. Carefully cut or tear the clothing so the injury may be seen.
- Wipe loose foreign particles away from wound.
- Control bleeding
- Tie bandage compress or gauze over wound.
- Embedded objects:
  - ✓ Do not remove embedded objects.
  - ✓ Cut clothing away from injury site.
  - ✓ Stabilize objects with bulky dressing.
  - ✓ If large object, cut off only enough to allow for transportation of patient.
- Cover all compresses or gauze dressings with outer bandage, except dressings for wounds of the eyes, nose, chin, one finger and one toe or compound fracture of the hand and foot when splinted. When eyes have been burned by chemicals, wash the eyes freely with clean water, cover both eyes with moistened sterile gauze pads and secure in place.

Sucking Chest Wounds

First Aid Treatment

If air is being sucked into the lungs through a wound in the chest:

- Cover wound with airtight material (plastic wrap or waxed paper) after the patient has exhaled. If no airtight material is available, use your gloved hand.

- Place the patient on the injured side to allow expansion room for the uninjured lung if there is no spinal injury.
- Get the patient to the hospital as soon as possible.

Protruding Intestines

First Aid Treatment

- Treat for shock and ensure an open airway.
- Do not try to re-place intestines.
- Flex uninjured legs at hips and knees to reduce tension of abdominal muscles.
- Apply sterile dressing that has been soaked in saline solution.
- Seal the edges of the dressing to prevent the loss of moisture from the internal organs
- Cover with a thick dressing to help prevent heat loss. Hold dressing in place with cravats.

Foreign Particles in the Eyes

Foreign particle frequently enter the eye and lodge there. If not removed, they can cause discomfort, inflammation and possibly infection.

First Aid Treatment

- Never rub eyes.
- Try to flush out with clean water.
- If particle is on upper lid, lift eyelid and remove particle with sterile gauze.
- If foreign particle is on the eye and cannot be washed out, cover eye and take patient to a doctor.

Embedded Objects in the Eyes

First Aid Treatment

- Leave object in eye; only a physician should remove.
- Place sterile gauze around eye; apply no pressure.
- Cover with paper cup or cardboard cone to prevent object from being further driven into eye.
- Cover both eyes and explain to patient why both eyes are covered – one eye cannot move without the other eye moving.
- Reassure the patient. He/she may panic with both eyes covered.

BURNS

A burn is an injury that results form contact with heat, chemicals, electricity and radiation. Burns vary in depth, size and degree of severity.

Problems, in addition to skin injuries, associated with burns are:

- Airway or respiratory difficulties
- Injuries that involve structures below the skin including muscles, bones, nerves and blood vessels.
- Loss of body fluids contributing to shock
- Pain contributing to shock
- Anxiety contributing to shock
- Swelling
- Infection due to destruction of skin tissue

Burns that involve the skin are classified as:

- **First Degree** (minor) – The outer layer of skin (epidermis) is reddened and painful, and slight swelling is present. This type of burn will heal of its own accord.
- **Second Degree** (moderate) – The epidermis and dermis (the second layer of skin) are damaged. The burn area is painful. Blister may form. The area may have a wet, shiny appearance because of exposed tissue.
- **Third Degree** (critical) – All layers of the skin are damaged and are charred black or brown or are dry and white. Muscle, tissue and bone may be damaged. Pain may or may not be severe due to nerves being destroyed.

Thermal Burns

Thermal burns a re caused by scalding liquids, steam, contact with hot objects, flames, flaming liquids and gases and the sun.

General Care for All Burns

- Maintain an open airway.
- Keep the burn site clean and keep the patient warm.
- Separate any burned areas that might come in contact with each other when bandaging (fingers, toes, ear and head, arm and side of body, armpit, crotch etc.)
- Apply moist dressings to first and second degree burns and dry dressings to third degree burns.
- Do not use ointments, sprays or butter on burned areas. This causes the heat to be trapped against the burn site, causing more pain.
- Do not apply ice to any burn because it can cause tissue damage.
- Do not break blisters.
- Get medical attention as soon as possible.

MUSCULOSKELETAL INJURIES

The musculoskeletal system is composed of all the bones, joints, muscles, tendons, ligaments and cartilages in the body. The musculoskeletal system is subject to injury from sprains, strains, fracture and dislocations. Since these injuries present basically the same signs and symptoms, treat all injuries to the bones and joints as fractures.

The usual sign of a strain, sprain, fracture or dislocation will be pain; therefore, you should keep the patient at rest, not moving any part of the body. Even though a strain, sprain and dislocation my appear obvious, you cannot rule out a fracture.

Musculoskeletal injuries are classified as either closed, painful, swollen, deformed extremities (skin is not broken) or open, painful, swollen, deformed extremities (skin is broken.)

Signs/Symptoms

- Pain
- Swelling
- Deformity

First Aid Treatment

- Immobilize suspected fracture.

- Handle as gently as possible – one person to immobilize the limb and one to apply the splint.
- Do not attempt to straighten any painful, swollen, deformed extremity. Splint in the position found. Move injured extremities as little as possible to avoid damage to exposed nerves, blood vessels and surrounding tissue.
- Splints:
  - ✓ Splints should be long enough to support joints above and below suspected fracture.
  - ✓ Splints should be rigid enough to support the suspected fracture.
  - ✓ Pad improvised splints to ensure even contact and pressure between the limb and the splint, and to protect all bony prominences.
  - ✓ Types of splints: Air splint, padded boards, rolled blanket, tools, newspapers, magazines.
- Apply improvised splints:
  - ✓ Handle the affected limb as gently as possible.
  - ✓ Place the padded splint under, above or alongside the limb.
  - ✓ Tie the limb and splint together with bandaging materials so the two are held firmly together. Make sure the bandaging material is not too tight that it impairs circulation. Leave uninjured fingers and toes exposed, so the circulation can be checked constantly.
- Applying inflatable splints:
  - ✓ Use inflatable splints to immobilize fractures of the lower leg or forearm.
  - ✓ To apply an air splint, gather splint on your own arm so the bottom edge is above the wrist.
  - ✓ Help support the patient's limb, or have someone else hold it
  - ✓ Hold injured limb and slide the splint from your forearm over the patient's limb.
  - ✓ Inflate by mouth only to the desired pressure. Inflate it to the point where your thumb makes a slight indentation.
  - ✓ If it is a zipper type air splint, lay the patient's limb in the unzipped splint, zip it and inflate. Traction cannot be maintained when applying this type of splint.
  - ✓ Change in temperature can affect this type of splint – going from cold to warm and warm to cold areas can cause the splint to expand or deflate. It may be necessary to check the splint for proper pressure.
  - ✓ Transport only after all fractures are immobilized unless the patient and first aider are in immediate danger at the accident site.

Skull Fracture

Consider a skull fracture serious because of possible injury to the brain. Injuries to the back of the head are particularly dangerous because the skull may be fractured without a visible wound on the scalp. Consider all serious injuries to the head as possible fracture of the skull. A person with a skull fracture may also have injury to the neck and spine.

Signs/Symptoms for Skull Fractures

- Unconsciousness
- Deformity of the skull
- Open wound
- Blood or clear water-like fluid coming from ear and/or nose
- Pupils may be unequal in size; impaired vision
- Partial or complete paralysis

Spinal fractures

A spinal fracture is difficult to detect when a patient is unconscious. Treat all injuries to the spinal column, even without signs or paralysis, as a fracture of the spinal column.

Signs/Symptoms for Spinal Fractures
(Conscious Patient)

- Ask if patient can feel your touch to his/her feet.
- Ask if patient can wiggle toes.
- Ask if patient can press against your hand with feet.

Signs/Symptoms for Spinal Fractures
(Unconscious Patient)

- Stroke the soles of the feet with a pointed object; if the spinal cord is undamaged, the feet will react.
- Stroke the palms of the hands with a pointed object; if the spinal cord is undamaged, the hands will react.

First Aid treatment for Skull and/or Spinal Fractures

- Stabilize the head until the patient is secured to a splint, stretcher or other hard, flat surface.
- Use the modified jaw-thrust to maintain an open airway.
- Use a blanket, padding, rolled up coats or other material around the head and neck to prevent movement.
- Control serious bleeding.
- Use enough people to list the patient safely in unison.
- Lift patient only high enough to slide the splint or stretcher underneath.
- Place the patient on his/her back on the splint or stretcher.
- Secure the patient to the splint or stretcher to immobilize the entire body.
- Cover with a blanket and treat for shock.
- Transport to a medical facility.

Rib Fracture

Signs/Symptoms

- Severe pain with each breath
- Tenderness over the fracture
- Deformity at sire of fracture
- Inability to take a deep breath

First Aid Treatment

- Apply thick padding over injured ribs.
- Apply two medium cravat bandages around the chest firmly enough to afford support, centering the cravats on either side of the injury.
- Tie the knots over a pad on the opposite side of the body.
- Support the arm in the injured side in a sling.
- Treat for shock.
- Secure medical treatment.

NOTE: Ensure that the binding is not too tight, as a fractured rib can puncture a lung. If a lung is punctured, frothy blood may come from the patient's mouth.

TRANSPORTATION

After receiving first aid, an injured person often requires transportation to a medical facility. Under special circumstances like those in mining accidents, the patient must be transported to a place accessible to ambulance personnel. It is the responsibility of the first aider to see that the patient is transported in such a manner as to prevent further injury, pain or discomfort. Improper handling and careless transportation often add to the original injuries, increase shock and endanger life.

Under normal circumstances, do not move an injured person until a thorough examination has been made and first aid has been given. Move a seriously injured person in a position that is least likely to aggravate injuries. Various methods for carrying a patient can be used in emergencies, but the stretcher is the preferred method of transportation. When a stretcher is not available or impractical, employ other means of transportation.

When the life of a person is in danger and the person must be pulled or dragged to safety, pull the body by the shoulders, not sideways. Avoid bending or twisting the neck or trunk. Carry in the arms, over the back, or use two-person carry when you know that no injury will be aggravated by such handling of the patient.

Two-Person Seat Carry

The two-person seat carry is a technique for transporting the patient in a seat fashioned from the rescuers' arms. Use this carry when moving the patient through narrow passageways. Do not use this carry when injury to the spinal column is suspected.

Three-Person Lift and Carry

Use the three-person lift and carry to move an injured person a short distance, through a narrow passageway, or when a stretcher is not available. Also use this carry when an injured person is placed on or removed from a stretcher.

Three persons are required for this lift and a fourth person is desirable. (A fourth person to hold the head is necessary if a spinal injury is suspected.) Proper lifting must be done by command or a leader, usually the bearer at the patient's head.

Performing the Three-Person Lift and Carry

- Each of the three bearers kneel on the knee nearest the patient's feet and on the least injured side, if possible.
- One bearer, opposite the patient's shoulders, supports the patient's neck and shoulders.
- Another bearer, opposite the patient's hips, supports patient's though and small back.
- The third bearer, opposite the patient's knees, supports the patient's knees and ankles.
- On command, the bearers slowly turn the patient on his/her side so the patient rest in the bend of their elbows close to their chests.
- On command, all bearers rise in unison.
- The bearers can then, when commanded, move the patient.

Four-Person Log Roll

The technique for moving a patient with spinal injuries requires four persons, one who acts as captain. To perform the four-person log roll, proceed as follows:

- One rescuer (who acts as captain) stabilizes the neck and head as he/she opens the airway by using the modified jaw-thrust maneuver. One rescuer places spine board parallel to the patient.
- Three rescuers (one rescuer at shoulder, one at waist, one at knee) keel at the patient's side opposite spine board, leaving room to roll patient toward them while the captain keeps the neck and head stabilized.
- The captain commands the shoulder level rescuer to extend patient's arm over the head on the side on which the patient will be rolled.

- The rescuer at the shoulder places one hand under patient's shoulder and the other hand under patient's upper arm.
  The rescuer at the waist places one hand on the patient's waist and the other under patient's buttocks.
- The rescuer at the knees places one hand under the patient's knees and the other hand under the mid-calf.
- On command, roll patient in unison on side toward the rescuers.
- On command, waist level rescuer or bystander pulls spine board into position against patient.
- Roll patient as a unit onto board, on command.
- Place rolled blankets beside head and neck for additional protection and secure head to board with cravat bandages.
- Secure patient to the splint or stretcher so the entire body is immobilized.

Straddle Slide

Another technique for moving a patient with a spinal injury onto a long board is the straddle slide. Three persons handle the patient and the fourth person slides the board into place. To perform the straddle slide, proceed as follows:

- One rescuer maintains an open airway with the modified jaw-thrust and applies traction.
- The second rescuer faces and straddles the patient. Bending at the waist, the rescuer grips the patient's arms, just below the shoulders.
- A third rescuer also faces and straddles the patient. Bending at the waist, the rescuer places his/her hands on the sides of the patient's waist. (The long board must pass between the legs of the three rescuers.)
- The fourth rescuer positions the board at the patient's head in line with the patient's body.
- On signal form the commanding rescuer, the rescuers lift the patient just high enough to allow the fourth rescuer to slide the board under the patient.
- On command, the rescuers gently lower the patient onto the board. Support is maintained until patient is secured.

Stretcher

Test the stretcher before placing the patient on it. Use a person of about equal weight as the patient. That person should be face down on the stretcher so if the stretcher breaks or tears when it is picked up, the person can catch himself/herself.

ENVIRONMENTAL EMERGENCIES

Exposure to cold and hot temperatures can cause life-threatening problems. Understanding how the body regulates its own temperature can help you give effective first aid when a person is simply too hot or too cold.

Cold Emergencies

When the environment is too cold, body heat is lost faster than it can be generated. This may results in damage to exposed tissue and body functions may be greatly reduced or stopped.

Generalized Hypothermia

Hypothermia is a general cooling of the entire body, even in temperatures well above freezing. When the inner core of the body is chilled, the body cannot generate enough heat to stay warm. The injured or ill patient and the young or old are most susceptible to hypothermia. With time, the body is unable to maintain its proper internal temperature and can lead to death.

Signs/Symptoms

- Shivering
- Numbness
- Drowsiness and/or muscular weakness
- Rapid breathing and rapid pulse
- Decreases level of consciousness
- Reddened skin in early stages. In prolonged cases, skin is pale to bluish and some body parts are stiff and hard (frozen.)

First Aid Treatment

- Get patient into a warm area.
- Remove all wet clothing.
- Wrap the patient in blankets. Maintain patient's body heat by placing blanket under as well as over the patient or place another rescuer in the blankets with the patient. (Do not warm too quickly.)
- Warm trunk of body first.
- Handle the patient gently and get him/her to a medical facility as soon as possible.

Localized Hypothermia

Cold-related emergencies are those affecting particular parts of the body being exposed to intensely cold air or liquid. Most commonly affected are the nose, cheeks, ears, toes and fingers. Localized cold injuries are classified as early or superficial, and late or deep.

Signs/Symptoms – Early or Superficial Cold Injury

- In early or superficial cold injury, light skin first reddens; dark skin lightens. Both then blanch (whiten.)
- Superficial cold injury feels numb to the patient.

Signs/Symptoms – Late or Deep Cold Injury

- In late or deep cold injury, the skin appears white and waxy and later turns from mottled or blotchy to grayish yellow and finally grayish blue.
- Deep cold injury feels frozen on the surface.

First Aid Treatment – Early or Superficial Cold Injury

- Get patient out of the cold environment.
- Warm the affected area.
- Splint affected extremity. Do not rub or massage and do not re-expose to cold.

First Aid Treatment – Late or Deep Cold Injury

- Get patient out of the cold environment.
- Handle frostbite or frozen area by using a covering such as loose, soft, sterile dressing and handling it as gently as possible.
- Do not re-expose patient to the cold.
- Transport to a medical facility as soon as possible.
- In cases of extreme hypothermia, assess the carotid pulse for 30-45 seconds. If there is no pulse, start CPR immediately, if you have been trained. Transport immediately.

Heat Emergencies

Exposure to excessive heat can create hear that is not needed for temperature maintenance.

Generalized Hyperthermia

Hyperthermia is an abnormally high body temperature caused by the body not being able to rid itself of excessive heat. Exposure to excessive heat and high humidity are often associated with hyperthermia.

Signs/Symptoms – Moist, Pale, Normal-to-Cool Skin

- Muscular cramps – usually in the legs and abdomen
- Weakness or exhaustion, dizziness or faintness
- Rapid, shallow breathing
- Weak pulse
- Moist pale skin which may feel normal to cool
- Heavy sweating
- Possible loss of consciousness

First Aid Treatment – Moist, Pale, Normal-to-Cool Skin

- Remove patient form the hot environment and place in a cool environment.
- Loosen or remove clothing and cool patient by fanning. Watch for shivering; do not chill.
- Keep patient lying down with foot-end of stretcher elevated.
- If the patient is responsive and not nauseated, give water to drink; otherwise give nothing by mouth.
- Apply moist applications over cramping muscles.

Signs/Symptoms – Hot, Dry or Moist Skin

- Rapid, shallow breathing
- Full and rapid pulse
- Weak
- Hot, dry or possibly moist skin
- Little or no perspiration
- Loss of consciousness or altered mental state
- Dilated pupils
- Patient may experience seizures, but no muscle cramps

First Aid Treatment – Hot, Dry or Moist Skin

- Remove patient form the hot environment and place in a cool environment.
- Loosen or remove clothing and apply cool packs to neck, groin and armpits. Keep skin wet by applying water by sponge or wet towels. Fan Patient.
- If immediate transport is delayed, immerse patient up to the neck in a tub of cool water.

MEDICAL EMERGENCIES

Hyperventilation

Hyperventilation s a temporary condition of rapid and deep breathing which reduces the carbon dioxide level in the blood.

Signs/Symptoms

- Chest pains
- Tingling sensation in the upper extremities
- Cramping in the fingers

First Aid Treatment

- Have patient breathe into a paper bag (not plastic.)
- If this does not control hyperventilation, transport patient to a medical facility.

Diabetic Emergencies

Diabetic Coma

Signs/Symptoms

- Warm and dry skin
- Extreme thirst
- Rapid and weak pulse
- Rapid and labored breathing
- Sickly sweet odor of acetone on breath
- Confused

First Aid Treatment

- Maintain an open airway.
- In case of vomiting, turn the head to one side.
- Treat patient for shock
- Transport patient to a medical facility as quickly as possible.

Insulin Shock

Signs/Symptoms

- Cold clammy skin
- Profuse perspiration
- Rapid, weak pulse
- Respiration normal or shallow
- Dizziness
- Convulsions or total unconsciousness

First Aid Treatment

- Give sugar (sugar, candy or orange juice) to conscious patient.
- If unconscious, put a “sprinkle” of granulated sugar under the tongue.
- Transport patient to a medical facility as soon as possible.

If you cannot distinguish between a patient of insulin shock and a patient progressing into a diabetic coma, give sugar to the patient. Giving sugar to a patient with too much blood sugar doesn’t make any significant difference to patient outcome, but giving sugar to a patient in insulin shock can save a life.

Seizure Disorders

A seizure is not a disease, but rather a sign of an underlying defect, injury or disease. Epilepsy is probably the best know condition that results in seizures. As a first aider, you should not try to diagnose the cause of a seizure, but rather treat the person during and after the seizure.

Signs/Symptoms

- Possible loss of consciousness
- Convulsions
- Severe spasms of the jaw muscles (may bite tongue)
- Vomiting
- Pale face before the seizure and bluish during seizure
- Loud and labored breathing with a peculiar hissing sound
- Seizure usually last only a few minutes, but it may be followed by another.

First Aid Treatment

- Keep patient clam.
- Do not restrain the patient
- Protect the patient from injury but do not try to hold him/her.
- Do not place anything in the patient’s mouth during the seizure.
- Ensure an open airway after convulsions have ended and provide artificial ventilation if needed.
- Position patient on side if there is no possibility of spinal injuries.
- Protect patient from stress or embarrassment.
- Transport to medical facility.

Stroke

A stroke occurs when an artery in the brain becomes blocked or ruptures. This prevents oxygenated blood from reaching the areas supplied by the artery.

Signs/Symptoms

- Confused or unconscious
- Dizziness
- Impaired speech
- Numbness or paralysis (usually on one side of the body with sagging muscles or loss of expression in the face.)
- Unequal pupils
- Impaired vision
- Rapid full pulse
- Nausea or vomiting

- Seizures
- Loss of bowel or bladder control

First Aid Treatment

- Conscious patient – Ensure an open airway. Try to reassure and keep patient calm. Transport in a semi-reclining position.
- Unconscious patient – Maintain and open airway. Transport lying on side.

Drug Abuse

Drug abuse or drug overdose signs and symptoms can vary from one patient to another, even for the same drug. When questioning the patient and bystanders, ask if the patient has been taking and medication rather then using the word "drugs."

First Aid Treatment

- Call for help. Ask bystanders to call for an ambulance and/or a physician.
- Monitor breathing and be alert for respiratory arrest.
- Protect the patient from further harm.
- Treat for shock.
- Reassure the patient throughout all phases of care.

Always be alert and ready to protect yourself. Some drug abusers appear calm at first and become violent as time passes.

Poisons

Poisons are substances which have harmful effects on the normal body processes. They enter the body through ingestion (eating or drinking), inhalation (breathing), injection (body tissues or blood stream), and/or absorption (through the skin.)

First Aid Treatment

- Try to determine the poison involved and when it occurred.
- Call the poison control center or a physician, immediately.

Animal Bites

Any warm-blooded animal may suffer from rabies. If a person is bitten by an animal, always suspect the animal to be rabid.

First Aid Treatment

- Control bleeding.
- Wash the wound with soap and water and rinse with alcohol.
- Dress and bandage the wound.
- Splint if bite is on an extremity.
- Get patient to a medical facility as soon as possible.

Snake Bites

Coral snakes, copperheads, rattlesnakes and water moccasins are the four types of poisonous snakes in the United States. Persons who frequent regions infested with poisonous snakes should carry a snakebite kit.

Signs/Symptoms

- Bite marks with sharp, stinging pain

- Severe burning, pain and swelling in bitten area
- Nausea and vomiting
- Rapid pulse and labored breathing
- Progressive general weakness
- Shock
- Vision problems
- Seizure
- Drowsiness or unconsciousness

First Aid Treatment

- Treat for shock and conserve body hear.
- Locate mark of fang(s) and clean site with soap and water.
- In case of swelling, remove jewelry from extremity.
- Immobilize bitten extremity and keep at the level of the heart or below the level of the heart.
- If a physician can be contacted, it may be ordered to apply a tight constricting band above and below the bitten area. The band should be tight, but not tight enough to stop arterial circulation.
- Transport to a medical facility, carefully monitoring breathing.

Insect Bites and Stings

Many insects bite or sting, but few can cause serious symptoms unless the person is allergic to them. Occasionally, insects have been feeding on or have been in contact with a poisonous substance transmitted at the time of the sting or bite.

Signs/Symptoms

- Altered state of awareness
- Local irritation, burning, pain or itching and possibly noticeable stings, bites or puncture marks
- Blotchy skin
- Redness, swelling or blistering
- Headache and dizziness/weakness or collapse
- Difficult breathing and abnormal pulse rate
- Chills and fever, excessive saliva formation, profuse sweating
- Nausea and vomiting
- Muscle cramps, chest tightening, joint pains

First Aid Treatment

- Treat for shock.
- If stinger remains, remove stinger by carefully scraping the site using a blade or a card. Do not use tweezers or forceps.
- Remove jewelry in case the limb swells.
- Keep the limb immobilizes and the patient quiet.
- Look for medical identification device to determine if patient is allergic.
- Get patient to a medical facility as soon as possible.

Information for this section was obtained from the following publications:

- **U.S. Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy – Safety Manual Series SM 3**

Title 30
Code of Federal Regulation

30 CFR § 50.20-3
Criteria--Differences between medical treatment and first aid.

(a) Medical treatment includes, but is not limited to, the suturing of any wound, treatment of fractures, application of a cast or other professional means of immobilizing an injured part of the body, treatment of infection arising out of an injury, treatment of bruise by the drainage of blood, surgical removal of dead or damaged skin (debridement), amputation or permanent loss of use of any part of the body, treatment of second and third degree burns. Procedures which are diagnostic in nature are not considered by themselves to constitute medical treatments. Visits to a physician, physical examinations, X-ray examinations, and hospitalization for observations, where no evidence of injury or illness is found and no medical treatment given, do not in themselves constitute medical treatment. Procedures which are preventive in nature also are not considered by themselves to constitute medical treatment. Tetanus and flu shots are considered preventative in nature. First aid includes any one-time treatment, and follow-up visit for the purpose of observation, of minor injuries such as, cuts, scratches, first degree burns and splinters. Ointments, salves, antiseptics, and dressings to minor injuries are considered to be first aid.

(1) *Abrasion.* (i) First aid treatment is limited to cleaning a wound, soaking, applying antiseptic and nonprescription medication and bandages on the first visit and follow-up visits limited to observation including changing dressing and bandages. Additional cleaning and application of antiseptic constitutes first aid where it is required by work duties that soil the bandage.

(ii) Medical treatment includes examination for removal of imbedded foreign material, multiple soakings, whirlpool treatment, treatment of infection, or other professional treatments and any treatment involving more than a minor spot-type injury. Treatment of abrasions occurring to greater than full skin depth is considered medical treatment.

(2) *Bruises.* (i) First aid treatment is limited to a single soaking or application of cold compresses, and follow-up visits if they are limited only to observation.

(ii) Medical treatment includes multiple soakings, draining of collected blood, or other treatment beyond observation.

(3) *Burns, Thermal and Chemical (resulting in destruction of tissue by direct contact).* (i) First aid treatment is limited to cleaning or flushing the surface, soaking, applying cold compresses, antiseptics or nonprescription medications, and bandaging on the first visit, and follow-up visits restricted to observation, changing bandages, or additional cleaning. Most first degree burns are amenable to first aid treatment.

(ii) Medical treatment includes a series of treatments including soaks, whirlpool, skin grafts, and surgical debridement (cutting away dead skin). Most second and third degree burns require medical treatment.

(4) *Cuts and Lacerations.* (i) First aid treatment is the same as for abrasions except the application of butterfly closures for cosmetic purposes only can be considered first aid.

(ii) Medical treatment includes the application of butterfly closures for non-cosmetic purposes, sutures, (stitches), surgical debridement, treatment of infection, or other professional treatment.

(5) *Eye Injuries.* (i) First aid treatment is limited to irrigation, removal of foreign material not imbedded in eye, and application of nonprescription medications. A precautionary visit (special examination) to a physician is considered as first aid if treatment is limited to above items, and follow-up visits if they are limited to observation only.

(ii) Medical treatment cases involve removal of imbedded foreign objects, use of prescription medications, or other professional treatment.

(6) *Inhalation of Toxic or Corrosive Gases.* (i) First aid treatment is limited to removal of the miner to fresh air or the one-time administration of oxygen for several minutes.

(ii) Medical treatment consists of any professional treatment beyond that mentioned under first aid and all cases involving loss of consciousness.

(7) *Foreign Objects.* (i) First aid treatment is limited to cleaning the wound, removal of any foreign object by tweezers or other simple techniques, application of antiseptics and nonprescription medications, and bandaging on the first visit. Follow-up visits are limited to observation including changing of bandages. Additional cleaning and applications of antiseptic constitute first aid where it is required by work duties that soil the bandage.

(ii) Medical treatment consists of removal of any foreign object by physician due to depth of imbedment, size or shape of object, or location of wound. Treatment for infection, treatment of a reaction to tetanus booster, or other professional treatment, is considered medical treatment.

(8) *Sprains and Strains.* (i) First aid treatment is limited to soaking, application of cold compresses, and use of elastic bandages on the first visit. Follow-up visits for observation, including reapplying bandage, are first aid.

(ii) Medical treatment includes a series of hot and cold soaks, use of whirlpools, diathermy treatment, or other professional treatment.

30 CFR § 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.

30 CFR § 77.1703
First-Aid training; supervisory employees.

The mine operator shall conduct first-aid training courses for selected supervisory employees at the mine. Within 60 days after the selection of a new supervisory employee to be so trained, the mine operator shall certify by signature and date the name of the employee and date on which the employee satisfactorily completed the first-aid training course. The certification shall be kept at the mine and made available on request to an authorized representative of the Secretary.

30 CFR § 77.1704
First aid training program; availability of instruction to all miners.

On or before December 30, 1971, each operator of a surface coal mine shall make available to all miners employed in the mine a course of instruction in first aid conducted by the operator or under the auspices of the operator, and such a course of instruction shall be made available to newly employed miners within 6 months after the date of employment.

30 CFR § 77.1705
First aid training program; retraining of supervisory employees; availability to all miners.

Beginning January 1, 1972, each operator of a surface coal mine shall conduct refresher first aid training programs each calendar year for all selected supervisory employees and make available refresher first aid training courses to all miners employed in the mine.

30 CFR § 77.1706
First aid training program; minimum requirements.

(a) All first aid training programs required under the provisions of §§77.1703 and 77.1704 shall include 10 class hours of training in a course of instruction similar to that outlined in "First Aid, A Bureau of Mines Instruction Manual."

(b) Refresher first aid training programs required under the provisions of §77.1705 shall include 5 class hours of refresher training in a course of instruction similar to that outlined in "First Aid, A Bureau of Mines Instruction Manual."

30 CFR § 77.1707
First aid equipment; location; minimum requirements.

(a) Each operator of a surface coal mine shall maintain a supply of the first aid equipment set forth in paragraph (b) of this section at or near each working place where coal is being mined, at each preparation plant and at shops and other surface installation where ten or more persons are regularly employed.

(b) The first aid equipment required to be maintained under the provisions of paragraph (a) of this section shall include at least the following:

(1) One stretcher;

(2) One broken-back board (if a splint-stretcher combination is used it will satisfy the requirements of both paragraph (b) (1) of this section and this paragraph (b) (2));

(3) Twenty-four triangular bandages (15 if a splint-stretcher combination is used);

(4) Eight 4-inch bandage compresses;

(5) Eight 2-inch bandage compresses;

(6) Twelve 1-inch adhesive compresses;

(7) An approved burn remedy;

(8) Two cloth blankets;

(9) One rubber blanket or equivalent substitute;

(10) Two tourniquets;

(11) One 1-ounce bottle of aromatic spirits of ammonia or 1 dozen ammonia ampules; and,

(12) The necessary complements of arm and leg splints or two each inflatable plastic arm and leg splints.

(c) All first aid supplies required to be maintained under the provisions of paragraphs (a) and (b) of this section shall be stored in suitable, sanitary, dust tight, moisture proof containers and such supplies shall be accessible to the miners.

FIRST AID
Questions for Review

Q: What are the symptoms of hyperventilation?

_____

Q: Spurting blood, bright red in color would indicate what type of bleeding?

_____

Q: What treatment would you use for a conscious patient who is choking?

_____

Q: What does CPR stand for?

_____

Q: What is the First Aid procedure for life-threatening conditions?

_____

Q: When should a tourniquet be used?

_____

Q: What are the signs of someone who is having a stroke?

_____

Q: What is the treatment for someone going into a Diabetic Coma?

_____

Q: What is a second degree burn?

_____

Q: What are some of the causes of respiratory arrest?

_____

Q: What are the symptoms of a rib fracture?

_____

Q: Why are injuries to the back of the head particularly dangerous?

_____

Q: How can you tell if an unconscious patient has a spinal fracture?

_____

Q: How do you test a stretcher before placing a patient on it?

_____

Q: What is the First Aid treatment for drug abuse?

_____

Q: What are the signs of Insulin Shock?

_____

Q: What is the general care for all burns?

_____

Q: Each operator of an underground coal mine shall maintain a supply of the first-aid equipment. What is the required equipment?
A: CFR 77.1707

_____

_____

_____

Q: Where does the required equipment have to be located?
A: CFR 77.1707

_____

_____

CHAPTER FIVE

DUST CONTROL

1. Best Practices for Dust Control – NIOSH publication
2. Federal Mine Safety & Health Act of 1977 – Title II
3. Code of Federal Regulations Part 71
4. Code of Federal Regulations Part 72 and 74
5. Questions and Review

IC 9517

INFORMATION CIRCULAR/2010

Best Practices for Dust Control in Coal Mining

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

CONTROLLING RESPIRABLE SILICA DUST AT SURFACE MINES

By John A. Organiscak
Mining engineer, Office of Mine Safety and Health Research, National Institute for Occupational Safety and Health, Pittsburgh, PA.

Overexposure to airborne respirable crystalline silica dust (referred to here as “silica dust”) can cause silicosis, a serious and potentially fatal lung disease. Mining continues to have some of the highest incidences of worker-related silicosis, and the mining machine operator is the occupation most commonly associated with the disease [NIOSH 2003]. In particular, some of the most severe cases of silicosis have been observed in surface mine rock drillers [NIOSH 1992]. A voluntary surface coal miner lung screening study conducted in Pennsylvania in 1996 found that silicosis was directly related to age and years of drilling experience [CDC 2000]. U.S. mine workers continue to be at risk of exposure to excessive levels of silica dust. The percentage of Mine Safety and Health Administration (MSHA) dust samples during 2004–2008 that exceeded the applicable or reduced respirable dust standard because of the presence of silica were: 12% for sand and gravel mines, 13% for stone mines, 18% for nonmetal mines, 21% for metal operations, and 11% for coal mines [MSHA 2009]. At surface mining operations, occupations most frequently exceeding the applicable respirable dust standard are usually operators of mechanized equipment such as drills, bulldozers, scrapers, front-end loaders, haul trucks, and crushers. This chapter summarizes the current state of the art of dust controls for surface mines. Surface mining operations present dynamic and highly variable silica dust sources. Most of the dust generated at surface mines is produced by mobile earth-moving equipment such as drills, bulldozers, trucks, and front-end loaders excavating silica-bearing rock and minerals. Four practical areas of engineering controls to mitigate surface mine worker exposure to all airborne dusts, including silica, are drill dust collection systems, enclosed cab filtration systems, controlling dust on unpaved haulage roads, and controlling dust at the primary hopper dump. Many surface mine dust control problems can be visually observed and diagnosed. Visible airborne dust emissions generated from a particular surface mine process usually indicate that respirable silica dust can be present and potentially become a worker exposure problem. Visual dust emissions affecting nearby workers indicates that an engineering control is needed or an existing control needs maintenance. Investigating possible causes of visual dust emissions when using an engineering control often can uncover the reason for its poor dust control effectiveness. Frequent visual inspections of engineering control systems can identify needed maintenance to optimize their dust control effectiveness. Area dust sampling should be conducted, in conjunction with personal sampling, to quantify potential dust sources and examine their contribution to the worker dust exposure problem.

DRILL DUST COLLECTION SYSTEMS

Drill dust is generated by compressed air (bailing airflow) flushing the drill cuttings from the hole. Dry or water-based dust collection systems are available for controlling this drill dust. Dry dust collection systems are the most common type of dust control incorporated into the drilling machine by original equipment manufacturers because of their ability to be operated in freezing temperatures. A typical dry dust collection system is shown in Figure 5-1.
It is composed of a self-cleaning (compressed air back-pulsing of filters) dry dust collector sucking the dusty air from underneath the shrouded drill deck located over the hole. Ninety percent of dust emissions with this type of system are attributed to drill deck shroud leakage, drill stem bushing leakage, and dust collector dump discharge. Wet suppression is another drill dust collection method and involves injecting water into the bailing airflow traveling down the drill stem. The process of the bailing airflow, water droplets, and cuttings mixing together

captures the airborne dust as they travel back up the hole. However, wet suppression is infrequently used because of operational problems in cold climates, lack of a readily accessible water supply, and shorter bit life. Studies by the U.S. Bureau of Mines and NIOSH have shown the practical aspects of optimizing these dust collection systems. These are discussed below for each dust collection method.

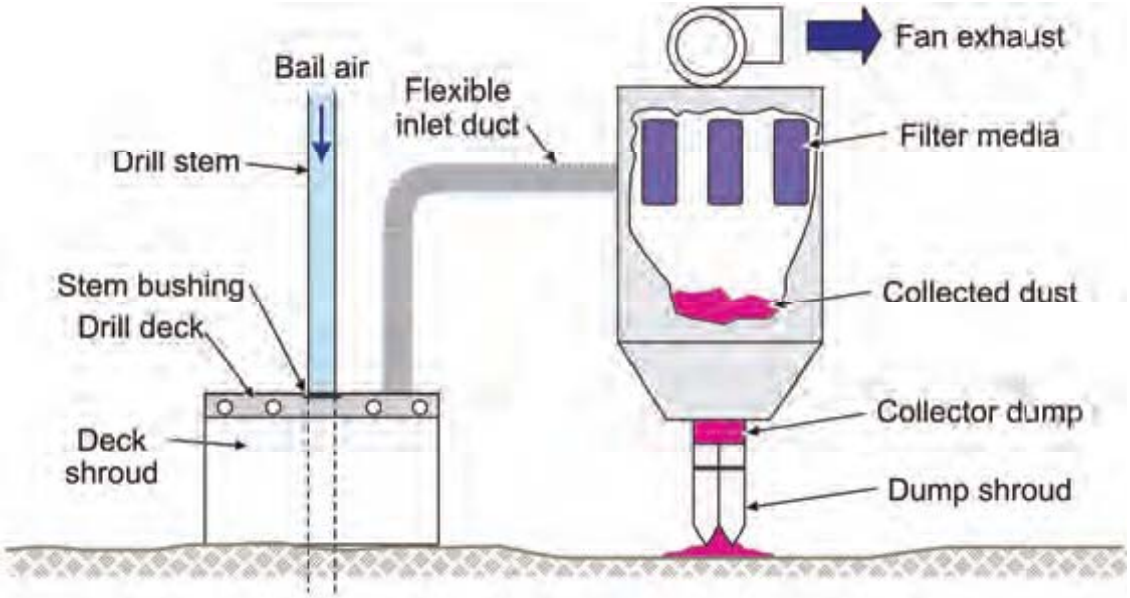


Figure 5-1.—Typical dry dust collection system used on surface drills.

Dry Dust Collector System

• **Maintain a tight drill deck shroud enclosure with the ground.** Dust emissions are significantly reduced around the drill deck shroud by maintaining the ground-toshroud gap height below 8 in [NIOSH 2005; USBM 1987]. This can be accomplished by better vertical positioning of the drill table shroud by the operator to minimize the ground-to-shroud gap. Dust levels were significantly reduced from 21.4 to 2.5 mg/m3 next to the drill deck shroud when the drill operator changed the drill setup procedure to minimize this gap [Organiscak and Page 1999]. Also, the ground-to-shroud gap can be more tightly closed by using a flexible shroud design that can be mechanically raised and lowered to the ground via cables and hydraulic actuators. An adjustable height shroud design maintains a better seal with uneven ground and was found to keep dust emissions next to the shroud below 0.5 mg/m3 at several drill operations [NIOSH 1998, 2005]. Finally, a shroud constructed in sections with vertical gaps along sections or corners can also be a source of shroud leakage. Overlapping sections of shroud material reduce gaps and leakage. One conceptual shroud design for a rectangular drill table is construction with corner sections and overlapping side sections of shroud material [Page and Organiscak 1995].

• **Maintain a collector-to-bailing airflow ratio of at least 3:1.** Dust emissions are significantly decreased around the shroud at or above a 3:1 collector-to-bailing airflow ratio [NIOSH 2005]. Dust collector airflow reductions under the shroud are generally caused by restrictions and/or leakages in the system. Loaded filters and material in the ductwork are likely causes of restrictions, whereas damaged ductwork and holes are likely causes of leakage in the system. Thus, inspection and maintenance of the dust collection system are vital to achieving and maintaining optimal collector operation and airflow.

• **Maintain a good drill stem seal with the drill table.** A rubber drill stem bushing (see Figure 5-1) restricts bailing airflow from blowing dust and cuttings through the drill deck and therefore needs to be replaced after mechanical wear. An alternative sealing method involves using a nonmechanical compressed air ring seal manifold under the drill deck. This manifold consists of a donut-shaped pipe with closely spaced holes on the inside perimeter that discharges air jets in a radial pattern at the drill stem. The high-velocity air jets block the gap between the drill stem and deck, reducing respirable dust leakage through the drill deck by 41%–70% [Page 1991]

. • **Shroud the collector dump discharge close to the ground.** Dumping dust from the collector discharge several feet above ground level can disperse significant amounts of airborne respirable dust. Dust emission reductions of greater than 63% were measured by the collector discharge dump after installing an extended shroud near ground level (Figure 5-1) [Reed et al. 2004; USBM 1995]. These shrouds can be fabricated quickly by wrapping brattice cloth around the perimeter of the collector discharge dump and securing it to the discharge dump with a hose clamp.

• **Maintain the dust collector as specified by manufacturer.** Collector system components should be frequently inspected and damaged components repaired or replaced. A 51% dust emission reduction was measured at one drill after a broken collector fan belt was replaced, while another drill showed a reduction of 83% after the torn deck shroud was replaced [Organiscak and Page 1999].

Wet Suppression

• **Add small amounts of water into the bailing air until the visible dust cloud has been significantly reduced.** Drill dust emissions are significantly reduced by increasing the water flow rate from 0.2 to 0.6 gal/min [USBM 1987]. A needle valve and water flow meter installed on the water supply line provides adjustable control for wet suppression systems. However, adding excessive water down the hole can cause operational problems with no appreciable improvement in dust control.

• **Minimizing water flow to a rolling cutter bit can increase bit life.** Wet drilling with rolling cutter bits can cause premature bit wear. A drill stem water separator installed upstream of a rolling cutter bit can increase bit life without adverse affects on dust control [Listak and Reed 2007; USBM 1988]. The water separator is a bit stabilizer with an internal cyclonic or impaction water droplet classifier, removing most of the water from the bailing airflow before it is flushed through the drill bit. The water removed by the internal separator is released through external holes in the bit stabilizer (Figure 5-2).

Figure 5-2.—Water separator discharging water before it reaches the drill bit.

ENCLOSED CAB FILTRATION SYSTEMS

Enclosed cab filtration systems are one of the mainstay engineering controls for reducing mobile equipment operators' exposure to airborne dust at surface mines. Enclosed cabs with heating, ventilation, and air conditioning (HVAC) systems are typically integrated into the drills and mobile equipment to protect the operator from the outside environment. Air filtration is often part of the HVAC system as an engineering control for airborne dusts. Surface mining dust surveys conducted by NIOSH on drills and bulldozers have shown that enclosed cabs can effectively control the operator's dust exposure, but cab performance can vary [Organiscak and Page 1999]. The enclosed cab protection factors (outside ÷ inside dust concentrations) measured on rotary drills ranged from 2.5 to 84, and those measured on bulldozers ranged from 0 to 45. NIOSH also conducted field studies of upgrading older equipment cabs to improve their dust control effectiveness. These studies involved retrofitting older enclosed cabs with air-conditioning, heating, and air filtration systems to show the effectiveness of upgrading older mine equipment cabs. During these retrofits, any reasonably repairable cracks, gaps, or openings were sealed with silicone and closed cell foam tape. Varying degrees of enclosure integrity were achieved. Table 5-1 shows the results in ascending order of performance achieved with these retrofitted installations. In addition, NIOSH conducted controlled laboratory experiments to examine the key design factors of enclosed cab dust filtration systems.

Key Performance Factors for Enclosed Cab Filtration Systems

• **Ensure good cab enclosure integrity to achieve positive pressurization against wind penetration into the enclosure.** As shown in Table 5-1, significant improvements in cab protection factors were achieved in the field studies when cab pressures exceeded 0.01 in w.g. This corresponded to wind velocity equivalents (an indicator of cab wind velocity resistance) greater than 4.5 mph. The cab enclosures with greater than 0.01 in w.g. pressure were of close-fitted construction, and their integrity could be readily improved by sealing cab enclosure cracks, gaps, or openings with silicone and closed cell foam tape. The loosely fitted cab construction on one of the drills and the truck were difficult to seal, which limited the amount of cab pressure that could be attained.

• **Use high-efficiency respirable dust filters on the intake air supply into the cab.** Filter efficiency performance specifications used in the field were 95% or greater on respirable-sized dusts [Chekan and Colinet 2003; Cecala et al. 2003, 2005; Organiscak et al. 2003a]. Laboratory experiments showed an order of magnitude increase in cab protection factors when using a 99% efficient filter versus a 38% efficient filter on respirable-sized particles [NIOSH 2007].

• **Use an efficient respirable dust recirculation filter.** All of the cab field demonstrations used recirculation filters that were 95% efficient or better in removing respirable-sized dusts [Chekan and Colinet 2003; Cecala et al. 2003, 2005; Organiscak et al. 2003a]. Laboratory experiments showed an order of magnitude increase in cab protection factors when using an 85%–94.9% efficient filter compared to no recirculation filter [NIOSH 2007]. Laboratory testing also showed that when using a recirculation filter, the time for interior cab concentration to decrease and reach stability after the door had been opened and closed was cut by more than half.

• **Minimize dust sources in the cab.** Use good housekeeping practices, and move heater outlets that blow across soiled cab floors. Dust levels were shown to increase from 0.03 to 0.26 mg/m3 by turning on a floor heater inside the cab [Cecala et al. 2005]. The floor heater was removed and cab heating was discharged down from the ceiling HVAC system, reducing dust entrainment in the cab during colder winter months. Another method of reducing entrainment of dust from a soiled cab floor is placing a gritless (without sand added) sweeping compound on the floor during the working shift. Most commercial sweeping compounds have petroleum-based oils or wax added to the cellulose material. It must be noted, however, that people sensitized to petroleum distillates could have allergic reactions to these sweeping compounds if used in enclosed cabs. A few companies offer non-petroleum-based sweeping compounds that use either a natural oil or chemical additive for dust adhesion [NIOSH 2001]. It is also recommended to cover the floor with rubber matting instead of carpeting for easy cleaning. More frequent cleaning of heavily soiled floors by the operator may be a more straightforward alternative to using sweeping compounds to minimize this type of dust entrainment.

• **Keep doors closed during equipment operation.** On one drill operation, the respirable dust concentrations inside the cab averaged 0.09 mg/m3 with the door closed and 0.81 mg/m3 when the door was briefly opened to add drill steels [Cecala et al. 2007]. Although this occurred after drilling stopped and the visible dust dissipated, opening the door, even briefly, produced a ninefold increase in respirable dust concentrations inside the cab during the many drill steel changes made over a working shift.

CONTROLLING HAULAGE ROAD DUST

Off-road haul trucks used in the mining industry typically contribute most of the total dust emissions at a mine site. Although most of the airborne dust generated from unpaved haulage roads is nonrespirable, up to 20% is in the respirable size range [Organiscak and Reed 2004]. The most common method of haul road dust control is surface wetting with water. Figure 5-3 shows the effectiveness of road wetting with water on airborne respirable dust generation measured next to an unpaved haul road. The road was wetted in the morning and dried out in the afternoon. Although the road treatment methods have been shown to be very effective, their application generally involves continual maintenance due to road degradation from traffic, dry climatic conditions, and material spillage on the road. Road dust generation then can be inevitable at times during the mining operation until controls are applied. Given their mobility, trucks have the potential to expose other downwind mine workers to respirable dust, as well as other truck drivers on the haul road. NIOSH has recently studied the size characteristics, concentrations, and spatial variation of airborne dust generated along unpaved mine haulage roads to examine the potential human health and safety impacts of this dust source and is examining other avenues of truck dust mitigation. Techniques for controlling haulage road dust are summarized below.

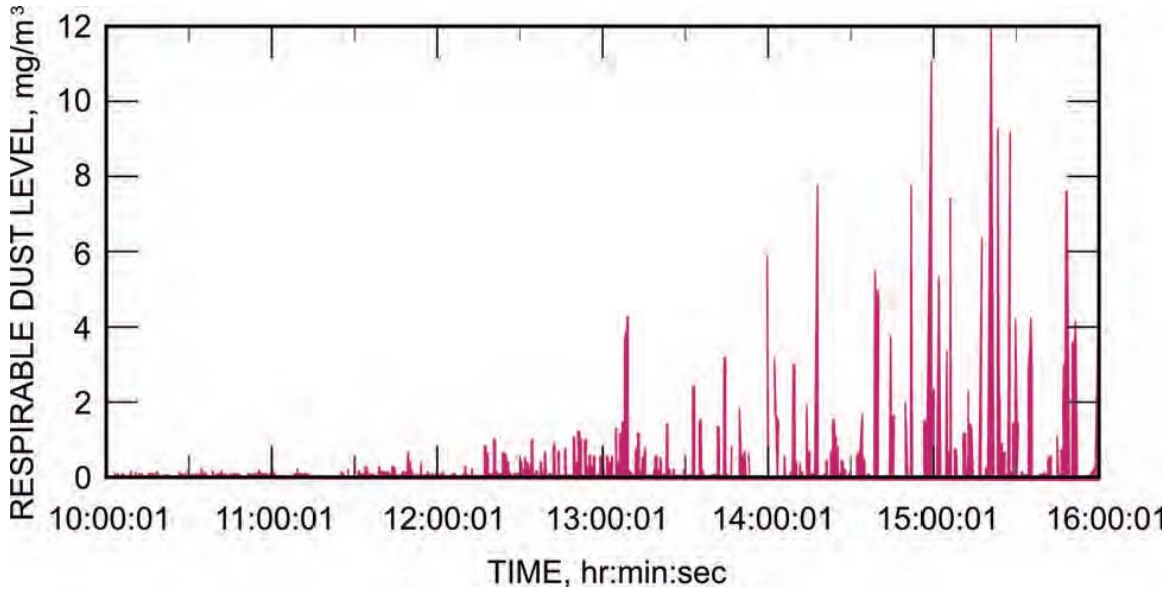


Figure 5-3.–Increase in dust when a wet haul road dries.

Methods for Controlling Haulage Road Dust Exposures

• **Treatment of unpaved road surfaces.** Figure 5-3 shows the effectiveness of road wetting with water on respirable dust liberation next to the haul road and its time-frame of effectiveness at this mine [Organiscak and Reed 2004]. Other haulage road treatments include adding hygroscopic salts, surfactants, soil cements, bitumens, and films (polymers) to the road surface, which can extend the time of effectiveness between treatments up to several weeks [Organiscak et al. 2003b; Olson and Veith 1987].

• **Increase the distance between vehicles traveling the haul road.** Research has shown that airborne dust concentrations generated from haulage roads rapidly decreased and approached ambient air dust levels 100 ft from the road [Organiscak and Reed 2004]. This road dust dissipation and dilution provides an opportunity to use administrative and mine planning controls to reduce worker dust exposure. If a trailing haul truck was not allowed to follow within 20 sec of a leading truck, the resulting distance between trucks allowed generated dust to dissipate. This led to more than a 40% reduction in respirable dust exposure to the following truck [Reed and Organiscak 2005]. Finally, advantageous road layout and traffic patterns can be designed into the mine plan to isolate the dust sources from other workers [Organiscak and Reed 2004].

CONTROLLING DUST AT THE PRIMARY HOPPER DUMP

The mined product is normally loaded into haul trucks from the surface mine pit and driven to the primary crusher location. This product is either dumped directly from the haul truck into the primary hopper feeding a crusher or dumped into a stockpile. If it is stockpiled, a front-end loader then takes the mined product and dumps it into the primary hopper. In either case during this dumping process, a dust cloud can billow out of the hopper and roll back under the truck bed or front-end loader bucket. Dust in the mined product is released from the large volume of material being dumped in a short period of time, which quickly displaces the air in

the hopper and transports the airborne dust released from dumping. If the equipment operators dumping the mined product into the hopper have an effective enclosed cab filtration system (as described earlier), their exposure to this dust would be reduced. However, if other mine personnel such as crusher operators and/or maintenance workers work near this primary dump, they can be exposed to this airborne dust. Several effective control methods are available and include enclosing the hopper dump and using water sprays to suppress and contain the dust from rolling back out of the enclosure.

Key Factors for Controlling Dust From the Primary Dump

• **Enclose the primary hopper dump.** Walls can be constructed around the primary dump location to form an enclosure that must be custom-designed to accommodate the dump vehicles being used. Walls can be either stationary (rigid) or removable (flexible material or curtains) based on maintenance access within parts of the enclosure. Staging curtains, also called stilling curtains, can be used in the enclosure to provide physical barriers that break up the natural tendency for dust to billow out of the primary dump hopper when a large volume of product is dumped in a very short time period (see Figure 5-4) [Weakly 2000]. Another option to restrict the dust from escaping the enclosure is using panels of flexible plastic stripping on the dump side of the enclosure. This plastic stripping employs an overlapping sequence that provides a very effective seal and resists damage if contacted by the bucket of the front-end loader or the bed of the haul truck during dumping. Finally, a local exhaust ventilation system can be used to filter the dust-laden air from the enclosed hopper area. This would be most appropriate when the primary dump is at a location where the dust could enter an adjoining structure or impact outside miners. Since hoppers are usually large, a significant amount of airflow would be required to create a negative pressure sufficient enough to contain the dust cloud. This approach would be a more expensive alternative than using wet suppression [Rodgers et al. 1978].

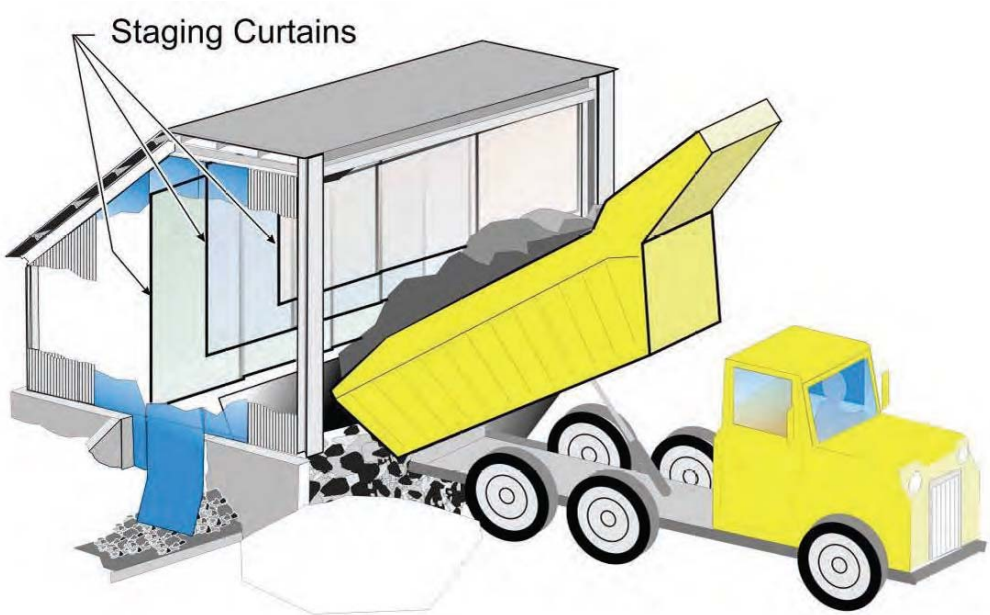


Figure 5-4.—Staging curtains used to prevent dust from billowing out of enclosure.

• **Use water sprays to suppress the dust in the enclosure.** Water sprays directed at the mined product dumped into the hopper will wet the material and suppress some of the airborne dust generated. A good starting point is to add 1% moisture by weight [Quilliam 1974]. This percentage can be adjusted based on the improvement gained from additional moisture versus any consequences from adding too much. Since continuous use of water sprays during long periods of idle time between dumping can have adverse operational effects, activate the water sprays during the actual dump cycle through the use of a photo cell or a mechanical switching device. A delay timer can also be used in this application so that the sprays continue to operate and suppress dust for a short time period after the dump vehicle has moved away.

• **Prevent the dust from rolling back under the dump vehicle.** A tire-stop water spray system is recommended to reduce the dust liberated due to rollback under the dumping mechanism. A tire stop or Jersey barrier should be positioned at the most forward point of dumping for the primary hopper. A water spray system should be attached to the back side of this tire stop to knock down and force the dust that would otherwise roll back under the dumping mechanism into the hopper. In addition, a shield should be placed over this water spray manifold to protect it from damage from falling material (Figure 5-5). Finally, a system should also be incorporated that allows the water sprays to be activated only during the actual dumping process, as previously discussed.

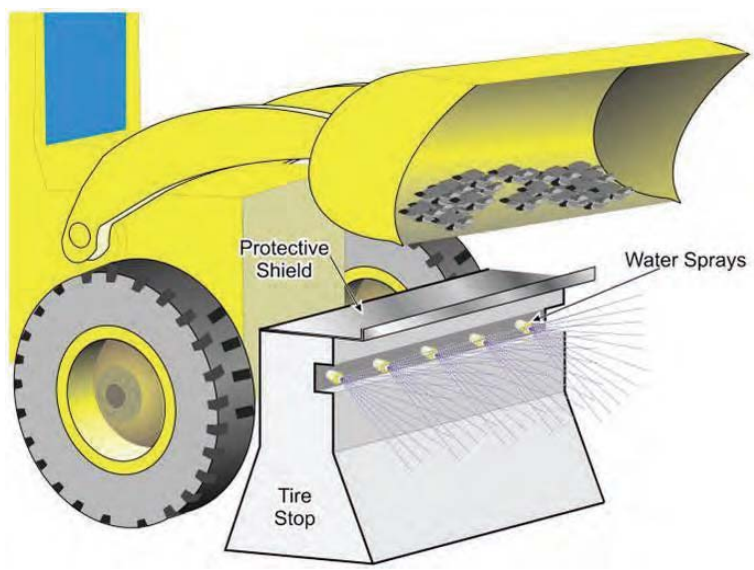


Figure 5-5.—Tire-stop water spray system reduces dust rollback under the dumping vehicle.

Federal Mine Safety & Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164*

TITLE II--INTERIM MANDATORY HEALTH STANDARDS

DUST STANDARD AND RESPIRATORY EQUIPMENT

SEC. 202. (a) Each operator of a coal mine shall take accurate samples of the amount of respirable dust in the mine atmosphere to which each miner in the active workings of such mine is exposed. Such samples shall be taken by any device approved by the Secretary and the Secretary of Health, Education, and Welfare and in accordance with such methods, at such locations, at such intervals, and in such manner as the Secretaries shall prescribe in the Federal Register within sixty days from the date of enactment of this Act and from time to time thereafter. Such samples shall be transmitted to the Secretary in a manner established by him, and analyzed and recorded by him in a manner that will assure application of the provisions of section 104(i) of this Act when the applicable limit on the concentration of respirable dust required to be maintained under this section is exceeded. The results of such samples shall also be made available to the operator. Each operator shall report and certify to the Secretary at such intervals as the Secretary may require as to the conditions in the active workings of the coal mine, including, but not limited to, the average number of working hours worked during each shift, the quantity and velocity of air regularly reaching the working faces, the method of mining, the amount and pressure of the water, if any, reaching the working faces, and the number, location, and type of sprays, if any, used.

(b) Except as otherwise provided in this subsection--

(1) Effective on the operative date of this title, each operator shall continuously maintain the average concentration of respirable dust in the mine atmosphere during each shift to which each miner in the active workings of such mine is exposed at or below 3.0 milligrams of respirable dust per cubic meter of air.
(2) Effective three years after the date of enactment of this Act, each operator shall continuously maintain the average concentration of respirable dust in the mine atmosphere during each shift to which each miner in the active workings of such mine is exposed at or below 2.0 milligrams of respirable dust per cubic meter of air.
(3) Any operator who determines that he will be unable, using available technology, to comply with the provisions of paragraph (1) of this subsection, or the provisions of paragraph (2) of this subsection, as appropriate, may file with the Panel, no later than sixty days prior to the effective date of the applicable respirable dust standard established by such paragraphs, an application for a permit for noncompliance. If, in the case of an application for a permit for noncompliance with the 3.0 milligram standard established by paragraph (1) of this subsection, the application satisfies the requirements of subsection (c) of this section, the Panel shall issue a permit for noncompliance to the operator. If, in the case of an application for a permit for noncompliance

with the 2.0 milligram standard established by paragraph (2) of this subsection, the application satisfies the requirements of subsection (c) of this section and the Panel determines that the applicant will be unable to comply with such standard, the Panel shall issue to the operator a permit for noncompliance.

(4) In any case in which an operator, who has been issued a permit (including a renewal permit) for noncompliance under this section, determines, not more than ninety days prior to the expiration date of such permit, that he still is unable to comply with the standard established by paragraph (1) of this subsection or the standard established by paragraph (2) of this subsection, as appropriate, he may file with the Panel an application for renewal of the permit. Upon receipt of such application, the Panel, if it determines, after all interested persons have been notified and given an opportunity for a public hearing under section 5 of this Act, that the application is in compliance with the provisions of subsection (c) of this section, and that the applicant will be unable to comply with such standard, may renew the permit.

(5) Any such permit or renewal thereof so issued shall be in effect for a period not to exceed one year and shall entitle the permittee during such period to maintain continuously the average concentration of respirable dust in the mine atmosphere during each shift in the working places of such mine to which the permit applies at a level specified by the Panel, which shall be at the lowest level which the application shows the conditions, technology applicable to such mine, and other available and effective control techniques and methods will permit, but in no event shall such level exceed 4.5 milligrams of dust per cubic meter of air during the period when the 3.0 milligram standard is in effect, or 3.0 milligrams of dust per cubic meter of air during the period when the 2.0 milligram standard is in effect.

(6) No permit or renewal thereof for noncompliance shall entitle any operator to an extension of time beyond eighteen months from the date of enactment of this Act to comply with the 3.0 milligram standard established by paragraph (1) of this subsection, or beyond seventy-two months from the date of enactment of this Act to comply with the 2.0 milligram standard established by paragraph (2) of this subsection.

(c) Any application for an initial or renewal permit made pursuant to this section shall contain--

(1) a representation by the applicant and the engineer conducting the survey referred to in paragraph (2) of this subsection that the applicant is unable to comply with the standard applicable under subsection (b)(1) or (b)(2) of this section at specified working places because the technology for reducing the concentration of respirable dust at such places is not available, or because of the lack of other effective control techniques or methods, or because of any combination of such reasons;

(2) an identification of the working places in such mine for which the permit is requested; the results of an engineering survey by a certified engineer of the respirable dust conditions of each working place of the mine with respect to which such application is filed and the ability to reduce such dust to the level required to be maintained in such place under this section; a description of the ventilation system of the mine and its capacity; the quantity and velocity of air regularly reaching the working faces; the method of mining; the amount and

pressure of the water, if any, reaching the working faces; the number, location, and type of sprays, if any; action taken to reduce such dust; and such other information as the Panel may require; and

(3) statements by the applicant and the engineer conducting such survey, of the means and methods to be employed to achieve compliance with the applicable standard, the progress made toward achieving compliance, and an estimate of when compliance can be achieved.

(d) Beginning six months after the operative date of this title and from time to time thereafter, the Secretary of Health, Education, and Welfare shall establish, in accordance with the provisions of section 101 of this Act, a schedule reducing the average concentration of respirable dust in the mine atmosphere during each shift to which each miner in the active workings is exposed below the levels established in this section to a level of personal exposure which will prevent new incidences of respiratory disease and the further development of such disease in any person. Such schedule shall specify the minimum time necessary to achieve such levels taking into consideration present and future advancements in technology to reach these levels.

(e) References to concentrations of respirable dust in this title mean the average concentration of respirable dust measured with a device approved by the Secretary and the Secretary of Health, Education, and Welfare.

(f) For the purpose of this title, the term "average concentration" means a determination which accurately represents the atmospheric conditions with regard to respirable dust to which each miner in the active workings of a mine is exposed (1) as measured, during the 18 month period following the date of enactment of this Act, over a number of continuous production shifts to be determined by the Secretary and the Secretary of Health, Education, and Welfare, and (2) as measured thereafter, over a single shift only, unless the Secretary and the Secretary of Health, Education, and Welfare find, in accordance with the provisions of section 101 of this Act, that such single shift measurement will not, after applying valid statistical techniques to such measurement, accurately represent such atmospheric conditions during such shift.

(g) The Secretary shall cause to be made such frequent spot inspections as he deems appropriate of the active workings of coal mines for the purpose of obtaining compliance with the provisions of this title.

(h) Respiratory equipment approved by the Secretary and the Secretary of Health, Education, and Welfare shall be made available to all persons whenever exposed to concentrations of respirable dust in excess of the levels required to be maintained under this Act. Use of respirators shall not be substituted for environmental control measures in the active workings. Each operator shall maintain a supply of respiratory equipment adequate to deal with occurrences of concentrations of respirable dust in the mine atmosphere in excess of the levels required to be maintained under this Act.

MEDICAL EXAMINATIONS

SEC. 203. (a) The operator of a coal mine shall cooperate with the Secretary of Health, Education, and Welfare in making available to each miner working in a coal mine the opportunity to have a chest roentgenogram within eighteen months after the

date of enactment of this Act, a second chest roentgenogram within three years thereafter, and subsequent chest roentgenograms at such intervals thereafter of not to exceed five years as the Secretary of Health, Education, and Welfare prescribes. Each worker who begins work in a coal mine for the first time shall be given, as soon as possible after commencement of his employment, and again three years later if he is still engaged in coal mining, a chest roentgenogram; and in the event the second such chest roentgenogram shows evidence of the development of pneumoconiosis the worker shall be given, two years later if he is still engaged in coal mining, an additional chest roentgenogram. All chest roentgenograms shall be given in accordance with specifications prescribed by the Secretary of Health, Education, and Welfare and shall be supplemented by such other tests as the Secretary of Health, Education, and Welfare deems necessary. The films shall be read and classified in a manner to be prescribed by the Secretary of Health, Education, and Welfare and the results of each reading on each such person and of such tests shall be submitted to the Secretary and to the Secretary of Health, Education, and Welfare, and, at the request of the miner, to his physician. The Secretary shall also submit such results to such miner and advise him of his rights under this Act related thereto. Such specifications, readings, classifications, and tests shall, to the greatest degree possible, be uniform for all coal mines and miners in such mines.

(b)(1) On and after the operative date of this title, any miner who, in the judgment of the Secretary of Health, Education, and Welfare based upon such reading or other medical examinations, shows evidence of the development of pneumoconiosis shall be afforded the option of transferring from his position to another position in any area of the mine, for such period or periods as may be necessary to prevent further development of such disease, where the concentration of respirable dust in the mine atmosphere is not more than 2.0 milligrams of dust per cubic meter of air.

(2) Effective three years after the date of enactment of this Act, any miner who, in the judgment of the Secretary of Health, Education, and Welfare based upon such reading or other medical examinations, shows evidence of the development of pneumoconiosis shall be afforded the option of transferring from his position to another position in any area of the mine, for such period or periods as may be necessary to prevent further development of such disease, where the concentration of respirable dust in the mine atmosphere is not more than 1.0 milligrams of dust per cubic meter of air, or if such level is not attainable in such mine, to a position in such mine where the concentration of respirable dust is the lowest attainable below 2.0 milligrams per cubic meter of air.

(3) Any miner so transferred shall receive compensation for such work at not less than the regular rate of pay received by him immediately prior to his transfer.

(c) No payment may be required of any miner in connection with any examination or test given him pursuant to this title. Where such examinations or tests cannot be given, due to the lack of adequate medical or other necessary facilities or personnel, in the locality where the miner resides, arrangements shall be made to have them conducted, in accordance with the provisions of this title, in such locality by the Secretary of Health, Education, and Welfare, or by an appropriate person, agency, or institution, public or private, under an agreement or arrangement between the Secretary of Health, Education, and Welfare and such person, agency, or institution. The operator of the mine shall reimburse the Secretary of Health, Education, and

Welfare, or such person, agency, or institution, as the case may be, for the cost of conducting each examination or test made, in accordance with this title, and shall pay whatever other costs are necessary to enable the miner to take such examinations or tests.

(d) If the death of any active miner occurs in any coal mine, or if the death of any active or inactive miner occurs in any other place, the Secretary of Health, Education, and Welfare is authorized to provide for an autopsy to be performed on such miner, with the consent of his surviving widow or, if he has no such widow, then with the consent of his surviving next of kin. The results of such autopsy shall be submitted to the Secretary of Health, Education, and Welfare and, with the consent of such survivor, to the miner's physician or other interested person. Such autopsy shall be paid for by the Secretary of Health, Education, and Welfare.

DUST FROM DRILLING ROCK

SEC. 204. The dust resulting from drilling in rock shall be controlled by the use of permissible dust collectors, or by water or water with a wetting agent, or by ventilation, or by any other method or device approved by the Secretary which is at least as effective in controlling such dust. Respiratory equipment approved by the Secretary and the Secretary of Health, Education, and Welfare shall be provided persons exposed for short periods to inhalation hazards from gas, dusts, fumes, or mist. When the exposure is for prolonged periods, other measures to protect such persons or to reduce the hazard shall be taken.

Title 30
Code of Federal Regulation
Part 71 – Subparts B, C and D

30 CFR § 71.100
Respirable dust standard.

Each operator shall continuously maintain the average concentration of respirable dust in the mine atmosphere during each shift to which each miner in the active workings is exposed at or below 2.0 milligrams of respirable dust per cubic meter of air. Concentrations shall be measured with an approved sampling device and expressed in terms of an equivalent concentration determined in accordance with §71.206 (Approved sampling devices; equivalent concentrations).

30 CFR § 71.101
Respirable dust standard when quartz is present.

When the respirable dust in the mine atmosphere of the active workings contains more than 5 percent quartz, the operator shall continuously maintain the average concentration of respirable dust in the mine atmosphere during each shift to which each miner is exposed at or below a concentration of respirable dust computed by dividing the percent of quartz into the number 10. Concentrations shall be expressed in milligrams per cubic meter of air as measured with an approved sampling device and in terms of an equivalent concentration determined in accordance with §71.206 (Approved sampling devices; equivalent concentrations).

EXAMPLE: The respirable dust associated with a designated work position contains quartz in the amount of 20%, Therefore, the average concentration of respirable dust in the mine atmosphere associated with that designated work position shall be continuously maintained at or below 0.5 milligrams of respirable dust per cubic meter of air (10/20=0.5 mg/m(sub)3).

30 CFR § 71.201
Sampling; general requirements.

(a) Each operator shall take respirable dust samples of the concentration of respirable dust in the active workings of the mine as required by this part with a sampling device approved by the Secretary and the Secretary of Health and Human Services under part 74 (Coal Mine Dust Personal Sampler Units) of this title.

(b) Sampling devices shall be worn or carried directly to and from the designated work position to be sampled and shall remain operational during the entire shift or for 8 hours, whichever time is less.

(c) Upon request from the District Manager, the operator shall submit the date on which collecting any respirable dust samples required by this part will begin.

(d) During the time for abatement fixed in a citation for violation of §71.100 (Resipirable dust standard) or §71.101 (Respirable dust standard when quartz is present), the operator shall take corrective action to lower the concentration of respirable dust to within the permissible concentration and then sample each normal work shift until five valid respirable dust samples are taken.

(e) Upon written request by the operator, the District Manager may waive the rain restriction for a normal work shift as defined in §71.2 (Definitions) for a period not to exceed two months, if the District Manager determines that:

(1) The operator will not have reasonable opportunity to complete the respirable dust sampling required by this part without the waiver because of the frequency of rain; and

(2) The operator did not have reasonable opportunity to complete the respirable dust sampling required by this part prior to requesting the waiver.

30 CFR § 71.202
Certified person; sampling.

(a) The respirable dust sampling required by this part shall be done by a certified person.

(b) To be certified, a person shall pass the MSHA examination on sampling of respirable coal mine dust.

(c) A person may be temporarily certified by MSHA to take respirable dust samples if the person receives instruction from an authorized representative of the Secretary in the methods of collecting and submitting samples under this rule. The temporary certification shall be withdrawn if the person does not successfully complete the examination conducted by MSHA on sampling of respirable coal mine dust within six months from the issue date of the temporary certification.

30 CFR § 71.203
Certified person; maintenance and calibration.

(a) Approved sampling devices shall be maintained and calibrated by a certified person.

(b) To be certified, a person shall pass the MSHA examination on maintenance and calibration procedures for respirable dust sampling equipment.

(c) A person may be temporarily certified by MSHA to maintain and calibrate approved sampling devices if the person receives instruction from an authorized representative of the Secretary in the maintenance and calibration procedures for respirable dust sampling equipment under this rule. The temporary certification shall be withdrawn if the person does not successfully complete the exmamination conducted by MSHA on maintenance and calibration procedures within six months from the issue date of the temporary certification.

30 CFR § 71.204
Approved sampling devices; maintenance and calibration.

(a) Approved sampling devices shall be maintained as approved under part 74 (Coal Mine Dust Personal Sampler Units) of this title and calibrated in accordance with MSHA Informational Report No. 1121, "Standard Calibration and Maintenance Procedures for Wet Test Meters and Coal Mine Respirable Dust Samplers (Supersedes IR 1073)," by a person certified in accordance with§71.203 (Certified person; maintenance and calibration).

(b) Approved sampling devices shall be calibrated at the flowrate of 2.0 liters of air per minute, or at a different flowrate as prescribed by the Secretary and the Secretary of Health and Human Services for the particular device, before they are put into service and at intervals not to exceed 200 hours of operating time thereafter.

(c) A calibration mark shall be placed on the flowmeter of each approved sampling device to indicate the proper position of the float when the sampler is operating at a flowrate of 2.0 liters of air per minute or other flowrate prescribed by the Secretary and the Secretary of Health and Human Services for the particular device. The standard to denote proper flow is when the lowest part of the float is tangent to the top of the calibration mark.

(d) Approved sampling devices shall be tested and examined immediately before each sampling shift and necessary external maintenance shall be performed to assure that the sampling devices are clean and in proper working condition by a person certified in accordance with §71.202 (Certified person; sampling) or §71.203 (Certified person; maintenance and calibration). This testing and examination shall include the following:

(1) Testing the voltage of each battery while under actual load to assure the battery is fully charged. The voltage for nickel cadmium cell batteries shall not be lower than the product of the number of cells in the battery pack multiplied by 1.25. The voltage for other than nickel cadmium cell batteries shall not be lower than the product of the number of cells in the battery pack multiplied by the manufacturer's nominal voltage per cell value;

(2) Examination of all components of the cyclone to assure that they are clean and free of dust and dirt;

(3) Examination of the inner surface of the cyclone on the approved sampling device to assure that it is free of scoring;

(4) Examination of the external tubing on the approved sampling device to assure that it is clean and free of leaks; and,

(5) Examination of the clamping and positioning of the cyclone body, vortex finder and cassette to assure that they are rigid, in alignment, and firmly in contact.

(e) MSHA Informational Report IR 1240 (1996) referenced in paragraph (a) of this section is incorporated-by-reference. This incorporation-by-reference was approved by the Director of the Federal Register in accordance with 5. U.S.C. 552(a) and 1 CFR part 51. Copies may inspected or obtained at MSHA, Coal Mine safety and Health, 1100 Wilson Blvd., Rooom 2424, Arlington, Virginia 22209-3939 and at each MSHA Coal Mine Safety and Health district office. Copies may be inspected at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-600, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

30 CFR § 71.205
Approved sampling devices; operation; air flowrate.

(a) Sampling devices approved in accordance with part 74 (Coal Mine Dust Personal Sampler Units) of this title shall be operated at the flowrate of 2.0 liters of air per minute, or at a different flowrate as prescribed by the Secretary and the Secretary of Health and Human Services for the particular device.

(b) Each approved sampling device shall be examined each shift by a person certified in accordance with §71.202 (Certified person; sampling) during the second hour after being put into operation to assure that the sampling device is operating properly and at the proper flowrate. If the proper flowrate is not maintained, necessary adjustments shall be made by the certified person.

(c) Each sampling device shall be examined each shift by a person certified in accordance with §71.202 (Certified person; sampling) during the last hour of operation to assure that the sampling device is operating properly and at the proper flowrate. If the proper flowrate is not maintained, the respirable dust sample shall be transmitted to MSHA with a notation by the certified person on the dust data card stating that the proper flowrate was not maintained.

30 CFR § 71.206
Approved sampling devices; equivalent concentrations.

The concentration of respirable dust shall be determined by dividing the weight of dust in milligrams collected on the filter of an approved sampling device by the volume of air in cubic meters passing through the filter and then converting that

concentration to an equivalent concentration as measured with an MRE instrument. To convert a concentration of respirable dust as measured with an approved sampling device to an equivalent concentration of respirable dust as measured with an MRE instrument, the concentration of respirable dust measured with the approved sampling device shall be multiplied by the constant factor prescribed by the Secretary for the approved sampling device used, and the product shall be the equivalent concentration as measured with an MRE instrument.

30 CFR § 71.208
Bimonthly sampling; designated work positions.

(a) Each operator shall take one valid respirable dust sample from each designated work position during each bimonthly period beginning with the bimonthly period of February 1, 1981. The bimonthly periods are:

February 1-March 31
April 1-May 31
June 1-July 31
August 1-September 30
October 1-November 30
December 1-January 31

(b) When the respirable dust standard is changed in accordance with §71.101 (Respirable dust standard when quartz is present), respirable dust sampling of designated work positions shall begin on the first normal work shift during the next bimonthly period following notification of such change from MSHA.

(c) Upon notification from MSHA that any respirable dust sample taken from a designated work position to meet the requirements of paragraph (a) or (b) of this section exceeds the applicable standard in §71.100 (Respirable dust standard) or§71.101 (Respirable dust standard when quartz is present), the operator shall take five valid respirable dust samples from that designated work position within 15 calendar days. The operator shall begin such sampling on the first day on which there is a normal work shift following the day of receipt of notification.

(d) Upon issuance of a citation for a violation of §71.100 (Respirable dust standard) or §71.101 (Respirable dust standard when quartz is present) involving a designated work position, paragraphs (a), (b), and (c) of this section shall not apply to that designated work position until the violation is abated in accordance with §71.201(d) (Sampling; general requirements).

(e) The District Manager shall designate the work positions at each surface coal mine and surface work area of an underground coal mine for respirable dust sampling under this section. The District Manager shall designate for sampling each work position at the mine where an average concentration of respirable dust exceeding 1.0 milligram per cubic meter of air has been measured by one or more samples. Where the respirable dust standard is below 1.0 milligram per cubic

meter of air in accordance with §71.101 (Respirable dust standard when quartz is present), the District Manager shall designate for sampling each work position where an average concentration of respirable dust exceeding the applicable standard has been measured by one or more samples.

(f) The District Manager shall withdraw the designation of a work position for sampling upon finding that the operator is able to maintain continuing compliance with the applicable respirable dust standard under §71.100 (Respirable dust standard) or§71.101 (Respirable dust standard when quartz is present). This finding shall be based on the results of samples taken during at least a one-year period under this part and by MSHA.

(g) Unless otherwise directed by the District Manager, designated work position samples shall be taken by placing the sampling device as follows:

(1) Equipment operator. On the equipment operator or on the equipment within 36 inches of the operator's normal working position;

(2) Non-equipment operators. On the miner assigned to the designated work position or at a location that represents the maximum concentration of dust to which the miner is exposed.

(h) Each designated work position sample shall be taken on a normal work shift. If a normal work shift is not achieved, the respirable dust sample shall be transmitted to MSHA with a notation by the person certified in accordance with §71.202(Certified person; sampling) that the sample was not taken on a normal work shift. When a normal work shift is not achieved, the sample for that shift may be voided by MSHA. However, any sample, regardless of whether a normal work shift was achieved, with a respirable dust concentration greater than 2.5 milligrams per cubic meter of air will be used to determine the average concentration for that designated work position.

30 CFR § 71.209
Respirable dust samples; transmission by operator.

(a) The operator shall transmit within 24 hours after the end of the sampling shift all samples collected to fulfill the requirements of this part in containers provided by the manufacturer of the filter cassette to: Respirable Dust Processing Laboratory, Pittsburgh Safety and Health Technology Center, Cochrans Mill Road, Building 38, P.O. Box 18179, Pittsburgh, Pennsylvania 15236-0179, or to any other address designated by the District Manager.

(b) The operator shall not open or tamper with the seal of any filter cassette or alter the weight of any filter cassette before or after it is used to fulfill the requirements of this part.

(c) A person certified in accordance with §71.202 (Certified person; sampling) shall properly complete the dust data card that is provided by the manufacturer

for each filter cassette. The card shall have an identification number identical to that on the cassette used to take the sample and be submitted to MSHA with the sample. Each card shall be signed by the certified person and shall include that person's certification number. Respirable dust samples with data cards not properly completed will be voided by MSHA.

(d) All respirable dust samples collected by the operator shall be considered taken to fulfill the sampling requirements of part70, 71 or 90 of this title, unless the sample has been identified in writing by the operator to the District Manager, prior to the intended sampling shift, as a sample to be used for purposes other than required by part 70, 71 or 90 of this title.

(e) Respirable dust samples received by MSHA in excess of those required by this part shall be considered invalid samples.

30 CFR § 71.210
Respirable dust samples; report to operator; posting.

(a) The Secretary shall provide the operator with a report of the following data on respirable dust samples as soon as practicable:

(1) The mine identification number;

(2) The designated work position at the mine from which the samples were taken;

(3) The concentration of respirable dust, expressed in milligrams per cubic meter of air, for each valid sample;

(4) The average concentration of respirable dust, expressed in milligrams per cubic meter of air, for all valid samples; and

(5) The reason for voiding any samples.

(b) Upon receipt, the operator shall post this data for at least 31 days on the mine bulletin board.

30 CFR § 71.220
Status change reports.

(a) If there is a change in operational status that affects the respirable dust sampling requirements of this part, the operator shall report the change in operational status of the mine or designated work position to the MSHA District Office or to any other MSHA office designated by the District Manager. Status changes shall be reported in writing within 3 working days after the status change has occurred.

(b) Each specific operational status is defined as follows: (1) Underground mine: (i) Producing--has at least one mechanized mining unit producing material.

(ii) Nonproducing--no material is being produced.

(iii) Abandoned--the work of all miners has been terminated and production activity has ceased.

(2) Surface mine:

(i) Producing--normal activity is occurring and coal is being produced or processed or other material or equipment is being handled or moved.

(ii) Nonproducing--normal activity is not occurring and coal is not being produced or processed or other material or equipment is not being handled or moved.

(iii) Abandoned--the work of all miners has been terminated and all activity has ceased.

(3) Designated work position:

(i) Producing--normal activity is occurring.

(ii) Nonproducing--normal activity is not occurring.

(iii) Abandoned--the dust generating source has been withdrawn and activity has ceased.

30 CFR § 71.300
Respirable dust control plan; filing requirements.

(a) Within 15 calendar days after the termination date of a citation for violation of §71.100 (Respirable dust standard) or§71.101 (Respirable dust standard when quartz is present), the operator shall submit to the District Manager for approval a written respirable dust control plan applicable to the work position identified in the citation. The respirable dust control plan and revisions thereof shall be suitable to the conditions and the mining system of the coal mine and shall be adequate to continuously maintain respirable dust within the permissible concentration at the surface work position identified in the citation.

(b) Each respirable dust control plan shall include at least the following:

(1) The mine identification number and designated work position number assigned by MSHA, the operator's name, mine name, mine address, and mine telephone number and the name, address, and telephone number of the principal officer in charge of health and safety at the mine;

(2) The specific designated work position at the mine to which the plan applies;

(3) A detailed description of the specific respirable dust control measures used to

abate the violation of the respirable dust standard; and

(4) A detailed description of how each of the respirable dust control measures described in response to paragraph (b)(3) of this section will continue to be used by the operator, including at least the specific time, place and manner the control measures will be used.

30 CFR § 71.301
Respirable dust control plan; approval by District Manager and posting.

(a) The District Manager will approve respirable dust control plans on a mine-by-mine basis. When approving respirable dust control plans, the District Manager shall consider whether:

(1) The respirable dust control measures would be likely to maintain compliance with the respirable dust standard; and

(2) The operator's compliance with all provisions of the respirable dust control plan could be objectively ascertained by MSHA.

(b) MSHA may take respirable dust samples to determine whether the respirable dust control measures in the operator's plan effectively maintain compliance with the respirable dust standard.

(c) The operator shall comply with all provisions of each respirable dust control plan upon notice from MSHA that the respirable dust control plan is approved.

(d) The operator shall post on the mine bulletin board a copy of each current respirable dust control plan approved by the District Manager.

(e) The operator may review respirable dust control plans and submit proposed revisions to such plans to the District Manager for approval.

Title 30
Code of Federal Regulation
Part 72 and 74

30 CFR § 72.620
Drill dust control at surface mines and surface areas of underground mines.

Holes shall be collared and drilled wet, or other effective dust control measures shall be used, when drilling non-water-soluble material. Effective dust control measures shall be used when drilling water-soluble material.

30 CFR § 72.710
Selection, fit, use, and maintenance of approved respirators.

In order to ensure the maximum amount of respiratory protection, approved respirators shall be selected, fitted, used, and maintained in accordance with the provisions of the American National Standards Institute's "Practices for Respiratory Protection ANSI Z88.2-1969," which is hereby incorporated by reference. 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, and may be inspected at any MSHA Coal Mine Safety and Health district office, or at MSHA's Office of Standards, Regulations, and Variances , Regulations, and Variances , 1100 Wilson Boulevard Room 2352, Arlington, Virginia 22209-3939, and at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51.

30 CFR § 74.1
Purpose.

The regulations in this part set forth the requirements for approval of coal mine dust sampling devices for determining the concentrations of respirable dust in coal mine atmospheres; procedures for applying for such approval; test procedures; and labeling.

30 CFR § 74.2
Definitions.

(a) *Accuracy*: the ability of a continuous personal dust monitor (CPDM) to determine the ''true'' concentration of the environment sampled. Accuracy describes the closeness of a typical measurement to the quantity measured, although it is defined and expressed in terms of the relative discrepancy of a typical measurement from the

quantity measured. The accuracy of a CPDM is the theoretical maximum error of measurement, expressed as the proportion or percentage of the amount being measured, without regard for the direction of the error, which is achieved with a 0.95 probability by the method.
(b) *Bias:* the uncorrectable relative discrepancy between the mean of the distribution of measurements from a CPDM and the true concentration being measured.
(c) *Coal mine dust personal sampler unit (CMDPSU):* a personal device for measuring concentrations of respirable dust in coal mine atmospheres that meets the requirements specified under Subpart B of this part.
(d) *Continuous personal dust monitor (CPDM):* a sampling device for continuously measuring concentrations of respirable dust in coal mine atmospheres that reports within-shift and end-of shift measurements of dust concentrations immediately upon the completion of the period of exposure that was monitored and that meets the requirements specified under Subpart C of this part.
(e) *ISO:* the International Organization for Standardization, an international standard-setting organization composed of representatives from various national standards-setting organizations. ISO produces industrial and commercial voluntary consensus standards used worldwide.
(f) *Precision:* the relative variability of measurements from a homogeneous atmosphere about the mean of the population of measurements, divided by the mean at a given concentration. It reflects the ability of a CPDM to replicate measurement results.

30 CFR § 74.3
Sampler Unit

A CMDPSU shall consist of:
(a) A pump unit,
(b) A sampling head assembly, and
(c) If rechargeable batteries are used in the pump unit, a battery charger.

30 CFR § 74.4
Specifications of sampler unit.

(a) *Pump unit:*
(1) *Dimensions.* The overall dimensions of the pump unit, hose connections, and valve or switch covers shall not exceed 4 inches (10 centimeters) in height, 4 inches (10 centimeters) in width, and 2 inches (5 centimeters) in thickness.
(2) *Weight.* The pump unit shall not weigh more than 20 ounces (567 grams).
(3) *Construction.* The case and all components of the pump unit shall be of sufficiently durable construction to endure the wear of use in a coal mine, shall be tight fitting to minimize the amount of dust entering the pump case, and shall be designed to protect against radio frequency interference and electromagnetic interference.
(4) *Exhaust.* The pump shall exhaust into the pump case, maintaining a slight positive pressure which will reduce the entry of dust into the pump case.
(5) *Switch.* The pump unit shall be equipped with an ON/OFF switch or equivalent device on the outside of the pump case. This switch shall be protected against accidental operation during use and protected to keep dust from entering the mechanisms.

(6) *Flow rate adjustment.* Except as provided in the last sentence of this paragraph, the pump unit shall be equipped with a suitable means of flow rate adjustment accessible from outside the case. The flow rate adjuster shall be recessed in the pump case and protected against accidental adjustment. If the pump is capable of maintaining the flow rate consistency required in this part without adjustment, an external flow rate adjuster is not required.

(7) *Battery.* The power supply for the pump shall be a suitable battery located in the pump case or in a separate case which attaches to the pump case by a permissible electrical connection.

(8) *Pulsation.* (i) The irregularity in flow rate due to pulsation shall have a fundamental frequency of not less than 20 Hz.

(ii) The quantity of respirable dust collected with a sampler unit shall be within ±5 percent of that collected with a sampling head assembly operated with nonpulsating flow.

(9) *Belt clips.* The pump unit shall be provided with a belt clip which will hold the pump securely on a coal miner's belt.

(10) *Recharging connection.* A suitable connection shall be provided so that the battery may be recharged without removing the battery from the pump case or from the battery case if a separate battery case is used.

(11) *Flow rate indicator.* A visual indicator of flow rate shall be provided either as an integral part of the pump unit or of the sampling head assembly. The flow rate indicator shall be calibrated within ±5 percent at 2.2, 2.0, and 1.7 liters per minute to indicate the rate of air passing through the accompanying sampling head assembly.

(12) *Flow rate range.* The pump shall be capable of operating within a range of from 1.5 to 2.5 liters per minute and shall be adjustable over this range.

(13) *Flow rate consistency.* The flow shall remain within ±0.1 liters per minute over at least a 10-hour period when the pump is operated at 2 liters per minute with a standard sampling head assembly.

(14) *Flow restriction indicator.* The pump shall be capable of detecting restricted flow and providing a visual indication if it occurs. The flow restriction indicator shall remain activated until the cause is corrected. The pump shall shut down automatically if flow is restricted for one minute.

(15) *Duration of operation.* The pump with a fully charged battery pack shall be capable of operating for (i) not less than 8 hours at a flow rate of 2 liters per minute against a resistance of 25 inches (64 centimeters) of water measured at the inlet of the pump; and (ii) for not less than 10 hours at a flow rate of 2 liters per minute against a resistance of 15 inches (38 centimeters) of water measured at the inlet of the pump.

(16) *Low battery indicator.* The pump unit shall be equipped with a visual indicator of low battery power.

(17) *Elapsed time indicator.* The pump unit shall be capable of displaying the actual pump run time in minutes (up to 999 minutes) and retaining the last reading after the pump is shut down due to either a flow restriction described in paragraph (a)(14) of this section or low battery power described in paragraph (a)(16) of this section or at the end of the sampling shift.

(b) *Sampling head assembly.* The sampling head assembly shall consist of a cyclone and a filter assembly as follows:

(1) *Cyclone.* The cyclone shall consist of a cyclone body with removable grit cap and a vortex finder and shall be constructed of nylon or a material equivalent in performance. The dimensions of the components, with the exception of the grit cap,

shall be identical to those of a Dorr-Oliver 10 millimeter cyclone body, part No. 28541/4A or 01B11476–01 and vortex finder, part No. 28541/4B.

(2) *Filter assembly.* The filter assembly shall meet the following requirements:

(i) *Filter.* The filter shall be a membrane filter type with a nominal pore size not over 5 micrometers. It shall be nonhydroscopic and shall not dissolve or decompose when immersed in ethyl or isopropyl alcohol. The strength and surface characteristics of the filter shall be such that dust deposited on its surface may be removed by ultrasonic methods without tearing the filter. The filter resistance shall not exceed 2 inches (0.5 centimeters) of water at an airflow rate of 2 liters per minute.

(ii) *Capsule.* The capsule enclosing the filter shall not permit sample air to leak around the filter and shall prevent visual inspection of the filter surface or filter loading. The capsule shall be made of nonhydroscopic material. Its weight, including the enclosed filter, shall not exceed 5 grams and it shall be pre-weighed by the manufacturer with a precision of ± 0.001 milligrams. Impact to the capsule shall not dislodge any dust from the capsule, which might then be lost to the weight measurement.

(iii) *Cassette.* The cassette shall enclose the capsule so as to prevent contamination and intentional or inadvertent alteration of dust deposited on the filter. The cassette must be easily removable without causing a loss or gain of capsule weight. The cassette shall be designed to prevent contaminants from entering or dust from leaving the capsule when it is not in use, and to prevent the reversal of airflow through the capsule or other means of removing dust collected on the filter.

(3) *Arrangement of components.* The connections between the cyclone vortex finder and the capsule and between the capsule and the 1/4-inch (0.64 centimeters) (inside diameter) hose mentioned in paragraph (b)(5) of this section shall be mechanically firm and shall not leak at a rate of more than 0.1 liters per hour under a vacuum of 4 inches (10 centimeters) of water.

(4) *Clamping of components.* The clamping and positioning of the cyclone body, vortex finder, and cassette shall be rigid, remain in alignment, be firmly in contact and airtight. The cyclone-cassette assembly shall be attached firmly to a backing plate or other means of holding the sampling head in position. The cyclone shall be held in position so that the inlet opening of the cyclone is pointing perpendicular to, and away from, the backing plate.

(5) *Hose.* A 3-foot (91 centimeter) long, 1/4-inch (0.64 centimeters) (inside diameter) clear plastic hose shall be provided to form an airtight connection between the inlet of the sampler pump and the outlet of the filter assembly. A device, capable of sliding along the hose and attaching to the miner's outer garment, shall be provided. (c) *Battery charger.*

(1) *Power supply.* The battery charger shall be operated from a 110 (VAC) (nominal), 60 Hz power line.

(2) *Connection.* The battery charger shall be provided with a cord and polarized connector so that it may be connected to the charge socket on the pump or battery case.

(3) *Protection.* The battery charger shall be fused, shall have a grounded power plug, and shall not be susceptible to damage by being operated without a battery on charge. (4) *Charge rates.* The battery charger shall be capable of fully recharging the battery in the pump unit within 16 hours

30 CFR § 74.5
Tests of coal mine dust personal sampler units.

(a) The National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, shall conduct tests to determine whether a CMDPSU that is submitted for approval under these regulations meets the requirements set forth in § 74.4.

(b) The Mine Safety and Health Administration (MSHA), Department of Labor, will conduct tests and evaluations to determine whether the pump unit of a CMDPSU that is submitted for approval under these regulations complies with the applicable permissibility provisions of 30 CFR 18.68.

30 CFR § 74.6
Quality control.

The applicant shall describe the way in which each lot of components will be sampled and tested to maintain its quality prior to assembly of each sampler unit. In order to assure that the quality of the CMDPSU will be maintained in production through adequate quality control procedures, MSHA and NIOSH reserve the right to have their qualified personnel inspect each applicant's control-test equipment procedures and records and to interview the employees who conduct the control tests. Two copies of the results of any tests made by the applicant on the CMDPSU or the pump unit thereof shall accompany an application provided under § 74.13 of this part.

30 CFR § 74.7
Design and construction requirements.

(a) *General requirement*. Continuous Personal Dust Monitors (CPDMs) shall be designed and constructed for coal miners to wear and operate without impeding their ability to perform their work safely and effectively, and shall be sufficiently durable to perform reliably in the normal working conditions of coal mines.

(b) *Ergonomic design testing*. Prior to submitting an application under - 74.13, the applicant shall develop a testing protocol and test the CPDM to assure that the device can be worn safely, without discomfort, and without impairing a coal miner in the performance of duties throughout a full work shift. The results of the test shall also demonstrate that the device will operate consistently throughout a full work shift under representative working conditions of underground coal miners, including representative types and durations of physical activity, tasks, and changes in body orientation.

(1) The testing protocol shall specify that the tests be conducted in one or more active mines under routine operating conditions during production shifts.

(2) The applicant shall submit the testing protocol, in writing, to NIOSH for approval prior to conducting such testing.

(3) The applicant shall include the testing protocol and written test results in the application submitted to NIOSH as specified in - 74.13.

(4) NIOSH will advise and assist the applicant, as necessary, to develop a testing protocol and arrange for the conduct of testing specified in this paragraph.

(5) NIOSH may further inspect the device or conduct such tests as it deems necessary to assure the safety, comfort, practicality, and operability of the device when it is worn by coal miners in the performance of their duties.

(6) NIOSH may waive the requirement for the applicant to conduct testing under paragraph (b) of this section if NIOSH determines that such testing is unnecessary to assure the safety, comfort, practicality, and operability of the device when it is worn by coal miners in the performance of their duties.

(c) *Maximum weight*. A CPDM shall not add more than 2 kg to the total weight carried by the miner. CPDMs that are combined with other functions, such as communication or illumination, may exceed 2 kg provided that the total added weight carried by the miner does not exceed 2 kg.

(d) *Dust concentration range*. The CPDM shall measure respirable coal mine dust concentrations accurately, as specified under - 74.8, for an end-of- shift average measurement, for concentrations within a range from 0.2 to 4.0 mg/m3 for respirable coal mine dust. For end-of-shift average concentrations exceeding 4.0 mg/m3, the CPDM shall provide a reliable indication that the concentration exceeded 4.0 mg/m3.

(e) *Environmental conditions*. The CPDM shall operate reliably and accurately as specified under - 74.8, under the following environmental conditions:

(1) At any ambient temperature and varying temperatures from minus 30 to plus 40 degrees centigrade;

(2) At any atmospheric pressure from 700 to 1000 millibars;

(3) At any ambient humidity from 10 to 100 percent relative humidity; and

(4) While exposed to water mists generated for dust suppression and while monitoring atmospheres including such water mists.

(f) *Electromagnetic interference*. The CPDM shall meet the following standards for control of and protection from electromagnetic interference.

(1) For emissions control, operators must follow: IEEE Std C95.1-2005, (IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz) and 47 CFR 15.1 through 15.407 (FCC Radio Frequency Devices). Persons must proceed in accordance with IEEE Std C95.1-2005 (IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz).

(i) The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Persons may obtain a copy from: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036. http://www.ansi.org.

(ii) Persons may inspect a copy at MSHA, Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia 22209-3939, (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. (

2) For immunity/susceptibility protection, operators must follow: IEC 61000-4-6, International Standard (Electromagnetic compatibility-Part 4- 6: Testing and measurement techniques-Immunity to conducted disturbances, induced by radio-frequency fields), Edition 3.0, 2008 §10. Persons must proceed in accordance with IEC 61000-4-6, International Standard (Electromagnetic compatibility-Part 4-6: Testing and measurement techniques—Immunity to conducted disturbances, induced by radio-frequency fields), Edition 3.0, 2008–10. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51.

(i) Persons may obtain a copy from the International Electrotechnical Commission at the address provided below:

International Electrotechnical Commission, IEC Central Office, 3, rue de Varembe´, P.O. Box 131, CH–1211 GENEVA 20, Switzerland. *http:// www.standardsinfo.net.*

(ii) Persons may inspect a copy at MSHA, Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia 22209–3939, (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.*

(g) *Durability testing.* The CPDM shall be designed and constructed to remain safe and measure respirable coal mine dust concentrations accurately, as specified under § 74.8 of this section after undergoing the following durability tests, which NIOSH will apply to test devices prior to their use in further testing under § 74.8 of this-subpart:

Vibration	Mil-Std-810F, 514.5	U.S. Highway Vibration, Restrained	1 Hours/Axis, 3 Axis; Total Duration =
		Figure 514.5C–1.	3 Hrs, equivalent to 1,000 miles.
Drop	3-foot drop onto bare concrete surface	In standard in-use configuration	1 drop per axis (3 total).

(1) Persons must proceed in accordance with Mil-Std-810F, 514.5, Department of Defense Test Method for Environmental Engineering Considerations and Laboratory Tests, 1 January 2000. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Persons may obtain a copy from the U.S. Department of Defense at the address provided below.
ASC/ENOI, Bldg. 560, 2530 Loop Road West, Wright-Patterson AFB OH 45433–7101. *http://www.dtc.army.mil/ navigator/.*

(2) Persons may inspect a copy at MSHA, Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia 22209–3939, (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.*

(h) *Reporting of monitoring results.*

(1) The CPDM shall report continuous monitoring results legibly or audibly during use. A digital display, if used, shall be illuminated and shall provide a minimum character height of 6 millimeters. Other forms of display (*e.g.,* analogue) must provide comparable visibility. Auditory reporting, if used, shall be clear, have adjustable volume, and provide means for the user to obtain data reports repetitively. The CPDM shall also report end-of-shift results using computer software compatible with current, commonly used personal computer technology.

(2) The CPDM shall report results as cumulative mass concentration in units of mass per volume of air (mg/m3) with two significant figures of accuracy rounded as customary.

(i) *Power requirements.* The power source of the CPDM shall have sufficient

capacity to enable continuous sampling for 12 hours in a coal mine dust atmosphere of up to 4.0 mg/m3. If the CPDM uses a rechargeable battery, the battery charger shall be operated from a 110 (VAC) (nominal), 60 Hz power line.

(j) *Flow stability and calibration of pump.* If a pump is used, the flow shall not vary more than ±5 percent of the calibrated flow for 95 percent of samples taken for any continuous duration for up to 12 hours. The flow calibration maintenance interval to assure such performance shall be specified in the calibration instructions for the device.

(k) *Battery check.* If the CPDM uses a rechargeable battery, the CPDM shall have a feature to indicate to the user that the device is sufficiently charged to operate and provide accurate measurements for an entire shift of 12 hours under normal conditions of use.

(l) *Integration with other personal mining equipment.*

(1) If the CPDM is integrated or shares functions with any other devices used in mines, such as cap lights or power sources, then the applicant shall obtain approvals for such other devices, prior to receiving final certification of the CPDM under this section.

(2) A CPDM that is integrated with another device shall be tested, according to all the requirements under this part, with the other device coupled to the CPDM and operating.

(m) *Tampering safeguards or indicators.* The CPDM shall include a safeguard or indicator which either prevents intentional or inadvertent altering of the measuring or reporting functions or indicates that the measuring or reporting functions have been altered.

(n) *Maintenance features.* The CPDM shall be designed to assure that the device can be cleaned and maintained to perform accurately and reliably for the duration of its service life.

30 CFR § 74.8
Measurement, accuracy, and reliability requirements.

(a) Breathing zone measurement requirement. The CPDM shall be capable of measuring respirable dust within the personal breathing zone of the miner whose exposure is being monitored.

(b) Accuracy. The ability of a CPDM to determine the true concentration of respirable coal mine dust at the end of a shift shall be established through testing that demonstrates the following:

(1) For full-shift measurements of 8 hours or more, a 95 percent confidence that the recorded measurements are within ± 25 percent of the true respirable dust concentration, as determined by CMDPSU reference measurements, over a concentration range from 0.2 to 4.0 mg/m3; and

(2) For intra-shift measurements of less than 8 hours, a 95 percent confidence that the recorded measurements are within ± 25 percent of the true respirable dust concentration, as determined by CMDPSU reference measurements, over the concentration range equivalent to 0.2 to 4.0 mg/m3 for an 8-hour period.1

(c) Reliability of measurements. The CPDM shall meet the accuracy

1 The equivalent dust concentration range to the 8-hour range of 0.2 ¥ 4 mg/m3 is calculated by multiplying this 8-hour range by the dividend of eight hours divided by

the duration of the intrashift measurement specified in units of hours. For example, for a measurement taken at exactly one hour into the shift, the 8-hour equivalent dust concentration range would be a one-hour average concentration range of: 8 hours/1 hour × (0.2 ¥ 4 mg/m3) = 1.6 ¥ 32 mg/m3; for a two-hour measurement, the applicable concentration range would be calculated as: 8 hours/2 hours × (0.2 ¥ 4 mg/m3) = 0.8 ¥ 16 mg/m3; for a 4-hours measurement, the equivalent range would be: 0.4 ¥ 8 mg/m3; *** etc. A CPDM must perform accurately, as specified, for intrashift measurements within such equivalent concentration ranges.

requirements under paragraph (b) of this section, regardless of the variation in density, composition, size distribution of respirable coal mine dust particles, and the presence of water spray mist in coal mines.

(d) Precision. The precision of the CPDM shall be established through testing to determine the variability of multiple measurements of the same dust concentration, as defined by the relative standard deviation of the distribution of measurements. The relative standard deviation shall be less than 0.1275 without bias for both full-shift measurements of 8 hours or more, and for intra-shift measurements of less than 8 hours within the dust concentration range equivalent to 0.2 to 4.0 mg/m3 for an 8-hour period, as specified under paragraph (b)(2) of this section.

(e) Bias. The bias of the CPDM measurements shall be limited such that the uncorrectable discrepancy between the mean of the distribution of measurements and the true dust concentration being measured during testing shall be no greater than 10 percent. Bias must be constant over the range of dust concentration levels tested, 0.2 to 4.0 mg/m3 for an 8-hour sampling period.

(f) Testing conditions. Laboratory and mine testing of the CPDM for accuracy, precision, bias, and reliability under diverse environmental conditions (as defined under § 74.7(e) and (g)) shall be determined using the NIOSH testing procedure, ''Continuous Personal Dust Monitor Accuracy Testing,'' June 23, 2008, available at: http://www.cdc.gov/ niosh/mining/pubs/pubreference/ outputid3076.htm. All testing results shall be submitted to NIOSH in writing on the application filed under § 74.11.

(1) Persons must proceed in accordance with NIOSH testing procedure ''Continuous Personal Dust Monitor Accuracy Testing,'' June 23, 2008. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Persons may obtain a copy at the address below: NIOSH–Publications Dissemination, 4676 Columbia Parkway, Cincinnati, OH 45226. http://www.cdc.gov/niosh/ mining.

(2) Persons may inspect a copy at MSHA, Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia 22209–3939, (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: federal_register/code_of_federal_ regulations/ibr_locations.html.

30 CFR § 74.9
Quality assurance.

(a) *General requirements.* The applicant shall establish and maintain a quality control system that assures that CPDM devices produced under the applicant's certificate of approval meet the required specifications and are reliable, safe, effective, and otherwise suitable for their intended use. To establish and to maintain an approval under this part, the applicant shall:

(1) Submit a copy of the most recent registration under ISO Q9001–2000,

American National Standard, Quality Management Systems-Requirements, published by ISO:

(i) With the application for approval under § 74.13 of this part; and

(ii) Upon request by NIOSH, subsequent to the approval of a CPDM under this part.

(2) Persons must proceed in accordance with ISO Q9001–2000, American National Standard, Quality Management Systems-Requirements. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Persons may obtain a copy from the International Organization for Standardization at the address provided below.

International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, Case Postale 56, CH–1211 GENEVA 20, Switzerland. *http://www.standardsinfo.net* .

(3) Persons may inspect a copy at MSHA, Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia 22209–3939, (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.*

(b) *Quality management audits.* Upon request, applicants or approval holders must allow NIOSH to inspect the quality management procedures and records, and to interview any employees who may be knowledgeable of quality management processes associated with the production of the CPDM. Audits may be conducted either on an occasional or periodic basis or in response to quality-related complaints or concerns.

(c) *Applicant remediation of quality management deficiencies.* An applicant or approval holder must correct any quality management deficiency identified by an audit within a reasonable time as determined by NIOSH. Failure to correct a deficiency may result in NIOSH disapproval of a pending application or, in the case of an approved device, revocation of approval until NIOSH determines that the deficiency is corrected.

30 CFR § 74.10

Operating and maintenance instructions.

(a) *Contents.* The manufacturer must include operating and storage instructions and a maintenance and service life plan with each new CPDM device sold. These documents must be clearly written.

(1) Operating and storage instructions must include:

(i) An explanation of how the CPDM works;

(ii) A schematic diagram of the CPDM;

(iii) Procedures for wearing and use of the CPDM;

(iv) A one page ‘‘quick start guide’’ that will enable a novice to start and operate the CPDM.

(v) Procedures for calibration of the CPDM;

(vi) Procedures for inspecting the operating condition of the CPDM;

(vii) Procedures and conditions for storage, including the identification of any storage conditions that would likely impair the effective functioning of the CPDM; and

(viii) Procedures and conditions of use, including identification of any conditions of use that would likely impair the effective functioning of the CPDM.

(2) The maintenance and service life plan must address:

(i) Conditions that should govern the removal from service of the CPDM; and

(ii) Procedures that a user or others should follow when inspecting, performing

maintenance and calibration, and determining when the CPDM should be removed from service.

(b) *Submission to NIOSH for approval.* A copy of the instructions and plan under paragraph (a) of this section shall be submitted to NIOSH with the application for approval of the CPDM and if substantive changes are made to the approved device or approved instructions.

30 CFR § 74.11
Tests of the continuous personal dust monitor.

(a) *Applicant testing.* The applicant shall conduct tests to determine whether a CPDM that is submitted for approval under these regulations meets the requirements specified in § § 74.7–
74.8 of this part, with the exception of durability testing, which shall be conducted by NIOSH as specified in § 74.7(g) of this part. Applicant testing shall be performed by an independent testing entity approved by NIOSH.

(b) *NIOSH testing assistance.* NIOSH will provide consultation to the applicant to identify and secure necessary testing services for meeting the requirements specified in § § 74.7–
74.8 of this part. Applicants must submit testing protocols to NIOSH prior to testing to verify that the testing protocols adequately address the requirements.

(c) *Reporting of applicant testing results.* The applicant shall include the results from testing specified under paragraph (a) of this section when submitting the application under § 74.13 of this part to NIOSH.

(d) *Intrinsic safety testing.* The applicant shall submit the CPDM to MSHA for testing and evaluation, pursuant to 30 CFR 18.68, to determine whether the electronic components of the CPDM submitted for approval meet the applicable permissibility provisions.

30 CFR § 74.12
Conduct of tests; demonstrations.

(a) Prior to the issuance of a certificate of approval, only personnel of MSHA and NIOSH, representatives of the applicant, and such other persons as may be mutually agreed upon may observe the tests conducted. MSHA and NIOSH shall hold as confidential, and shall not disclose, principles of patentable features, nor shall MSHA or NIOSH disclose any details of the applicant's drawings or specifications or other related material.

(b) After the issuance of a certificate of approval, MSHA or NIOSH will conduct such public demonstrations and tests of the approved device as MSHA or NIOSH deem appropriate, and may reveal the protocols and results of testing considered for the approval of the device. The conduct of any additional investigations, tests, and demonstrations shall be under the sole direction of MSHA and NIOSH and any other persons shall be present only as observers.

30 CFR § 74.13
Applications.

(a) Testing of a CMDPSU will be performed by NIOSH, and testing of the pump unit of the CMDPSU will be conducted by MSHA. The applicant must submit a written

application in duplicate to both NIOSH and MSHA. Each copy of the application must be accompanied by complete scale drawings, specifications, and a description of materials. Ten complete CMDPSUs must be submitted to NIOSH with the application, and one pump unit must be submitted to MSHA.

(b) Testing of a CPDM will be performed by the applicant as specified under § 74.11. The applicant must submit a written application in duplicate to both NIOSH and MSHA. Each copy of the application must be accompanied by complete scale drawings, specifications, a description of materials, and a copy of the testing protocol and test results which were provided by an independent testing entity, as specified in § 74.11(a). Three complete CPDM units must be sent to NIOSH with the application, and one CPDM device must be sent to MSHA.

(c) Complete drawings and specifications accompanying each copy of the application shall be fully detailed to identify the design of the CMDPSU or pump unit thereof or of the CPDM and to disclose the dimensions and materials of all component parts.

30 CFR § 74.14
Certificate of approval.

(a) Upon completion of the testing of a CMDPSU or the pump unit or after review of testing protocols and testing results for the CPDM, NIOSH or MSHA, as appropriate, shall issue to the applicant either a certificate of approval or a written notice of disapproval. NIOSH will not issue a certificate of approval unless MSHA has first issued a certificate of approval for either the pump unit of a CMDPSU or for the CPDM. If a certificate of approval is issued, no test data or detailed results of tests will accompany such approval. If a notice of disapproval is issued, it will be accompanied by details of the defects, resulting in disapproval, with a view to possible correction.

(b) A certificate of approval will be accompanied by a list of the drawings and specifications covering the details of design and construction of the CMDPSU and the pump unit, or of the CPDM, as appropriate, upon which the certificate of approval is based. The applicant shall keep exact duplicates of the drawings and specifications submitted to NIOSH and to MSHA relating to the CMDPSU, the pump unit thereof, or the CPDM, which has received a certificate of approval. The approved drawings and specifications shall be adhered to exactly in the production of the certified CMDPSU, including the pump unit or of the CPDM, for commercial purposes. In addition, the applicant shall observe such procedures for, and keep such records of, the control of component parts as either MSHA or NIOSH may in writing require as a condition of approval.

30 CFR § 74.15
Approval labels

(a) Certificate of approval will be accompanied by photographs of designs for the approval labels to be affixed to each CMDPSU or CPDM, as appropriate.

(b) The labels showing approval by NIOSH and by MSHA shall contain such information as MSHA or NIOSH may require and shall be reproduced legibly on the outside of a CMDPSU or CPDM, as appropriate, as directed by NIOSH or MSHA.

(c) The applicant shall submit full-scale designs or reproductions of approval labels and a sketch or description of the position of the labels on each sampling device.

(d) Use of the approval labels obligates the applicant to whom the certificate of

approval was issued to maintain the quality of the complete CMDPSU or CPDM, as appropriate, and to guarantee that the complete CMDPSU or CPDM, as appropriate, is manufactured or assembled according to the drawings and specifications upon which the certificate of approval was based. Use of the approval labels is authorized only on CMDPSUs or CPDMs, as appropriate, that conform to the drawings and specifications upon which the certificate of approval we based.

30 CFR § 74.16
required for record.

(a) As part of the permanent record of the approval application process, NIOSH will retain a complete CMDPSU or CPDM, as appropriate, and MSHA will retain a CMDPSU or CPDM, as appropriate, that has been tested and certified. Material not required for record purposes will be returned to the applicant at the applicant's request and expense upon receipt of written shipping instructions by MSHA or NIOSH.

(b) As soon as a CMDPSU or CPDM, as appropriate, is commercially available, the applicant shall deliver a complete sampling device free of charge to NIOSH at the address specified on the NIOSH Web page: *http://www.cdc.gov/ niosh/mining.*

30 CFR § 74.17
Changes after certification.

(a) If the applicant desires to change any feature of a certified CMDPSU or a certified CPDM, the applicant shall first obtain the approval of NIOSH pursuant to the following procedures:

(1) Application shall be made as for an original certificate of approval, requesting that the existing certification be extended to encompass the proposed change. The application shall be accompanied by drawings, specifications, and related material.

(2) The application and accompanying material will be examined by NIOSH to determine whether testing of the modified CMDPSU or CPDM or components will be required. Testing will be necessary if there is a possibility that the modification may adversely affect the performance of the CMDPSU or CPDM. NIOSH will inform the applicant whether such testing is required.

(3) If the proposed modification meets the pertinent requirements of these regulations, a formal extension of certification will be issued, accompanied by a list of new and revised drawings and specifications to be added to those already on file as the basis for the extension of certification.

(b) If a change is proposed in a pump unit of a certified CMDPSU or in electrical components of a CPDM, the approval of MSHA with respect to intrinsic safety shall be obtained in accordance with the procedures set forth in § 74.11(d).

30 CFR § 74.18
Withdrawal of certification.

Any certificate of approval issued under this part may be revoked for cause by NIOSH or MSHA which issued the certificate.

DUST CONTROL
Questions for Review

Q: What is *respirable dust*?

_____

Q: What is a key factor in controlling dust from a primary dump?

_____

Q: What is the acceptable concentration of respirable dust in a mine atmosphere?
A: CFR 71.100

_____

Q: How often must dust sampling devices be examined?
A; CFR 71.205

_____

Q: Who can maintain and calibrate dust sampling devices?
A: CFR 71.203

_____

Q: What dust control measures should be taken when drilling holes at surface mines?
A: CFR 72.620

_____

Q: Who is responsible for testing *coal mine dust personal sampler units*?
A: CFR 74.5

_____

Q: A *coal mine dust personal sampler unit* must consist of what?
A: CFR 74.3

_____

_____

_____

CHAPTER SIX

SURFACE HAULAGE

1. Surface Haulage Safety
2. Code of Federal Regulations Part 77
3. Questions and Review

SURFACE HAULAGE

In the mining industry, haulage refers to the horizontal transport of workers, ore, coal, supplies, and waste (hoisting is the vertical transport of the same). The industry employs large, powerful, sophisticated equipment to move millions of tons of ore and rock. A wide array of smaller vehicles transports workers and supplies, which commonly share the roadways with the massive ore hauling equipment. This equipment is often in use around the clock, in poorly lighting and adverse weather conditions. This interaction of equipment and less than ideal working conditions creates numerous potential hazards, with the result that in underground mines, haulage accounts for over 17% of the fatalities and 14% of the lost time accidents. In surface mines, haulage accounts for over 37% of the fatalities and 9% of the lost time accidents.

Haulage accidents contribute to a majority of the fatalities that occur at surface coal mines and operations. Surface haulage equipment in the safety manual involves equipment such as: haul trucks, front-end loaders, scraper, forklifts and personal vehicles such as automobiles and pickup trucks.

Haulage trucks are one of the most widely used pieces of equipment at surface coal mines. Fatalities involving haulage trucks most often occur when they leave the haul road and overturn, back over the edge of an embankment when the ground at the edge fails and when they run over or back over the victim. Front-end loader fatalities frequently occur when tramming an unloaded machine at high speed. Front-end loader accidents also result from collisions with other machines, and the operator getting caught in pinch points. Scraper accidents occur due to excessive speed for road conditions, lack of roadway berms and loss of control.

Drivers not wearing seat belts also contribute to many surface haulage fatalities. Remember, if there's an accident, your chances are much better if you remain in the vehicle. Drivers who jump or are thrown from their haulage vehicle are often run over by it. Many haulage fatalities are a result of being thrown form the haulage vehicle and being run over by the equipment.

Information for surface haulage was obtained from the following publications/websites:

- **NIOSH Office of Mine Safety and Health Research**
- **U.S. Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy – Safety Manual Series SM 22**

SURFACE HAULAGE SAFETY

CAUSES OF SRUFACE HAULAGE FATALITIES

Causes responsible for haulage fatalities that occur at surface coal operations include:

- Berms or guards not provided on the outer banks of elevated roadways.
- Seat belts not worn at all times when operating haulage trucks.
- Mobile equipment left unattended without the brakes being set, wheels not turned into a bank or berm or blocked, when the equipment was parked on a grade.
- The operator not having full control of equipment.
- Excessive speed.
- Backup alarms or similar warning devices not working when equipment was used.
- Uncorrected safety defects on equipment, machines and tools.
- Equipment operators not aware of hazardous conditions affecting their ability to take evasive action when necessary.
- Workers placing themselves in hazardous location around moving equipment.
- Mobile and stationary machinery and equipment not maintained in a safe operating condition and machinery or equipment in unsafe condition not immediately removed from service.

HAULAGE SAFETY

Mining involves the use of highway and off-road trucks to haul heavy loads, sometimes over long and steep grades. Safe transportation of the mined product to the plant or mill requires well-planned and well-constructed haul roads, careful selection and maintenance of haul trucks, and thorough driver training.

Loss-of-control accidents continue to plague our Nation's mining industry. These accidents are often fatal.

Safe truck haulage should be carefully considered in initial mine planning. Items to be considered include:

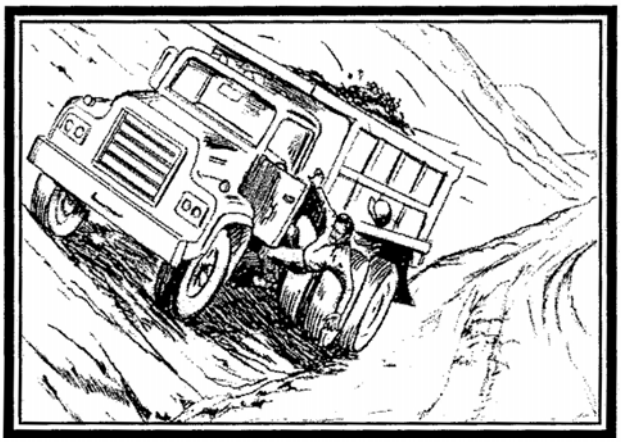
- Truck size and type
- Roadway widths
- Slope of grade
- Grade lengths
- Curve radius and width
- Drainage
- Berms or guardrails
- Retaining walls
- Road surface stability
- Traffic patterns

EXAMPLES OF FATAL ACCIDENTS

Seat belts were not worn at all times when operating haulage trucks.

COAL:

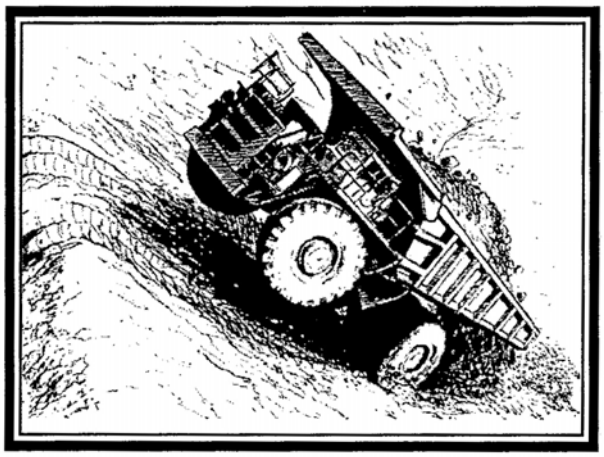
A truck driver was operating a loaded 30-ton coal truck, en route to a load-out facility. He lost control of the vehicle on a slight downgrade. The truck left the haulage road, crossed a ditch line, traveled up an adjacent hillside, and overturned. The driver either jumped or was thrown from the vehicle and sustained fatal injuries.



Berms or guards were not provided on the outer banks of elevated roadways.

COAL:

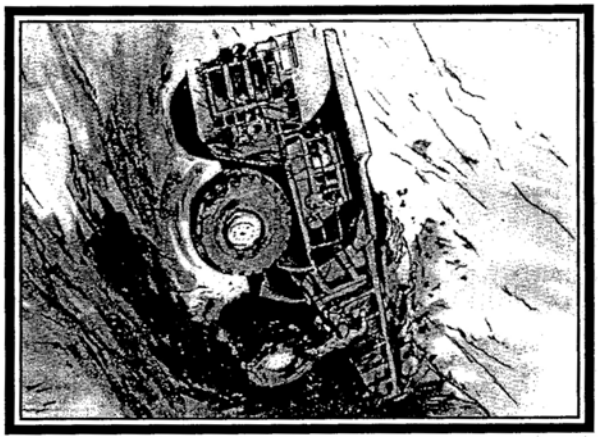
A truck driver was fatally injured while operating a rock truck. While backing toward the edge of the dump, the truck, loaded with 156 tons of rock, went over the edge of the dump. The truck flipped over onto its bed, slid approximately 125 feet and flipped back onto it's tires, coming to rest on the haul road below.



Mobile equipment was not maintained in safe operating condition.

COAL:

A loaded truck was ascending a 17 percent grade when it started backwards down the haul road. The truck traveled approximately 250 feet, struck a berm, and overturned onto the driver's side. The truck driver was observed trying to jump clear of the truck. He received fatal injuries. Investigation revealed that the brakes failed to stop the loaded truck.



The operator did not always have full control of mobile equipment while it was in motion.

COAL:

A truck driver, operating a 50-ton truck, failed to negotiate a sharp curve on a haul road. The truck traveled through a berm and into a 20-foot-deep ditch. The driver received head and neck injuries when he was thrown from the truck and died 13 days later.

PRINCIPLES OF HAUL ROAD DESIGN

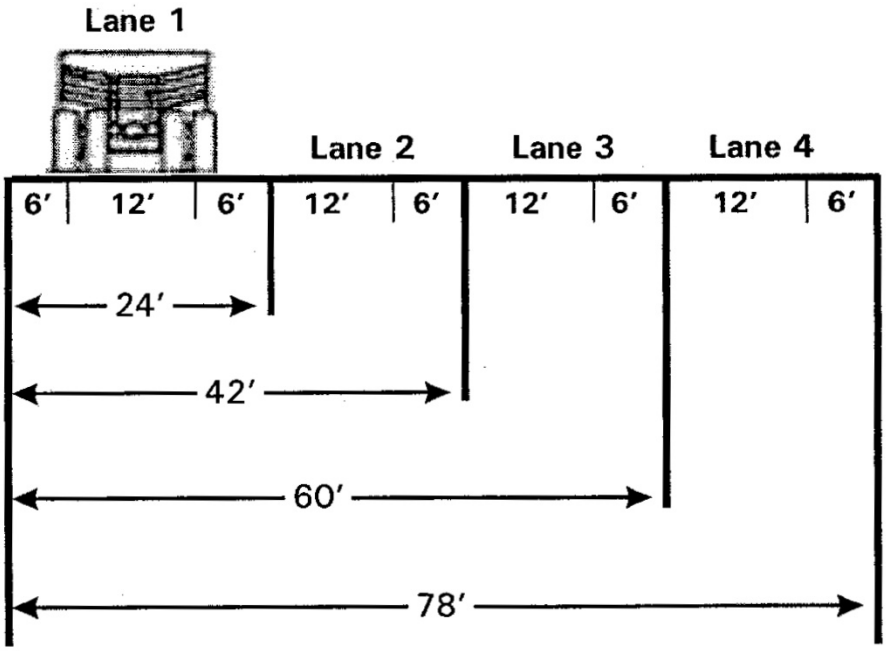
Haul roads should be designed to minimize the percent of grade slope. If steep grades are required that approach the truck manufacturer's maximum recommendation, then the length of these steep sections should be kept to a minimum. Road ways should not be so steep as to require the constant use of service brakes, under normal conditions, to maintain speed on grades. On highway trucks, engine brakes, along with trailer brakes, are usually preferred as the first means of speed control. On off-road trucks, auxiliary retarders or dynamic braking are usually preferred as the first means of speed control.

Haul roads should be designed so that drivers can stop within the limits of their visibility. They also should be designed to minimize blind areas, or if such areas do exist, speed should be restricted for safe stopping. Signs governing procedures in these areas must be posted.

Road width is also primary design consideration. It is best to provide ample width for two-way traffic. The least desirable condition is a one-lane road with pull offs for passing at intervals along the roadway, especially where visibility is limited. This type of road frequently requires stopping and backing. Risk of collision is increased, wear and tear on trucks is increased and haulage cycles are slowed.

Recommendations for roadway width to provide adequate room for passing are based on the width of the largest trucks using the road. Berm width is not considered as part of the roadway width, and should be provided in addition to these recommendations.

One-Half Vehicle Width



Typical haulageway sections for 12-foot-wide vehicle

Width recommendations:

- Single lane roads should be twice as wide as the truck, thus providing a clearance of one-half the truck's width on either side.
- Multi-lane roadways should provide this same clearance from the edges of the road, plus one-half the truck's width between traffic lanes. For example, a two lane roadway should be at least three and one-half times as wide as the truck.
- Additional roadway width is needed on curves to provide necessary clearance, particularly where there is two-way traffic.

Other factors need to be considered in the design of curves:

- Avoid sharp curves at or near the crest of a hill. Drivers have difficulty perceiving the curve, especially at night when the truck lights shine ahead into space. If a curve is absolutely necessary, start it in advance of the crest.
- Avoid sharp curves at or near the bottom of grades or after a long sustained downgrade. Braking efficiency may have been reduced a this point. If a driver is having difficulty maintaining speed on the grade, loss of control is more likely with a sharp curve at the bottom.
- Avoid intersections near hill crests and sharp curves. Consider the sight distance in all directions.

Haul roads require constant attention to maintain safe conditions. Water, debris or spilled material on roadways, which create a hazard to truck drivers, must be removed. Dust control measure must be taken when road dust significantly reduces the visibility of drivers, or presents a health hazard because of respirable dust.

BERMS, GUARDRAILS AND BARRIERS

Berms of guardrails are required on the outer banks of elevated roadways where a drop-off exists of sufficient grade or depth to cause a vehicle to overturn or to endanger persons in equipment.

A berm is a pile or mound of material along an elevated roadway used to keep vehicles from running off the road.

An ordinary berm is not designed to (and can not be expected to) stop a runaway truck. It serves only to alert the driver, and may also assist in redirecting or diverting the truck back onto the road. A truck striking a berm at a sharp angle is more likely to travel over or through the berm.

For a berm to have any measurable tendency to redirect a truck, its height must be equal or greater than the rolling radius of the truck's tire. This is mid-axle height, or half the diameter of the truck's tire. This same height criterion can't be applied to guardrails or other barriers. Of course, mid-axle height is a minimum, and the higher the berm or other device, the more effective it will be.

The tire must initially sink into the berm. The berm then raises the tire, which causes the truck to return to the roadway, or to ride along the berm until it stops. The face of a berm

should be cut at a steep angle to raise the wheel soon after it hits the berm, and to minimize any ramping effect that could let the truck ride over the berm. This angle should be maintained. However, if berms are repeatedly cut along the inside, their stability will suffer. Berms require continual attention to maintain adequate width and height.

Boulders are sometimes used where they are a natural product of the mine operation and in areas where large rock formations are present in the overburden. Boulders, large enough to stop highway trucks in a short distance, cause impacts that would likely injure the driver. Smaller boulders used to minimize impact will slide a considerable distance and should, therefore, not be placed close to the edge. For these reasons, boulders are not the best means of providing vehicle restraint.

Guardrails are used in locations where the installation is thought to be permanent, such as at mine entrances. They can also be found where the road is no wide enough for berms. When guardrails are used they must be substantially constructed and suitable for the type and size of vehicle.

Center (or straddle) berms and escape lanes do not replace edge-to-edge berms or guardrails to provide a greater degree of safety. Center berms also serve as an excellent means of traffic control to prevent head-on collisions.

Well-designed haul road are a key safety factor but do not, by themselves, ensure safe truck haulage. The condition and operation of the truck itself are equally important.

One of the most important safety devises on trucks are the brakes. Properly maintained brakes are essential for safe operation.

BRAKING SYSTEM INSPECTION AND MAINTENANCE

Today's highway trucks are equipped with straight air systems that actuate front disk brakes and other shoe-type brakes. Many trucks have spring-applied and air-release brakes. These systems require air pressure to keep the brakes releases. Therefore, a loss of air pressure will cause the brakes to automatically apply.

There are two main types of brakes on <u>highway trucks:</u>

- Shoe and drum (usually air applied with S-cam or hydraulic wedge and push rod.) Air pressure forces the shoes outward into the rotating drum.
- Caliper disk (usually air systems.) Air pressure forces the brake pads against the rotor.

There are three main types of brakes on <u>off-road trucks:</u>

- Shoe and drum (usually air over hydraulic applied with S-cam or hydraulic wedge and push rod.) Oil pressure forces the shoes outward into the rotating drum.
- Caliper disk (usually air over hydraulic system.) Hydraulic pressure forces the brake pads against the rotating disk.
- Full disk (or wet disk) is the newest type. These brakes consist of layers of disks, alternating rotating and stationary, which run on hydraulic oil. Hydraulic brake pressure squeezes the disks together.

Modern **highway trucks** and **off-road trucks** have a number of systems designed to slow or stop the truck.

Highway trucks:

- The service brake or the foot brake is the main brake for stopping the truck.
- The parking brake is used when parked, and also serves as an emergency brake which releases air pressure to set the fail-safe spring brakes.
- Tractor-trailers have a “tractor emergency” valve that is used to isolate the tractor brakes from the trailer brakes, in case of a leak or loss of air pressure in the trailer’s air system. This valve may set automatically and can also be set manually.
- The trailer brake in a tractor-trailer applies the service brake on the trailer.
- The dump brake on a tandem highway truck applies rear brakes. (Not to be used as a parking brake.)

Highway trucks are usually equipped with engine brakes. This system is used primarily to slow the truck and maintain speed on grades. It can not bring the truck to a full stop. It protects the primary service brake system from heat and buildup and extends service brake life.

Off-road trucks:

- The service brake or the foot brake is the main brake for stopping the truck.
- The emergency brake is just what its name implies, for use only if there is a problem with the service brake. On some newer model trucks this brake is called a secondary brake.
- The parking brake is also as its name implies, for use only when parked.

Off-road trucks are also equipped with retarders or dynamic braking. These systems are used primarily to slow the truck and maintain speed on grades. They protect the primary service brake system from heat buildup and extend the service brake life. Retarders are used on diesel trucks, and dynamic braking is used on diesel/eclectic trucks. With retarders it is important to maintain specified engine RPMs to ensure the retarding system does not stall the engine.

Check brakes carefully during your pre-operation inspection. Of course your pre-operation inspection included many items besides brakes.

PRE-OPERATION INSPECTION

As part of your pre-operation inspection, be sure to check your truck’s braking systems for missing, loose, cracked or nonfunctioning parts, such as:

- Loose belts
- Leaking hydraulic lines
- Leaks in wheel cylinders
- Brake linings or pads saturated with oil, grease or brake fluid
- Excessive wear or cracks in rotors and brake pads or drums and linings
- Loose or missing air chamber mounting bolts
- Loose or leaking air tanks

Once you have entered the cab, fasten your seat belt, sound the horn and start the engine. With the engine running, check all gauges and warning lights – which should read in the normal range. Check the low air warning device.

With your parking brake set and your transmission in neutral, check and bleed air tanks and check for fluid leaks.

Highway trucks: Release the parking brake and set the trailer brake. Pull gently against the trailer to be sure it's hooked up properly. The release the trailer brakes. Build up speed to a maximum of five to seven miles per hour and apply the service brakes and note any pulling or soft brake pedal feeling as the truck stops.

Off-road trucks: Continue running the engine at low idle and watch the gauges. When the engine is warmed up tot operating temperatures, gradually increase the engine speed. If your truck is equipped with an air pressure system, make certain that, during warm-up, the air pressure reached and maintains the minimum pressure. Frequently scan the gauges.

DRIVER PROCEDURES RELATED TO RUNAWAYS

Now that you're sure the brakes, and other systems, are in good condition, you can begin your normal daily operations. The potential for a runaway is one of the most dangerous, and one of the most common, hazards you face in operating highway and off-road trucks. There is a lot you can do to prevent runaways, and to protect yourself if you do experience a runaway.

A key precaution is to "buckle up" and stay buckled during operation. Seat belts will protect your life in emergencies. They keep you in position to control your truck, keep you out of the windshield in collisions, and protect you from being ejected from or thrown about the cab during a rollover.

Overloading, especially if you're running on steep grades, is a factor that can contribute to runaways. If the load or grade exceeds the manufacture's specifications, braking ability and your margin of safety are reduced.

Always follow posted traffic control signs along the haulage roadway. They are there to assist and remind you of safe operating procedures.

Before you start down a grade slow down, select the proper gear, and be sure the retarder system is operating. Don't depend on the engine brake and service brakes to slow you down after you've started down the grade. If something is wring with the brakes, you can lose control of your truck.

If you start to lose control of the truck because of brake failure – don't panic. Fully apply the retarder system, if you haven't already done so. Try every brake and if the service brakes have failed, use the emergency parking brake. After stopping, turn wheels into the bank and summon help. Use flares or other means to warn other traffic. If the emergency parking brake fails, steer to the inside.

If you're still gaining speed with all braking systems fully applied, you're in a runaway condition. Don't jump out! See if there are any center berms, escape lane, or other options to slow you down. Use these berms or lanes as soon as possible. Your chances of survival are better if you stay buckles up and with the truck. It's very rare to unbuckle a dead driver. Victims are usually found along the roadway where the truck has run them over.

If you're not close enough to the bottom of the grade, immediately rake the truck along the inside bank or guide the tire in the berm, whichever you fell is best, to try to slow down. If you have time, warn others by sounding the horn or using your two-way radio. Even if the truck is completely out of control – don't jump, stay with the truck. Your odds of survival are still a lot better buckled in your seat.

SURFACE HAULAGE
HAZARDS AND PREVENTIVE MEASURES

The material in this section is designed to raise awareness of hazards associated with surface haulage and to recommend measures which may be used to minimize these hazards to the equipment operators.

We will look at potential hazards and preventative measures for the following areas:

- Walking to and from equipment
- Checking around equipment and mounting and dismounting
- Entering cab and starting vehicle
- Traveling haul roads and ramps
- Loading operations
- Dumping material
- Parking your vehicle
- Performing maintenance and repairs

WALKING TO AND FROM EQUIPMENT

Potential Hazards

- Muddy walkways, ice etc.
- Moving vehicles
- Congested area

Preventative Measures

1. Walk around vehicle, as part of pre-operation inspection, to check for persons around the machine.
2. Sound the horn or other warning device before starting to move.
3. Be sure backup alarm and brakes are operating properly.
4. Always look in the direction of travel.
5. Be alert for person on foot.

CHECKING AROUND EQUIPMENT AND MOUNTING AND DISMOUNTING

Potential Hazards

- Missing wheel lugs
- Low tire pressure
- Tire damage
- Lowest ladder rung too high
- Missing or broken steps, ladder rungs, handrails, etc.
- Slick (muddy, greasy, or icey) boot and/or ladder
- Both hands not free for climbing
- Miners in dangerous position around equipment
- Poor access to areas which must be checked
- Undetected suspension or steering damage

Preventative Measures

1. Make sure vehicle is not loaded and is secured against motion before inspecting.
2. Make thorough pre-operation inspection a habit to include tires, wheels, ladders and platforms, suspension and steering, and walking around the vehicle to check for persons or obstructions. Report and safety defects.
3. Clean mud, grease or ice off boots and ladders. Wear gloves to ensure a good grip.
4. Use belt hooks, pockets, etc. to carry material up ladders and keep both hands free for climbing. Ropes can be used to hoist bulkier items. Face ladder and use three points of contact when climbing (two hands and one foot, or two feet and one hand, in contact with ladder at all times.)
5. Sound the horn or other warning device before starting engine or starting to move.
6. Be sure backup alarm is operating properly.
7. Always look in the direction of travel.

ENTERING CAB AND STARTING VEHICLE

Potential Hazards

- Loose items in cab
- Not using sear belts
- Staring engine with parking brake “off.”
- Congested parking area
- Poor visibility due to dirty windshield
- Possibility of fire hazards
- Defective brakes, gauges, steering or retarder

Preventative Measures

1. Keep cab free of extraneous material; secure necessary items.
2. Check equipment for warning tags.
3. Make sure parking brake is set and controls are in neutral prior to starting.
4. Adjust seat and buckle up.
5. Keep cab windows clean.

6. Check around equipment before getting on, and, to the extent possible, use mirrors before moving.
7. Check gauges and warning lights before and after starting engine. Check for smooth idle and unusual smoke or noise. Check wipers and lights.
8. Make sure all controls are working properly before moving.
9. Check for fuel leaks. Know the location operation of fire extinguishers.
10. Sound the horn or other warning device before starting engine or starting to move.
11. Check all brake systems, steering systems, and retarders in accordance with company policy or manufacturer's recommendations.

TRAVELING HAUL ROADS AND RAMPS

Potential Hazards

- Equipment failure (steering, brakes, retarders, driveline/engine stalling, or running out of fuel.)
- Roadway and weather conditions (mud, ice, fog, rain, steep grades, blocked roadways; ruts, bumps, rocks or holes in road, missing or inadequate berms.)
- Poor visibility
- Loose rock or unstable ground about haul road
- Unstable ground under roadway
- Operator error or inattention
- Heavy vehicle traffic and/or automotive in use of roadway

Preventative Measures

1. Be mentally and physically prepared to do your job each day. Be sure you clearly understand your work assignment prior to starting your shift.
2. Use your seat belt.
3. Keep cab free of loose materials.
4. Make the first trip of the day a slow speed to check roadway conditions and vehicle response.
5. Keep speed under control; adjust speed to conditions.
6. Obey traffic rules, traffic patterns, signs and signals.
7. Select proper gear before descending or ascending grades.
8. Maintain safe following distance. Remember that your stopping distance is much greater when loaded and when traveling downgrade.
9. Yield right-of-way to loaded vehicle.
10. When descending ramp, slow or stop at top and select proper gear. Use retarder.
11. Drive front-end loader in reverse only when carrying a loaded bucket down a steep grade.
12. Monitor gauges and indicators regularly.
13. Allow no one to ride outside the cab. No one should ride with the operator unless safe seating facilities are provided.
14. If you loose power, engine dies, or you otherwise lose control, stay with the vehicle; don't panic and jump. Use service brakes and/or emergency brake, retarder, drag bowl or scrappers, etc. (whatever is working) to slow or stop. Steer clear of traffic and sound horn to warn others. When you get vehicle to stop, park it securely

(brake set, wheels turned into bank and/or blocked.) Do not attempt to restart. Set warning flags and obtain assistance.

15. Check brakes and tires frequently.

LOADING OPERATIONS

Potential Hazards

- Material falling from bucket or loading equipment
- Failure of wire ropes or booms of loading shovel or dragline
- Highwall or spoil slides
- Traffic congestion
- Pedestrian traffic
- Unstable front-end loader with bucket raised
- Uneven loading of truck

Preventative Measures

1. Follow established traffic pattern. Avoid backing up if possible. If you must back, always check the mirror on the blind side, making sure of your clearance. Backing in on the blind side requires that you have good approach and straight back-in.
2. Communicate your intentions by signal or other means. Be aware of the location of other persons or vehicles.
3. Stay in the cab, if protected by cab guards, and leave your seat belt fastened, or get out of the truck and stay in the clear of loading operation and other traffic. If you are out of you vehicle in the loading area, be constantly watchful for other traffic. An individual on foot is very vulnerable in this area.
4. Truck driver should wait for signal before driving off. Start slowly to get the fell of driving the loaded truck.
5. When operating a front-end loader, establish a smooth loading cycle. Do not unnecessarily travel with raised bucket. Tilt bucket forward to avoid spillage back toward the cab. Check before backing and keep backup alarm working.
6. Avoid striking truck or hopper with bucket. Dump material slowly to reduce shock and flying material. Distribute load evenly in truck. Signal truck driver when truck is loaded.
7. Visually check highwall or stockpile regularly for changing and/or hazardous conditions.
8. When loading from stockpile, do not allow hazardous over-hangings or excessive slope angle to develop. Work material from top if necessary to maintain stockpile stability.

DUMPING MATERIAL

Potential Hazards

- Poor visibility when backing
- Unstable edge or berm
- Lack of berms or bumper blocks
- Ground sloping downward toward edge
- Traffic congestion
- Opening into hoppers or open grates/grizzlies at crossover dumps
- Overhead power lines

Preventative Measures

1. If the material must be dumped over edge of stockpile or highwall, examine area carefully, especially at beginning of the shift, for signs of unstable ground and lack of berms. Immediately report unsafe conditions.
2. If ground at dump site could fail, arrange to dump material a safe distance from the edge.
3. Stay in truck when waiting at dump.
4. When dumping at stockpile, do not dump over the edge where the toe of the stockpile has been removed.
5. When approaching the dump location, observe the entire area. You should pick a location to dump and decide on how you want to turn. Before backing, you should visually inspect the dump edge fir clumping or soft spots and good berms.
6. Back up and dump perpendicular, not a t an angle, t the edge of the slope.
7. While backing, observe the berm and back edge of your wheels. Once you have touched the berm, stop the truck with your service brakes – do not use the berm as a brake. Put the transmission in neutral and apply the parking brake.
8. Pull the dump level and increase the engine's rpm's to dump your load. Lower the bed as quickly as possible before pulling onto the main haul road. Pull out slowly from the dump area.
9. When pulling away from the dump edge, be sure to engage the transmission before releasing the park brake.
10. If dump edge fails or rear of truck slips off:
    a. Engage front brakes if slippery road switch is activated and set park brake. (Truck will usually stop sliding once the undercarriage drags on the edge of the dump.)
    b. Stay in the cab until the truck stops sliding, then carefully climb down.
    c. Notify foreman.
11. If you must work around open gates, grizzlies, hoppers or crushers, use a safety belt and line.
12. Watch out for overhead power lines.
13. When dumping, watch out for high voltage lines. If you do get into high voltage lines, stay in the truck until help arrives. If you have to leave the truck, in case of fire etc., be sure to jump free of the truck and don't touch the truck and ground at the same time.

PARKING YOUR VEHICLE

Potential Hazards

- Obstructing traffic
- Grades
- Defective parking brake
- Leaving buckets etc., raised
- Failure to block wheels or turn into bank on grades
- Congested parking areas
- Controls not places in “off” or “shutdown” position
- Engine left running
- Slippery or cluttered ground at parking location
- Other equipment operating nearby

Preventative Measures

1. Avoid parking on grades, in roadways, or where you cannot be seen by approaching traffic, unless absolutely necessary.
2. Always set parking brake, lower buckets etc. and place all controls in the “neutral”, “off,” or “shutdown” position.
3. On a pan scrapper, lower bowl to the ground and fully retract ejector.
4. Idle engine for a short period of time, and always shit it off before dismounting.
5. If necessary to park on an incline, turn wheels into bank and/or block securely.
6. If necessary to park on a haul road, place warning markers, flares etc. to warn oncoming traffic.
7. Use designated parking areas. Watch your footing when dismounting. Don’t jump from ladder.

PERFORMING MAINTENANCE OR REPAIRS

Potential Hazards

- Raised unblocked equipment
- Improperly marked equipment
- Moving machine parts
- Machinery and parts being hoisted
- Lifting heavy parts in awkward positions
- Performing repairs or maintenance with which you are unfamiliar
- Pinch points
- Other equipment operating nearby
- Working at elevated locations where there is a danger of falling
- Carrying bulky objects which obscure vision
- Hoses under pressure
- Damaged tools
- Hazardous highwalls or banks
- Inadequate towing equipment or towing vehicle
- Poor communication between person performing repairs
- Faulty wheel assemblies
- Machine reacting in an unexpected manner after repairs

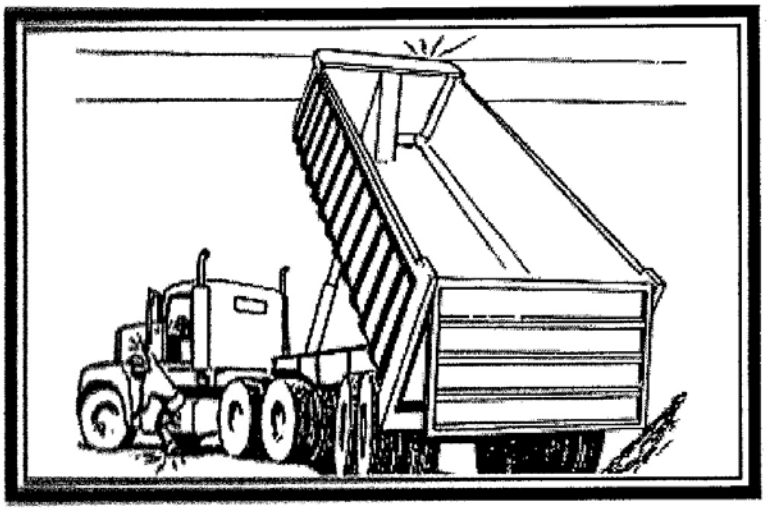
- Excessive oil and grease on skin or clothing

Preventative Measures

1. See that buckets, bowls etc. are lowered. Verify that parking brake is set and controls are in the neutral or shutdown position.
2. Locate job site (if possible) in a safe and easily accessible location. Mobile equipment that can be moved should be repaired on level ground out of the way of other operations. Advise others of selected job site and work plans.
3. Reposition equipment as necessary to avoid working between equipment and the highwall or spoil bank where escape may be hindered. Special safety precautions must be taken when repair work is required between immobilized equipment and the highwall or spoil bank.
4. Block wheels securely, especially if on a grade or if maintenance operation could possibly cause release of brakes, transmission etc. Keep yourself to the side when installing and removing wheel blocks.
5. Lower any raised parts which can be lowered. If necessary to work on or from equipment in the raised position, it must be blocked securely. Good blocking materials for most purposes include solid ground, berms, wooden crib blocks, solid concrete blocks, or specially designed locking devices, pins etc. Cinder blocks are inadequate for many purposes.
6. Visually inspect work area for potential hazards. Remove debris and combustible material from job site.
7. If equipment must be running or moving to evaluate condition, or to complete certain portions of the repair, exercise extreme caution and be sure of good communications with anyone involved.
8. Obtain assistance as needed for towing. Be sure the vehicle used is large enough and powerful enough to handle the job.
9. Do not operate any towing equipment you are not trained and qualified to operate.
10. When towing requires disabling any fail-safe brake system or other safety devices, be sure they are restored to operative condition before the equipment is returned to service.
11. Use a smooth, steady pull when towing. Do not snatch and jerk equipment.
12. Carefully watch contour of ground when towing. Take precautions against the towed equipment overtaking the towing equipment on a downgrade.
13. Place warning tags on steering wheel or other prominent location, and remove ignition key.
14. Equipment operator should not attempt repairs or maintenance they do not understand.
15. Ensure that pressure is relieved from hydraulic systems before any attempt to disconnect or repair hoses, cylinders, motors etc.
16. Use safety belt or harness and line where there is a danger of falling (when work must be done at an elevated location unprotected by railing.)
17. Select, inspect, and use proper tools for the job. Do not use tools with mushroomed heads, loose or cracked handles etc.
18. Do not leave tools or other objects lying around loose where they could fall on someone. Rope off area, use screens etc. if necessary, for adequate

protection of those working or passing below. Do not leave tools or other objects lying around in walkways.

19. Keep hands, finger and other parts of the body out of pinch points.
20. Take care to avoid burns from hot bearings, hot hydraulic fluid etc. Wear gloves where possible. Wear safety glasses.
21. When using a wrench, seat it firmly and use steady controlled force. Avoid jerking the wrench.
22. Always where safety glasses when striking objects with a hammer.
23. Wear gloves to handle metal parts and when using tools.
24. Maintain good communication with all coworkers. Tell them what you're about to do if it could cause equipment movement.
25. Assume a safe position out of direct line of potential motion of parts. Do not position yourself in the inside radius of wire ropes regularly being used.
26. Avoid excessive skin contact with lubricants. Especially penetrating oil. Carry waterless hand cleaner or preferably soap and water, and use regularly. Wear proper protective equipment when using solvents, oil etc.
27. Use extreme caution when working with tires and multi-piece rims. Be sure components are properly matched and undamaged. Use inflation cages, long inflation hoses, adequate lifting and handling equipment, and adequate mounting and dismounting tools.



When dumping, keep the raised bed at least 10 feet from high voltage lines. If you do get into high voltage lines, stay in the truck until help arrives. If you have to leave the truck, in case of fire etc., be sure to jump free of the truck and don't touch the truck and the ground at the same line

28. Use proper lifting procedure. Obtain held when load may be too heavy.
29. Carry, inspect and use lifting devices such as jacks.
30. Be sure component being removed is secured as last bolts or nuts are removed.
31. Before taking on the weight of a part being removed, be sure it is something you can handle. Stand in close to the part and be sure of good footing. Get help in advance if you thin you'll need it.
32. Stay clear of suspended loads.

33. Use tagline to steady or guide hoisted objects. Stay out of confined areas where you could be caught between a swinging load and a stationary object.
34. Keep hands and fingers clear of pinch points when lowering or placing parts.
35. Secure all guards, covers and shields which protect people and equipment.
36. Remove any accumulation of oil and grease.
37. Inspect complete work to ensure that all bolts are tightened, guards replace, tools removed etc. Be sure tools, old parts or other objects are returned to proper storage or disposed of properly.

CONCLUSION

To prevent surface haulage accidents, equipment operator should follow these recommendations:

- Check the equipment before operating
- Check brakes regularly and keep them in good condition
- Never exceed the truck's rated load capacity
- Travel at speeds consistent with road grade and conditions
- If you loose control of the vehicle, stay belted in and do not jump
- Never operate on grades steeper then the equipment is designated to safely negotiate

Mine operators should:

- Design haul roads to minimize steep grades and visual obstructions
- Maintain berms and roadways in a safe condition
- Provide miners with safety training
- Establish and enforce safety rules, including traffic signs and signals
- Implement a regular maintenance program
- Select equipment suitable for mine conditions
- Provide escape ramps and barriers

In the mining industry, haulage accidents are defined as those involving equipment that is primarily used to transport materials or personnel. U.S. mining industries employ thousands of miners. Most of these miners work in surface mines or other surface mine facilities. By working together, and following procedures listed in this safety manual, we can reduce these accidents that cause disabling injuries and tragic loss of life.

Information for this section was obtained from the following publications:

- **U.S. Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy – Safety Manual Series SM 22**

Title 30
Code of Federal Regulation
Part 77 – Subpart Q
Loading and Haulage

30 CFR § 77.1600
Loading and haulage; general.

(a) Only authorized persons shall be permitted on haulage roads and at loading or dumping locations.

(b) Traffic rules, signals, and warning signs shall be standardized at each mine and posted.

(c) Where side or overhead clearances on any haulage road or at any loading or dumping location at the mine are hazardous to mine workers, such areas shall be conspicuously marked and warning devices shall be installed when necessary to insure the safety of the workers.

30 CFR § 77.1601
Transportation of persons; restrictions.

No person shall be permitted to ride or be otherwise transported on or in the following equipment whether loaded or empty:

(a) Dippers, shovels, buckets, forks, and clamshells;

(b) The cargo space of dump trucks or haulage equipment used to transport coal or other material;

(c) Outside the cabs and beds of mobile equipment;

(d) Chain, belt, or bucket conveyors, except where such conveyors are specifically designed to transport persons; and

(e) Loaded buckets on aerial tramways.

30 CFR § 77.1603
Trains and locomotives; authorized persons.

(a) Only authorized persons shall be permitted to ride on trains or locomotives and they shall ride in a safe position.

(b) Men shall not get on or off moving equipment, except that trainmen may get on or off of slowly moving trains.

30 CFR § 77.1604
Transportation of persons; overcrowding.

(a) No man-trip vehicle or other conveyance used to transport persons to and from work areas at surface coal mines shall be overcrowded and all persons shall ride in a safe position.

(b) Supplies, materials, and tools other than small handtools shall not be transported with men in man-trip vehicles unless such vehicles are specifically designed to make such transportation safe.

30 CFR § 77.1605
Loading and haulage equipment; installations.

(a) Cab windows shall be of safety glass or equivalent, in good condition and shall be kept clean.

(b) Mobile equipment shall be equipped with adequate brakes, and all trucks and front-end loaders shall also be equipped with parking brakes.

(c) Positive-action type brakes shall be provided on aerial tramways.

(d) Mobile equipment shall be provided with audible warning devices. Lights shall be provided on both ends when required.

(e) Guard nets or other suitable protection shall be provided where tramways pass over roadways, walkways, or buildings.

(f) Guards shall be installed to prevent swaying buckets from hitting towers.

(g) Aerial tramway cable connections shall be designed to offer minimum obstruction to the passage of wheels.

(h) Rocker-bottom or bottom-dump cars shall be equipped with positive locking devices, or other suitable devices.

(i) Ramps and dumps shall be of solid construction, of ample width, have ample clearance and headroom, and be kept reasonably free of spillage.

(j) Chute-loading installations shall be designed so that the men pulling chutes are not required to be in a hazardous position during loading operations.

(k) Berms or guards shall be provided on the outer bank of elevated roadways.

(l) Berms, bumper blocks, safety hooks, or similar means shall be provided to prevent overtravel and overturning at dumping locations.

(m) Roadbeds, rails, joints, switches, frogs, and other elements on railroads shall be designed, installed, and maintained in a safe manner consistent with the speed and type of haulage.

(n) Where practicable, a minimum of 30 inches continuous clearance from the farthest projection of moving railroad equipment shall be provided on at least one side of the tracks; all places where it is not possible to provide 30-inch clearance shall be marked conspicuously.

(o) Track guardrails, lead rails, and frogs shall be protected or blocked so as to prevent a person's foot from becoming wedged.

(p) Positive-acting stop-blocks, derail devices, track skates, or other adequate means shall be installed wherever necessary to protect persons from runaway or moving railroad equipment.

(q) Switch throws shall be installed so as to provide adequate clearance for switchmen.

(r) Where necessary, bumper blocks or the equivalent shall be provided at all track dead ends.

30 CFR § 77.1606
Loading and haulage equipment; inspection and maintenance.

(a) Mobile loading and haulage equipment shall be inspected by a competent person before such equipment is placed in operation. Equipment defects affecting safety shall be recorded and reported to the mine operator.

(b) Carriers on aerial tramways, including loading and unloading mechanisms, shall be inspected each shift; brakes shall be inspected daily; ropes and supports shall be inspected as recommended by the manufacturer or as physical conditions warrant. Equipment defects affecting safety shall be reported to the mine operator.

(c) Equipment defects affecting safety shall be corrected before the equipment is used.

30 CFR § 77.1607
Loading and haulage equipment; operation.

(a) Vehicles shall follow at a safe distance; passing shall be limited to areas of adequate clearance and visibility.

(b) Mobile equipment operators shall have full control of the equipment while it is in

motion.

(c) Equipment operating speeds shall be prudent and consistent with conditions of roadway, grades, clearance, visibility, traffic, and the type of equipment used.

(d) Cabs of mobile equipment shall be kept free of extraneous materials.

(e) Operators shall sit facing the direction of travel while operating equipment with dual controls.

(f) When an equipment operator is present, men shall notify him before getting on or off equipment.

(g) Equipment operators shall be certain, by signal or other means, that all persons are clear before starting or moving equipment.

(h) Where possible, aerial tramways shall not be started until the tramway operator has ascertained that everyone is in the clear.

(i) Dust control measures shall be taken where dust significantly reduces visibility of equipment operators.

(j) Dippers, buckets, loading booms, or heavy suspended loads shall not be swung over the cabs of haulage vehicles until the drivers are out of the cabs and in safe locations, unless the trucks are designed specifically to protect the drivers from falling material.

(k) Men shall not work or pass under the buckets or booms of loaders in operation.

(l) Tires shall be deflated before repairs on them are started and adequate means shall be provided to prevent wheel locking rims from creating a hazard during tire inflation.

(m) Electrically powered mobile equipment shall not be left unattended unless the master switch is in the off position, all operating controls are in the neutral position, and the brakes are set or other equivalent precautions are taken against rolling.

(n) Mobile equipment shall not be left unattended unless the brakes are set. The wheels shall be turned into a bank or berm, or shall be blocked, when such equipment is parked on a grade.

(o) Lights, flares, or other warning devices shall be posted when parked equipment creates a hazard to vehicular traffic.

(p) Dippers, buckets, scraper blades, and similar movable parts shall be secured or lowered to the ground when not in use.

(q) Shovel trailing cables shall not be moved with the shovel dipper unless cable slings or sleds are used.

(r) Equipment which is to be hauled shall be loaded and protected so as to prevent sliding or spillage.

(s) When moving between work areas, the equipment shall be secured in the travel position.

(t) Any load extending more than 4 feet beyond the rear of the vehicle body should be marked clearly with a red flag by day and a red light at night.

(u) Tow bars shall be used to tow heavy equipment and a safety chain shall be used in conjunction with each tow bar.

(v) Railroad cars shall be kept under control at all times by the car dropper. Cars shall be dropped at a safe rate and in a manner that will insure that the car dropper maintains a safe position while working and traveling around the cars.

(w) Railroad cars shall not be coupled or uncoupled manually from the inside of curves unless the railroad and cars are so designed to eliminate any hazard from coupling or uncoupling cars from inside of curves.

(x) Persons shall wear safety belts when dropping railroad cars.

(y) Railcars shall not be left on sidetracks unless ample clearance is provided for traffic on adjacent tracks.

(z) Parked railcars, unless held effectively by brakes, shall be blocked securely.

(aa) Railroad cars and all trucks shall be trimmed properly when they have been loaded higher than the confines of their cargo space.

(bb) When the entire length of a conveyor is visible from the starting switch, the operator shall visually check to make certain that all persons are in the clear before starting the conveyor. When the entire length of the conveyor is not visible from the starting switch, a positive audible or visible warning system shall be installed and operated to warn persons that the conveyor will be started.

(cc) Unguarded conveyors with walkways shall be equipped with emergency stop devices or cords along their full length.

(dd) Adequate backstops or brakes shall be installed on inclined-conveyor drive units to prevent conveyors from running in reverse if a hazard to personnel would be caused.

(ee) Aerial tram conveyor buckets shall not be overloaded, and feed shall be regulated to prevent spillage.

30 CFR § 77.1608
Dumping facilities.

(a) Dumping locations and haulage roads shall be kept reasonably free of water, debris, and spillage.

(b) Where the ground at a dumping place may fail to support the weight of a loaded dump truck, trucks shall be dumped a safe distance back from the edge of the bank.

(c) Adequate protection shall be provided at dumping locations where persons may be endangered by falling material.

(d) Grizzlies, grates, and other sizing devices at dump and transfer points shall be anchored securely in place.

(e) If truck spotters are used, they shall be well in the clear while trucks are backing into dumping position and dumping; lights shall be used at night to direct trucks.

SURFACE HAULAGE
Questions for Review

Q: What is the lit of items you should check on a pre-operation inspection?

_____

_____

_____

Q: If you lose control of a vehicle you should never do what?

_____

Q: Single lane roads should be at least how wide?

_____

Q: Dust control measure must be taken when:
A: CFR 77.1607 (i)

_____

Q: In order to leave mobile equipment unattended, you must first:
A: CFR 77.1607 (n)

_____

Q: How should a load extending more than 4 feet beyond the rear of the vehicle be marked?
A: CFR 77.1607 (t)

_____

Q: All trucks and front-end loaders shall be equipped with what?
A: CFR 77.1605 (b)

_____

Q: What are the construction regulation for ramps and dumps?
A: CFR 77.1605 (i)

_____

Q: What is required on the outer bank of elevated roadways?
A: CFR 77.1605 (k)

Q: What should be avoided when designing haulage roads?

Q: When dumping, keep the raised bed how far away from high voltage lines?

Q: What must be done to tires prior to doing any repair work on them?
A: CFR 77.1607 (l)

Q: Electronically powered mobile equipment must not be left unattended unless:
A: CFR 77.1607 (m)

Q: If using a truck spotter, where should he/she be standing?
A: CFR 77.1608 (e)

Q: How should dumping stations and haulage roads be maintained?
A: CFR 77.1608 (a)

Q: No person is permitted to ride in what equipment (loaded or empty)?
A: CFR 1601

CHAPTER SEVEN

FIRES AND EXPLOSIONS

1. Historical Mine Disasters
2. Fire Classifications
3. Mining Terms for Explosive Mixtures
4. Code of Federal Regulations Part 77
5. Questions and Review

FIRES

Fires are a significant hazard to the safety and health of mine workers. Fires at underground and surface mines place the lives and livelihood of our nation's miners at risk. Ventilation streams in underground mines can carry smoke and toxic combustion products throughout the mine, making escape through miles of confined passageways difficult and time consuming. A fire in an underground coal mine is especially hazardous due to the unlimited fuel supply and the presence of flammable methane gas. The greatest mine fire disaster in the US occurred at the Cherry Coal Mine, IL, in November 1909, where 259 miners perished. During 1990-2001, more than 975 reportable fires occurred in the US mining industry, causing over 470 injuries, 6 fatalities, and the temporary closing of several mines. Over 95 of the fires occurred in underground coal mines. The leading causes of mine fires include flame cutting and welding operations, friction, electrical shorts, mobile equipment malfunctions, and spontaneous combustion. Several recent large coal mine fires have resulted in mine evacuations and temporary sealing of the mines. The prevention, early and reliable detection, control, and suppression of mine fires are critical elements in safeguarding the lives and livelihood of over 230,000 mine workers.

Information for historical mine fires was obtained from the following publications/websites:

- **NIOSH Office of Mine Safety and Health Research**

Coal Mining Disasters

(Incidents with 5 or more fatalities)

From 1980 - 2010

Date	Mine Name	City	State	Killed	Product	Type
11/07/1980	Ferrell No. 17	Uneeda	WV	5	Coal	Explosion
04/15/1981	Mid-Continent Resources Dutch Creek #1	Redstone	CO	15	Coal	Explosion
12/07/1981	Adkins Coal Mine #11	Kite	KY	8	Coal	Explosion
12/08/1981	Grundy Mining Co. Mine #21	Whitewell	TN	13	Coal	Explosion
01/20/1982	No. 1	Craynor	KY	7	Coal	Explosion
06/21/1983	McClure #1 Mine	McClure	VA	7	Coal	Explosion
12/19/1984	Wilberg Mine	Orangeville	UT	27	Coal	Fire
02/06/1986	Loveridge No. 22	Fairview	WV	5	Coal	Collapsed coal pile caused suffocation
09/13/1989	William Station No. 9 Mine	Wheatcroft	KY	10	Coal	Explosion
12/07/1992	No. 3 Mine	Norton	VA	8	Coal	Explosion
09/23/2001	No. 5 Mine	Brookwood	AL	13	Coal	Explosion
01/02/2006	Sago Mine	Buckhannon	WV	12	Coal	Explosion
05/20/2006	Darby Mine No. 1	Millsboro	KY	5	Coal	Explosion
08/06/2007	Crandall Canyon Mine	Huntington	UT	6**	Coal	Fall of face or rib
04/05/2010	Upper Big Branch Mine	Montcoal	WV	29	Coal	Explosion

** Subsequent incident occurred 8/16/2007 during the rescue efforts that claimed the lives of three rescue workers (including one MSHA employee).

Information for historical mine disasters was obtained from the following publications:

- Bureau of Mines Bulletin 509, Injury Experience in Coal Mining, 1948
- Bureau of Mines Bulletin 616, Historical Documentation of Major Coal-Mine Disasters in the United States Not Classified as Explosions of Gas or Dust: 1846-1962
- Bureau of Mines Bulletin 586; Historical Summary of Coal-Mine Explosions in the United States, 1810-1958
- Historical Summary of Mine Disasters in the United States, Volume I, Coal Mines, 1810-1958
- Historical Summary of Mine Disasters in the United States, Volume II, Coal Mines, 1959-1998
- 1998-present, MSHA Fatalgrams and Fatality Reports
- Newspaper article citations when available
- Archives at the National Mine Health & Safety Academy Library, Beckley, West Virginia

Historical accident reports are available in the library archives at the National Mine Health & Safety Academy in Beckley, West Virginia. Please contact the MSHA Academy at 304-256-3266 or MSHAlibrary@dol.gov to check on the availability of a particular report.

FIRE CLASSES

In firefighting, fires are identified according to one or more **fire classes**. Each class designates the fuel involved in the fire, and thus the most appropriate extinguishing agent. The classifications allow selection of extinguishing agents along lines of effectiveness at putting the type of fire out, as well as avoiding unwanted side-effects. For example, non-conductive extinguishing agents are rated for electrical fires, so to avoid electrocuting the firefighter.

Multiple classification systems exist, with different designations for the various classes of fire. The United States uses the NFPA system. Europe and Australasia use another.

United States – NFPA system		
		Fuel/Heat source
Class A		Ordinary combustibles
Class B		Flammable liquids
		Flammable gases
Class C		Electrical equipment
Class D		Combustible metals
Class K		Cooking oil or fat

Ordinary combustibles

"Ordinary combustible" fires are the most common type of fire, and are designated *Class A*. These occur when a solid, organic material such as wood, cloth, rubber, or some plastics]become heated to their flash point and ignite. At this point the material

undergoes combustion and will continue burning as long as the four components of the fire tetrahedron (heat, fuel, oxygen, and the sustaining chemical reaction) are available.

This class of fire is commonly used in controlled circumstances, such as a campfire, match or wood-burning stove. To use the campfire as an example, it has a fire tetrahedron - the heat is provided by another fire (such as a match or lighter), the fuel is the wood, the oxygen is naturally available in the open-air environment of a forest, and the chemical reaction links the three other facets. This fire is not dangerous, because the fire is contained to the wood alone and is usually isolated from other flammable materials, for example by bare ground and rocks. However, when a class-A fire burns in a less-restricted environment the fire can quickly grow out of control and become a wildfire.

This class of fire is fairly simple to fight and contain - by simply removing the heat, oxygen, or fuel, or by suppressing the underlying chemical reaction, the fire tetrahedron collapses and the fire dies out. The most common way to do this is by removing heat by spraying the burning material with water; oxygen can be removed by smothering the fire with foam from a fire extinguisher; forest fires are often fought by removing fuel by backburning; and an ammonium phosphate dry chemical powder fire extinguisher (but not sodium bicarbonate or potassium bicarbonate both of which are rated for B-class fires) breaks the fire's underlying chemical reaction.

Flammable liquid and gas

Flammable or combustible liquid or gaseous fuels. The US system designates all such fires "Class B". These fires follow the same basic fire tetrahedron (heat, fuel, oxygen, chemical reaction) as ordinary combustible fires, except that the fuel in question is a flammable liquid such as gasoline, or gas such as natural gas. A solid stream of water should never be used to extinguish this type because it can cause the fuel to scatter, spreading the flames. The most effective way to extinguish a liquid or gas fueled fire is by inhibiting the chemical chain reaction of the fire, which is done by dry chemical and Halon extinguishing agents, although smothering with CO_2 or, for liquids, foam is also effective. Chemicals such as FM-200 are now the recommended halogenated suppressant.

Electrical

Electrical fires are fires involving potentially energized electrical equipment. The US system designates these "Class C". This sort of fire may be caused by, for example, short-circuiting machinery or overloaded electrical cables. These fires can be a severe hazard to firefighters using water or other conductive agents: Electricity may be conducted from the fire, through water, the firefighter's body, and then earth. Electrical shocks have caused many firefighter deaths.

Electrical fire may be fought in the same way as an ordinary combustible fire, but water, foam, and other conductive agents are not to be used. While the fire is, or could possibly be electrically energized, it can be fought with any extinguishing agent rated for electrical fire. Carbon dioxide CO_2, FM-200 and dry chemical powder extinguishers such as PKP and even baking soda are especially suited to extinguishing this sort of fire. Once

electricity is shut off to the equipment involved, it will generally become an ordinary combustible fire.

Metal

Certain metals are flammable or combustible. Fires involving such are designated "Class D" in both systems. Examples of such metals include sodium, titanium, magnesium, potassium, steel, uranium, lithium, plutonium, and calcium. Magnesium and titanium fires are common, and 2006-7 saw the recall of laptop computer models containing lithium batteries susceptible to spontaneous ignition. When one of these combustible metals ignites, it can easily and rapidly spread to surrounding ordinary combustible materials.

With the exception of the metals that burn in contact with air or water (for example, sodium), masses of combustible metals do not represent unusual fire risks because they have the ability to conduct heat away from hot spots so efficiently that the heat of combustion cannot be maintained - this means that it will require a lot of heat to ignite a mass of combustible metal. Generally, metal fire risks exist when sawdust, machine shavings and other metal 'fines' are present. Generally, these fires can be ignited by the same types of ignition sources that would start other common fires.

Water and other common firefighting materials can excite metal fires and make them worse. The NFPA recommends that metal fires be fought with 'dry powder' extinguishing agents. Dry Powder agents work by smothering and heat absorption. The most common of these agents are sodium chloride granules and graphite powder. In recent years powdered copper has also come into use.

Some extinguishers are labeled as containing *dry chemical* extinguishing agents. This may be confused with *dry powder*. The two are not the same. Using one of these extinguishers in error, in place of dry powder, can be ineffective or actually increase the intensity of a metal fire.

Metal fires represent a unique hazard because people are often not aware of the characteristics of these fires and are not properly prepared to fight them. Therefore, even a small metal fire can spread and become a larger fire in the surrounding ordinary combustible materials.

Cooking oil

Laboratory simulation of a chip pan fire: a beaker containing wax is heated until it catches fire. A small amount of water is then poured into the beaker. The water sinks to the bottom and vaporises instantly, ejecting a plume of burning liquid wax into the air.

Fires that involve cooking oils or fats are designated "Class K" under the US system. Though such fires are technically a subclass of the flammable liquid/gas class, the special characteristics of these types of fires are considered important enough to recognize separately. Saponification can be used to extinguish such fires. Appropriate fire extinguishers may also have hoods over them that help extinguish the fire.

MINING TERMS FOR EXPLOSIVE MIXTURES

Fire Damp

Made up mainly by methane, an inflammable gas which when mixed with the right proportion of oxygen, can be explosive, fire damp is also quite dangerous in a coal mine. Methane, which makes up between 90% and 100% of the inflammable part of fire damp (generally around 70% to 80% of the "air," when the nonflammable gases are accounted for). Like carbon monoxide, it is lighter than air. It is a product of the mine, itself, being given off when it is released from the rock where it was trapped ages ago (methane is, like coal, a product of decomposition of organic matter). When the rock is removed or a seam is opened or cracked, methane can escape.

Besides the danger of the gas through fire/explosion and breathing it in (while not poisonous, it cannot support life, having no oxygen as part of the molecule—fire damp has very little oxygen, anyway), the gas trapped within the rock can have built up enormous pressure that when released, can cause injury and even death when the rock flies into the miner.

Depending on the amount of oxygen and the percentage of methane, the mixture can be merely inflammable (where the gas will continue to burn on its own after the ignition source is removed) or explosive. At inflammable levels, rather than exploding, the methane will burn around the ignition source in a sort of halo effect, known as a "cap."

In addition to methane, fire damp may also have small amounts of ethane and/or propane (anywhere from 0% to 2%)—both of which are more inflammable and ignite at a lower temperature). In an important way, the degree of other gases present affects the ignition temperature; higher or lower depending on the gas and the percentage present in the air. Another gas, sometimes found in trace amounts, is ethylene, another highly inflammable gas. Despite the low percentages of each, their presence makes fire damp even more volatile and liable to explode, then methane alone.

After Damp

The combination of gases remaining following an explosion (whether due to "fire damp" or to coal dust—which in fine quantities can result in an explosion under the right conditions). It varies depending on the amount of oxygen that was present as part of the explosion. If methane in the explosion combusts completely, it will produce carbon dioxide and steam. This will leave a form of "black damp." If there is less oxygen, there will be additional amounts of carbon monoxide and hydrogen mixed with the aforementioned gases. This will result if there is either greater amounts of methane or smaller amounts of oxygen.

After damp is particularly dangerous, as carbon monoxide is poisonous, carbon dioxide can cause suffocation, and free oxygen will be necessarily depleted. A further danger is that if air is re-added to the mixture, it can become explosive again (not an unheard of occurrence). According to my source (www.therhondda.co.uk), over 75% of deaths in coal mine explosions in Great Britain were caused by "after-damp alone." The main reason being the carbon monoxide in it. There can be many other gases found in after damp, following the explosion, including hydrogen sulfide, sulfur dioxide, nitrous oxide, ammonia, and others.

Black Damp

Also known as "choke damp" or "stythe," it is when levels of carbon dioxide are high and mixed with nitrogen (taking the place of free oxygen). These levels can be from 5% to 20%. My source gives around 13% as an average carbon dioxide level in black damp (15% and higher will put out a flame). While at the low end of the scale it is about the same density as air, as the percentage increases, so does the density, making black damp especially dangerous the lower the level in a mine one is working (workers would sometimes hold their lights near the floor to aid in detection).

Black damp is neither combustible nor poisonous, by itself, but enough in the air mixture can lead to physical effects or even death by suffocation.

White Damp

White Damp is a mining term for, carbon monoxide (CO); a gas that may be present in the afterdamp of a gas or coal-dust explosion, or in the gases given off by a mine fire; it is an important constituent of illuminating gas, supports combustion, and is very poisonous.

Title 30
Code of Federal Regulation
Part 77- Subpart L
Fire Protection

30 CFR § 77.1100
Fire protection; training and organization.

Firefighting facilities and equipment shall be provided commensurate with the potential fire hazards at each structure, enclosure and other facility (including custom coal preparation) at the mine and the employees at such facilities shall be instructed and trained annually in the use of such firefighting facilities and equipment.

30 CFR § 77.1101
Escape and evacuation; plan.

(a) Before September 30, 1971, each operator of a mine shall establish and keep current a specific escape and evacuation plan to be followed in the event of a fire.

(b) All employees shall be instructed on current escape and evacuation plans, fire alarm signals, and applicable procedures to be followed in case of fire.

(c) Plans for escape and evacuation shall include the designation and proper maintenance of adequate means for exit from all areas where persons are required to work or travel including buildings and equipment and in areas where persons normally congregate during the work shift.

30 CFR § 77.1102
Warning signs; smoking and open flame.

Signs warning against smoking and open flames shall be posted so they can be readily seen in areas or places where fire or explosion hazards exist.

30 CFR § 77.1103
Flammable liquids; storage.

(a) Flammable liquids shall be stored in accordance with standards of the National Fire Protection Association. Small quantities of flammable liquids drawn from storage shall be kept in properly identified safety cans.
(b) Unburied flammable-liquid storage tanks shall be mounted securely on firm foundations. Outlet piping shall be provided with flexible connections or other special

fittings to prevent adverse effects from tank settling.
(c) Fuel lines shall be equipped with valves to cut off fuel at the source and shall be located and maintained to minimize fire hazards.
(d) Areas surrounding flammable-liquid storage tanks and electric substations and transformers shall be kept free from grass (dry), weeds, underbrush, and other combustible materials such as trash, rubbish, leaves and paper, for at least 25 feet in all directions.

30 CFR § 77.1104
Accumulations of combustible materials.

Combustible materials, grease, lubricants, paints, or flammable liquids shall not be allowed to accumulate where they can create a fire hazard.

30 CFR § 77.1105
Internal combustion engines; fueling.

Internal combustion engines, except diesels, shall be shut off and stopped before being fueled.

30 CFR § 77.1106
Battery-charging stations; ventilation.

Battery-charging stations shall be located in well-ventilated areas. Battery-charging stations shall be equipped with reverse current protection where such stations are connected directly to direct current power systems.

30 CFR § 77.1107
Belt conveyors.

Belt conveyors in locations where fire would create a hazard to personnel shall be provided with switches to stop the drive pulley automatically in the event of excessive slippage.

30 CFR § 77.1108
Firefighting equipment; requirements; general.

On and after September 30, 1971, each operator of a coal mine shall provide an adequate supply of firefighting equipment which is adapted to the size and suitable for use under the conditions present on the surface at the mine.

30 CFR § 77.1108-1
Type and capacity of firefighting equipment.

Firefighting equipment required under this §77.1108 shall meet the following minimum requirements:

(a) *Waterlines.* Waterlines shall be capable of delivering 50 gallons of water a minute

at a nozzle pressure of 50 pounds per square inch. Where storage tanks are used as a source of water supply, the tanks shall be of 1,000-gallon capacity for each 1,000 tons of coal processed (average) per shift.

(b) *Fire extinguishers.* Fire extinguishers shall be:

(1) Of the appropriate type for the particular fire hazard involved;

(2) Adequate in number and size for the particular fire hazard involved;

(3) Replaced immediately with fully charged extinguishers after any discharge is made from an extinguisher; and

(4) Approved by the Underwriter's Laboratories, Inc., or the Factory Mutual Research Corp., or other competent testing agency acceptable to the Mine Safety and Health Administration.

(c) *Fire hose.* Fire hose and couplings shall meet the requirements of the Underwriter's Laboratories, Inc., or Factory Mutual Research Corp.'s specifications. Cotton or cotton-polyester jacketed hose shall be treated in accordance with the U.S. Department of Agriculture Forest Service Specification 182 for mildew resistance. The water pressure at the hose nozzle shall not be excessively high so as to present a hazard to the nozzle operator.

30 CFR § 77.1109
Quantity and location of firefighting equipment.

Preparation plants, dryer plants, tipples, drawoff tunnels, shops, and other surface installations shall be equipped with the following firefighting equipment.

(a) Each structure presenting a fire hazard shall be provided with portable fire extinguishers commensurate with the potential fire hazard at the structure in accordance with the recommendations of the National Fire Protection Association.

(b) Preparation plants shall be equipped with waterlines, with outlet valves on each floor, and with sufficient fire hose to project a water stream to any point in the plant. However, where freezing conditions exist or water is not available, a 125-pound multipurpose dry powder extinguisher may be substituted for the purposes of this paragraph (b) for each 2,500 square feet of floor space in a wooden or other flammable structure, or for each 5,000 square feet of floor space in a metal, concrete-block, or other type of non-flammable construction.
(c)(1) Mobile equipment, including trucks, front-end loaders, bulldozers, portable welding units, and augers, shall be equipped with at least one portable fire extinguisher.

(2) Power shovels, draglines, and other large equipment shall be equipped with at least one portable fire extinguisher; however, additional fire extinguishers may be required by an authorized representative of the Secretary.

(3) Auxiliary equipment such as portable drills, sweepers, and scrapers, when operated more than 600 feet from equipment required to have portable fire extinguishers, shall be equipped with at least one fire extinguisher.

(d) Fire extinguishers shall be provided at permanent electrical installations commensurate with the potential fire hazard at such installation in accordance with the recommendations of the National Fire Protection Association.

(e) Two portable fire extinguishers, or the equivalent, shall be provided at each of the following combustible liquid storage installations:

(1) Near each above ground or unburied combustible liquid storage station; and,

(2) Near the transfer pump of each buried combustible liquid storage tank.

(f) Vehicles transporting explosives and blasting agents shall be equipped with fire protection as recommended in Code 495, section 20, National Fire Protection Association Handbook, 12th Edition, 1962.

30 CFR § 77.1110
Examination and maintenance of firefighting equipment.

Firefighting equipment shall be continuously maintained in a usable and operative condition. Fire extinguishers shall be examined at least once every 6 months and the date of such examination shall be recorded on a permanent tag attached to the extinguisher.

30 CFR § 77.1111
Welding, cutting, soldering; use of fire extinguisher.

One portable fire extinguisher shall be provided at each location where welding, cutting, or soldering with arc or flame is performed.

30 CFR § 77.1112
Welding, cutting, or soldering with arc or flame; safeguards.

(a) When welding, cutting, or soldering with arc or flame near combustible materials, suitable precautions shall be taken to insure that smoldering metal or sparks do not result in a fire.

(b) Before welding, cutting, or soldering is performed in areas likely to contain methane, an examination for methane shall be made by a qualified person with a device approved by the Secretary for detecting methane. Examinations for methane shall be made immediately before and periodically during welding, cutting, or soldering and such work shall not be permitted to commence or continue in air which contains 1.0 volume per centum or more of methane.

FIRES AND EXPLOSIONS
Questions for Review

Q: What is a Class A fire?

_____

Q: What is the main gas created in White damp?

_____

Q: What is After damp?

_____

Q: Why are fires in underground coal mines so dangerous?

_____

Q: What is a Class D fire?

_____

Q: Fire damp is made up mainly of what gas?

_____

Q: The mixture of what two gases create Black damp?

_____

Q: What is a Class C fire?

_____

Q: How often must employees be instructed and trained on fire fighting equipment?
A: CFR 77.1100

_____

Q: Water lines must be capable of delivering how many gallons per minute?
A: CFR 77.1108-1

_____

Q: Areas surrounding flammable-liquid storage tank and electric substation shall be kept clear of what? For what distance?
A: CFR 77.1103

Q: Combustible materials, such as what, are prohibited from accumulating in areas that may create a fire hazard?
A: CFR 77.1104

Q: How often shall fire extinguishers be examined?
A: CFR 77.1110

Q: What fire fighting equipment must be provided where welding is done?
A: CFR 77.1111

Q: Fire extinguisher must be replaced immediately if what occurs?
A: CFR 77.1108-1 (b)(3)

Q: What fire fighting equipment is required at combustible liquid storage installations?
A: CFR 77.1109 (e)

Q: In regards to fire fighting equipment, what are preparation plants required to be equipped with?
A: CFR 77.1109 (b)

Q: Belt conveyers in locations where fires could create a hazard to people must be provided with what?
A: CFR 77.1107

CHAPTER EIGHT

MINE GASSES

1. Methane
2. Carbon Monoxide
3. Carbon Dioxide
4. Hydrogen Sulphide
5. Hydrogen
6. Sulfur Dioxide
7. Nitrogen Dioxide
8. Nitrogen
9. Oxygen
10. Acetylene
11. Properties of Air
12. Types of Coal
13. Properties of Mine Gases
14. Questions and Review

Methane

CH_4

Methane is a colorless, odorless, flammable gas. It is lighter than air, having a specific gravity of 0.554 and is often found near the mine roof (ceiling of the mine opening). It is only slightly soluble in water. It burns readily in air, forming carbon dioxide and water vapour; the flame is pale, slightly luminous, and very hot. The boiling point of methane is -162.0° C (-259.6° F) and the melting point is -182.5° C (-296.5° F). Methane in general is very stable, but mixtures of methane and air are explosive. Explosions of such mixtures have been frequent in coal mines and collieries and have been the cause of many mine disasters. The most volatile explosion of methane and air mixture occurs when methane content is at 10 percent.

When mixed with air, methane is explosive in concentrations between approximately 5% and 15%. Liquid methane does not burn unless subjected to high pressure.

Potential health effects

Methane is not toxic; however, it is highly flammable and may form explosive mixtures with air. High concentrations of the gas in closed spaces, may reduce the oxygen percentage in air and cause suffocation. Asphyxia may result if the oxygen concentration is reduced to below 19.5% by displacement.

Facts About Methane

- Methane gas occurs naturally in all coal mines, trapped in pores within the coal bed. It is released as the coal is broken up during the mining process. The amount of methane liberated by the coal depends on the geologic age and type of coal and the depth of the coal deposit. Natural gas used in household furnaces is composed mostly of methane.

- Methane can be detected with hand-held or stationary instruments. Checks for methane are made by certified persons at regular intervals before and during the time while people are working underground.

- Federal safety standards mandate that, “when 1.0 percent or more methane is present in a working place or an intake air course, electrically powered equipment in the affected area shall be de-energized, and other mechanized equipment shall be shut off.”

- A flammable mixture of methane and air can be ignited by electric arcs and sparks, open flames or by the heat of friction between the cutting bits of mining equipment and the mine rock immediately above or below the coal.

Coal Mines and Methane

Methane emissions in working mines arise at two key stages:

(1) Methane is released as a direct result of the physical process of coal extraction. In many modern underground mines, the coal is extracted through longwall mining. Longwall mining, as with other sub-surface techniques, releases methane previously trapped within the coal seam into the air supply of the mine as layers of the coal face are removed, thus creating a potential safety hazard.

(2) Methane emissions arise from the collapse of the surrounding rock strata after a section of the coal seam has been mined and the artificial roof and wall supports are removed as mining progresses to another section. The debris resulting from the collapse is known as gob and also releases methane or ‘gob gas’ into the mine.

Carbon monoxide

CO

Carbon Monoxide is a colorless, odorless and tasteless gas, which is highly toxic to humans and animals. It is produced from the incomplete combustion or explosion of substances containing carbon such as coal, natural gas or gasoline. Large quantities of CO are generated during mine fires or explosions.

Carbon monoxide is slightly lighter than air. It is flammable and explosive in mixtures with air in concentrations between 12.5 and 74%. It is toxic because it blocks the ability of the hemoglobin in the blood to carry oxygen from the lungs to the muscles and other tissue in the human body.

Coal Mines and Carbon Monoxide

Carbon monoxide may be present in the afterdamp of a gas- or coal-dust explosion, or in the gases given off by a mine fire; also one of the gases produced by blasting. It is an important constituent of illuminating gas, supports combustion, and is very poisonous.

Carbon monoxide (sometimes referred to as "white damp") is the most dangerous gas to be dealt with in a mine. Unlike carbon dioxide, which as the levels increase the density makes it sink, carbon monoxide is lighter than air and subsequently more deadly because of it. It can be caused by explosions either from fire damp or coal dust (thus being an integral part of after damp). In addition to being toxic, it is also very inflammable.

The NIOSH recommended exposure limit (REL) for CO is 35 ppm, measured as a time-weighted average (TWA) for up to a 10-hour workday during a 40-hour work week. The ceiling concentration (not to be exceeded during any part of the workday) is 200 ppm. CO

in concentrations of 500 ppm or 0.05% can be fatal in 3 hours. Higher concentrations can lead to coma and death in minutes. Carbon monoxide is known as a “silent killer”.

Carbon monoxide can be detected by hand-held sensors. Stationary sensors may also be installed at strategic points in mine airways.

Effects on Life

Carbon monoxide is so dangerous to humans because it is so readily absorbed by the blood—even more than just oxygen. Making it worse, the body is slow to "give it up," making treatment that much more difficult. Also, because the body continues to absorb the gas (death comes at 80% saturation), even low levels can build up in the body causing death. It is at about 0.02% that one begins feeling the effects—in this case, "slight giddiness, headache and breathlessness" If the level gets as high as 0.2%, death will take place in one to two hours. The amount of time before a fatality (from there on up), is dependent not only on the percentage of carbon monoxide, but the amount of exertion by the person.

Because, unlike carbon dioxide, flames won't extinguish or die down in the presence of carbon monoxide, one of the chief tests was done by bringing small animals, usually birds (the proverbial "canary in a coal mine") and mice. They would succumb much sooner than a full grown man or even a boy.

Symptoms Associated With a Given Concentration of CO Over Time

PPM CO	Time	Symptoms
35	8 hours	Maximum exposure allowed by OSHA in the workplace over an eight hour period.
200	2-3 hours	Mild headache, fatigue, nausea and dizziness.
400	1-2 hours	Serious headache-other symptoms intensify. Life threatening after 3 hours.
800	45 min	Dizziness, nausea and convulsions. Unconscious within 2 hours. Death within 2-3 hours.
1600	20 min	Headache, dizziness and nausea. Death within 1 hour.
3200	5-10 min	Headache, dizziness and nausea. Death within 1 hour.
6400	1-2 min	Headache, dizziness and nausea. Death within 25-30 minutes.
12,800	1-3 min	Death

Carbon Dioxide

CO_2

At room temperature, **carbon dioxide** takes the form of an odorless, colorless gas which is incombustible in normal conditions. Carbon dioxide can be forced into a solid form, in which case it is known as dry ice, and the gas is toxic to animals in high concentrations. People who inhale too much carbon dioxide essentially suffocate, ultimately falling into unconsciousness as their oxygen saturation level drops.

Carbon dioxide is a trace gas being only 0.038% of the atmosphere. It is produced through decomposition of organic materials as well as through respiration and combustion. It is also generated as a by-product of the combustion of fossil fuels or the burning of vegetable matter, among other chemical processes.

Coal Mines and Carbon Dioxide

Besides being a part of both after damp and black damp, as noted above, carbon dioxide levels increase due to human and (in some cases, particularly in the past) animal respiration. Other sources include burning of candles or torches (less common since electricity came to mining), explosions, chemical reactions with certain rocks/minerals, even the decay of timber. One of the key tasks of a mine ventilation system is to get rid of carbon dioxide (hardly the most deadly, but the one most apt to build up in the day to day operation of a mine).

While not combustible or poisonous, by itself, levels of 18% can kill, 25% quickly. If it is combined with a corresponding drop in the percentage of oxygen, those numbers can drop to 9% and 10%, respectively. Levels as low as 3% can make breathing more difficult, symptoms worsening as the percentage rises.

Effects on Life

While carbon dioxide does contribute to maintaining human health by maintaining the pH balance of blood, it can lead to suffocation when the concentration is too high.

CO_2 is toxic in higher concentrations: 1% (10,000 ppm) will make some people feel drowsy. When inhaled at concentrations much higher than usual atmospheric levels, it can produce a sour taste in the mouth and a stinging sensation in the nose and throat. Concentrations of 7% to 10% cause dizziness, headache, visual and hearing dysfunction, and unconsciousness within a few minutes to an hour.

Hydrogen Sulfide

H_2S

Hydrogen sulfide is a colorless, highly toxic and flammable gas. Being heavier than air, it tends to accumulate at the bottom of poorly ventilated spaces. It smells like rotten eggs and is sometimes called hydrosulfuric acid, stink gas or sewer gas. Although very pungent at first, it quickly deadens the sense of smell, so potential victims may be unaware of its presence until it is too late.

- 0.0047 ppm is the recognition threshold, the concentration at which 50% of humans can detect the characteristic odor of hydrogen sulfide
- Less than 10 ppm has an exposure limit of 8 hours per day.
- 10–20 ppm is the borderline concentration for eye irritation.
- 50–100 ppm leads to eye damage.
- At 150–250 ppm the olfactory nerve is paralyzed after a few inhalations, and the sense of smell disappears, often together with awareness of danger,
- 320–530 ppm leads to pulmonary edema with the possibility of death.
- 530–1000 ppm causes strong stimulation of the central nervous system and rapid breathing, leading to loss of breathing;
    - 800 ppm is the lethal concentration for 50% of humans for 5 minutes exposure(LC50).
- Concentrations over 1000 ppm cause immediate collapse with loss of breathing, even after inhalation of a single breath.

Health Effects of Hydrogen Sulfide

H2S is classed as a ***chemical asphyxiant***, similar to carbon monoxide and cyanide gases. It inhibits cellular respiration and uptake of oxygen, causing biochemical suffocation. Typical exposure symptoms include:

LOW	0 - 10 ppm	Irritation of the eyes, nose and throat
MED	10 - 50 ppm	Headache Dizziness Nausea and vomiting Coughing and breathing difficulty
HIGH	50 - 200 ppm	Severe respiratory tract irritation Eye irritation / acute conjunctivitis Shock Convulsions Coma Death in severe cases

Prolonged exposures at lower levels can lead to bronchitis, pneumonia, migraine headaches, pulmonary edema, and loss of motor coordination.

Should a co-worker ever be overcome by H2S gas, do not attempt a rescue until you are properly protected yourself. The rescuer can very easily get caught out by venturing into a confined space without adequate protection. Remember that at levels above 200 ppm, collapse, coma and death due to respiratory failure can occur within seconds after only a few inhalations so you can be overcome yourself very quickly. Such incidents are sadly all too common and only serve to make the rescue effort twice as difficult.

Coal Mines and Hydrogen Sulfide

Hydrogen Sulfide, also known as "stink damp," the gas is caused by the decomposition of iron pyrites in a mine due to the dampness or presence of water. While considerably more deadly than carbon monoxide (and inflammable), amounts of this gas are usually only trace. Another thing in favor of the miners is that the gas has a foul, disagreeable odor (like rotten eggs) which serves as a usually adequate warning.

Like carbon dioxide, it is heavier than air and sinks. Animals could also be used to test for it by placing them near the floor of the mine (1% could cause death rather quickly and as little as 0.07%, over time, could also kill) but the smell and relative nonabundance of the gas make it less of a concern than the others.

While proper ventilation and methods to test for gases have come a long way since they actually used animals to test, the danger of gas buildup in a coal mine is a constant and important concern. Awareness of the potential problem and knowledge of the safety procedures are an important part of keeping men alive who spend so much of their lives digging underground for coal.

Hydrogen

H_2

Hydrogen is the lightest element. It is by far the most abundant element in the universe and makes up about about 90% of the universe by weight. Hydrogen as water (H_2O) is absolutely essential to life and it is present in all organic compounds. Hydrogen is the lightest gas. Hydrogen gas was used in lighter-than-air balloons for transport but is far too dangerous because of the fire risk. It burns in air to form only water as waste product and if hydrogen could be made on sufficient scale from other than fossil fuels then there might be a possibility of a hydrogen economy.

Table: basic information about and classifications of hydrogen.

Name: Hydrogen	Group in periodic table: 1
Symbol: H	Group name: (none)
Atomic number: 1	Period in periodic table: 1
Atomic weight: 1.00794 (7)	Block in periodic table: s-block
Standard state: gas at 298 K	Color: colorless
CAS Registry ID: 1333-74-0	Classification: Non-metallic

Properties/Combustion

Hydrogen gas is highly flammable and will burn in air at a very wide range of concentrations between 4% and 75% by volume. The enthalpy of combustion for hydrogen is −286 kJ/mol: $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(l) + 572$ kJ (286 kJ/mol)

Hydrogen gas forms explosive mixtures with air in the concentration range 4-74% (volume per cent of hydrogen in air) and with chlorine in the range 5-95%. The mixtures spontaneously detonate by spark, heat or sunlight. The hydrogen autoignition temperature, the temperature of spontaneous ignition in air, is 500 °C (932 °F). Pure hydrogen-oxygen flames emit ultraviolet light and are nearly invisible to the naked eye. The detection of a burning hydrogen leak may require a flame detector; such leaks can be very dangerous. The destruction of the Hindenburg airship was an infamous example of hydrogen combustion; the cause is debated, but the visible flames were the result of combustible materials in the ship's skin. Because hydrogen is buoyant in air, hydrogen flames tend to ascend rapidly and cause less damage than hydrocarbon fires.

H_2 reacts with every oxidizing element. Hydrogen can react spontaneously and violently at room temperature with chlorine and fluorine to form the corresponding hydrogen halides, hydrogen chloride and hydrogen fluoride, which are also potentially dangerous acids.

Safety and precautions

Hydrogen poses a number of hazards to human safety, from potential detonations and fires when mixed with air to being an asphyxant in its pure, oxygen-free form. In addition, liquid hydrogen is a cryogen and presents dangers (such as frostbite) associated with very cold liquids. Hydrogen dissolves in many metals, and, in addition to leaking out, may have adverse effects on them, such as hydrogen embrittlement, leading to cracks and explosions. Hydrogen gas leaking into external air may spontaneously ignite. Moreover, hydrogen fire, while being extremely hot, is almost invisible, and thus can lead to accidental burns.

Even interpreting the hydrogen data (including safety data) is confounded by a number of phenomena. Many physical and chemical properties of hydrogen depend on the parahydrogen/orthohydrogen ratio (it often takes days or weeks at a given temperature to reach the equilibrium ratio, for which the data is usually given). Hydrogen detonation parameters, such as critical detonation pressure and temperature, strongly depend on the container geometry.

Sulfur Dioxide

SO_2

Sulfur dioxide (also **sulphur dioxide**) is a heavy, colorless, poisonous gas with a pungent odor, familiar as the smell of a just-struck match. It is a liquid when under pressure, and it dissolves in water very easily. Since coal and petroleum often contain sulfur compounds, their combustion generates sulfur dioxide. Further oxidation of SO_2, usually in the presence of a catalyst such as NO_2, forms H_2SO_4, and thus acid rain. Large quantities of sulfur dioxide are formed in the combustion of sulfur-containing fuels.

Effects on Life

Sulfur dioxide is toxic in large amounts and can be life threatening. Exposure to 100 ppm is considered immediately dangerous to human life and health. Burning of the nose and throat, breathing difficulties, and severe airway obstructions occurred in miners who breathed Sulfur Dioxide released as a result of exposure. Sulfur dioxide blocks nerve signals from the pulmonary stretch receptors (PSR's). Inhaling sulfur dioxide has been associated with increased respiratory symptoms and disease and premature death.

Sources: Combustion of fuel containing sulfur -- mostly coal and oil. Also produced during metal smelting and other industrial processes.

Nitrogen Dioxide

NO_2

Nitrogen Dioxide is a reddish-orange brown, gas with a characteristic sharp, biting odor and it is toxic. It is produced when fossil fuels (like gasoline or diesel) are burned. It dissolves in water with reaction to give a mixture of nitric acid and nitrous acid.

Exposure to Nitrogen dioxide

People are exposed to NO2 by breathing in the gas from the air. The levels of NO2 are usually higher outdoors than indoors. The operation of gas or diesel engines in enclosed areas can result in a build up of dangerous levels of NO2 in the air.

When energy sources burn fuel incompletely, there is the risk of NO2 being produced. Gases produced by electric arc welding may also contain dangerous levels of nitrogen dioxide. Traces of NO2 can be found in tobacco smoke.

Effect on Life

Nitrogen dioxide is toxic by inhalation, but this could be avoided as the material is acrid and easily detected by our sense of smell.

Low concentrations (4 ppm) will anesthetize the nose, thus creating a potential for overexposure. Breathing low levels of nitrogen dioxide can cause a slight cough, mild fatigue, and nausea. Eye, nose, and throat irritation are also common symptoms.

High concentrations of NO_2 can cause severe coughing, choking, headache, nausea, abdominal pain, and shortness of breath. If the exposure is severe, symptoms may continue after the exposure has ended, causing difficulty breathing for weeks.

Long-term exposure to NO_2 at concentrations above 40– 100 $\mu g/m^3$ causes adverse health effects.

Nitrogen dioxide is a pulmonary irritant affecting primarily the upper respiratory system. Individuals with asthma, respiratory disorders and lung diseases are more sensitive to the effects of NO2. Healthy individuals exposed to concentrations of NO_2 from 0.7 to 5.0 ppm for 10-15 minutes have developed abnormalities in pulmonary airway resistance. At higher concentrations it can irritate the lungs, cause bronchitis and pneumonia and lower resistance to respiratory infections.

Health problems caused by nitrogen dioxide can either be acute, which occur immediately or within a few days of exposure, or they can be chronic, which are long-term health effects that might not show up for many years

Nitrogen

N_2

Nitrogen makes up the major portion of the earth's atmosphere, accounting for 78.08% of the air by volume. Nitrogen gas is a colorless, odorless, tasteless, nontoxic and almost totally inert gas. It is nonflammable and it will not support combustion. Nitrogen gas is slightly lighter than air and slightly soluble in water.

Nitrogen condenses at its boiling point, -195.8^{o} C (-320.4^{o} F), turning into a colorless liquid that is lighter than water. It will freeze at −210 °C; (−346 °F.)

Uses of Nitrogen

It is commonly thought of and used as an inert gas; but it is not truly inert. It forms nitric oxide and nitrogen dioxide with oxygen, ammonia with hydrogen, and nitrogen sulfide with sulfur. It is used to shield potentially reactive materials from contact with oxygen

Liquid nitrogen is valued for coldness as well as inertness. When liquid nitrogen is vaporized and warmed to ambient temperature, it absorbs a large quantity of heat. The inert properties of nitrogen make it a good blanketing gas in many applications. Nitrogen blanketing is used to protect flammable or explosive solids and liquids from contact with air. When working with liquid nitrogen, proper ventilation is very important.

Nitrogen is principally shipped and used in either gaseous or liquid form. When appropriately insulated from ambient heat, liquid nitrogen can be stored and transported, for example in vacuum flasks. Depending on the size and design, the holding time of vacuum flasks ranges from a few hours to a few weeks.

Effect on Life

When inhaled at high partial pressures nitrogen begins to act as an anesthetic agent. It can cause nitrogen narcosis, a temporary semi-anesthetized state of mental impairment similar to that caused by nitrous oxide.

Direct skin contact with liquid nitrogen will eventually cause severe frostbite. This may happen almost instantly on contact, depending on the form of liquid nitrogen.

As liquid nitrogen evaporates it will reduce the oxygen concentration in the air and might act as an asphyxiant, especially in confined spaces. Nitrogen may produce asphyxia without any sensation or prior warning.

Vessels containing liquid nitrogen can condense oxygen from air. The liquid in such a vessel becomes increasingly enriched in oxygen as the nitrogen evaporates, and can cause violent oxidation of organic material.

Oxygen

O_2

Oxygen is a colorless odorless tasteless gas. Atmospheric oxygen is of vital importance for all aerobic organisms. It is used in high-temperature flames and in breathing apparatus. Oxygen occurs in the free state as a gas, and makes up approximately 21% of the air we breathe.

Properties

- A colorless gas, without smell or taste,
- Is slightly heavier than air,
- Is sparingly soluble in water,
- Is difficult to liquefy, boiling point -183 °C, and the liquid is pale blue in color and is appreciably magnetic. At still lower temperatures, light-blue solid oxygen is obtained, which has a melting point of -218.4 °C

Uses

Oxygen is essential for life and it takes part in processes of combustion, its biological functions in respiration make it important.

Oxygen is sparingly soluble in water, but the small quantity of dissolved oxygen in is essential to the life of fish.

Oxygen gas is used with hydrogen or coal gas in blowpipes and with acetylene in the oxy-acetylene torch for welding and cutting metals.

Liquid oxygen mixed with powdered charcoal has been used as an explosive.

Combustion and other hazards

Highly concentrated sources of oxygen promote rapid combustion. Fire and explosion hazards exist when concentrated oxidants and fuels are brought into close proximity; however, an ignition event, such as heat or a spark, is needed to trigger combustion.

Concentrated O_2 will allow combustion to proceed rapidly and energetically. Steel pipes and storage vessels used to store and transmit both gaseous and liquid oxygen will act as a fuel; and therefore the design and manufacture of O_2 systems requires special training to ensure that ignition sources are minimized.

Liquid oxygen spills, if allowed to soak into organic matter, such as wood, petrochemicals, and asphalt can cause these materials to detonate unpredictably on subsequent mechanical impact. As with other cryogenic liquids, on contact with the human body it can cause burns to the skin and the eyes.

Acetylene

C_2H_2

Acetylene Gas also called *ethyne*. – is a hydrocarbon consisting of two carbon atoms and two hydrogen atoms. It is a colorless, highly flammable, explosive gas with a garlic-like odor.

Acetylene has the highest flame temperature of any common hydrocarbon because of its triple-bond structure H-C=C-H. Combustion with oxygen achieves a flame temperature of 5580° F (3087° C), releasing 1470 BTUs per cubic foot. Its high flame temperature allows it to be used in a variety of metal working applications like cutting, welding, brazing, and soldering.

Safety and handling

When acetylene is liquefied, compressed, heated, or mixed with air, it becomes highly explosive. As a result special precautions are required during its production and handling.

Acetylene is not especially toxic but when generated from calcium carbide it can contain toxic impurities such as traces of phosphine and arsine. It is also highly flammable (hence its use in welding). Its singular hazard is associated with its intrinsic instability; samples of concentrated or pure acetylene will explosively decompose. Acetylene can explode with extreme violence if the pressure of the gas exceeds about 200 kPa (29 psi) as a gas or when in liquid or solid form.

It is therefore shipped and stored dissolved in acetone or dimethylformamide (DMF), contained in a metal cylinder with a porous filling, which renders it safe to transport and use, given proper handling.

MSHA – Safety Hazard Information
Special Hazards of Acetylene

Acetylene is the most common gas used for fueling cutting torches in both general industry and the mining industry. When mixed with pure oxygen in a cutting torch assembly, an acetylene flame can theoretically reach over 5700°F. Users of this type of equipment are generally familiar with the fire hazards associated hot flames and the production of hot slag. However, many users may not be aware of the unique characteristics of acetylene itself that create special hazards compared to other fuel gases.

Chemical Composition: An acetylene molecule is composed of two carbon atoms and two hydrogen atoms. The two carbon atoms are held together by what is known as a triple carbon bond. This bond is useful in that it stores substantial energy that can be released as heat during combustion. However, the triple carbon bond is unstable, making acetylene gas very sensitive to conditions such as excess pressure, excess temperature, static electricity, or mechanical shock.

Storage: Because of acetylene's unstable nature, it must be stored under special conditions. This is accomplished by dissolving the acetylene in liquid acetone. The liquid acetone is then stored in the acetylene cylinder, which in turn, is filled with a porous (sponge-like) cementitious material.

- NEVER ATTEMPT TO STORE OR INJECT ACETYLENE GAS INTO ANY TYPE OF VESSEL, TANK, OR ENCLOSURE. IMPROPERLY STORED ACETYLENE GAS IS UNSTABLE.
- ACETYLENE GAS REGULATORS SHOULD NOT EXCEED A SETTING OF 15 P.S.I.G.
- FLAME ARRESTORS AND CHECK VALVES SHOULD BE INSTALLED AT BOTH THE TORCH BASE HOSE CONNECTIONS AND AT THE REGULATOR HOSE CONNECTIONS.
- ACETYLENE CYLINDERS SHOULD BE PROPERLY SECURED AT ALL TIMES. MOVEMENT OF CYLINDERS SHOULD BE DONE WITH CARE. CYLINDERS SHOULD BE PROTECTED FROM FLAME OR HEAT.

When exposed to excess temperature, pressure, or mechanical shock, pure or less than pure acetylene gas can undergo a violent, explosive decomposition reaction. Additionally, if this reaction, or an ignition of acetylene occurs within the torch base or supply hose, it can propagate back into the storage cylinder causing it to explode violently.

Flammable range: Acetylene has a very wide range of flammability. The lower flammable limit (LFL) is typically listed as 2.5% and the upper flammable limit (UFL) is listed as 81%. Although acetylene will not undergo combustion at concentrations above the UFL, it can undergo an explosive decomposition reaction, even at concentrations of 100%.

- NEVER USE ACETYLENE OR ITS EQUIPMENT IN ANY WAY NOT CONSISTANT WITH RECOGNIZED GOOD PRACTICE.
- ALWAYS MAINTAIN ACETYLENE CUTTING EQUIPMENT IN PROPER WORKING CONDITION TO PREVENT INADVERTANT LEAKAGE OF ACETYLENE OR OXYGEN INTO THE SURROUNDING WORK ENVIRONMENT.
- WHILE STORAGE IN A HORIZONTAL POSITION DOES NOT MAKE THE ACETYLENE LESS STABLE OR SAFE, IT DOES INCREASE THE LIKELIHOOD OF SOLVENT LOSS, WHICH WILL RESULT IN A LOWER FLAME QUALITY WHEN THE CYLINDER IS USED. THEREFORE IT IS ALWAYS PREFERABLE TO STORE AN ACETYLENE CYLINDER IN AN UPRIGHT POSITION.

Acetylene gas is ignitable over a wide range of concentrations.

Ease of ignition: Acetylene is a very easy gas to ignite. In fact, the energy from a static spark capable of igniting acetylene is lower than for any other fuel gas except hydrogen. The ignition energy of acetylene in air is approximately seventeen times lower than that of methane. The static charge developed by walking across a carpet floor on a dry day can be 1700 times greater than that needed to ignite acetylene. When mixed with pure oxygen, the ignition energy of acetylene is almost 100 times lower than it is in air.

- NEVER DISCHARGE UNBURNED ACETYLENE GAS FROM A TORCH EXCEPT FOR THE NORMAL PROCESS OF LIGHTING THE TORCH.
- NEVER DISCHARGE UNBURNED ACETYLENE GAS FROM A TORCH INTO ANY TYPE OF CONTAINER OR VESSEL.

When unburned acetylene gas is discharged from a torch, static electricity can be generated at the torch tip. If the tip comes in contact with a ground path, a static spark capable of igniting the acetylene can occur.

Rate of combustion reaction: Because of its simple chemical make up and sensitive triple bond, acetylene burns at a very fast rate. This very fast burning rate can accelerate the rate at which pressure is generated in an explosion beyond what would occur for other fuels. This, in turn, can make acetylene explosions more violent than for other fuels.

- NEVER DISCHARGE UNBURNED ACETYLENE GAS INTO ANY TYPE OF CONTAINER, VESSEL, ENCLOSURE, OR PIPE (SUCH AS A "POTATO GUN") WITH THE INTENT OF IGNITING THE GAS TO "DEMONSTRATE" THE HAZARDS OF ACETYLENE, OR TO PROPEL AN OBJECT FROM AN ENCLOSURE OR TUBE.

Because of the very fast reaction rate of burning acetylene, it is not generally possible to design an enclosure to safely vent the explosive pressures. Furthermore, because of the ease of ignition of acetylene, premature ignition is very possible.

AIR

Air is a mixture of gases and aerosols that composes the atmosphere surrounding Earth. The primary gases of air include nitrogen (78%) and oxygen (21%). Trace gases and aerosols make up the remaining 1% of air. The trace gases include the noble gases argon, neon, helium, krypton and xenon; hydrogen; and the greenhouse gases. The aerosols are solid or liquid particles having diameters in the region of 0.001 to 10 microns (millionth of a metre), and include dust, soot, sea salt crystals, spores, bacteria, viruses and a plethora of other microscopic particles, which may be natural or man-made.

Besides "air," which is made up of primarily/approximately 78% nitrogen and 21% oxygen, there are four main gases that concern workers in a coal mine. They are carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), and hydrogen sulfide (H_2S). The levels and combinations of these gases along with the level of oxygen or "air" determine the danger and what they are known as.

What gases make up air?

A:

Nitrogen - 78.09 %
Oxygen - 20.95%
Argon - .93%
Carbon Dioxide - .03%.
Neon - .0018%
Helium - .0005%
Krypton - .0001%
Hydrogen - .0005%
Xenon - .000008%
Ozone - .000002%
Radon - Traces

COAL

Coal is a combustible rock formed from the remains of decayed vegetation. It is the only rock containing significant amounts of elemental carbon. The composition of coal varies between 60% and 95% carbon. Coal also contains hydrogen and oxygen, with small concentrations of nitrogen, chlorine, sulfur, and several metals. Coals are classified by the amount of volatile material they contain, that is, by how much of the mass is vaporized when the coal is heated to about 900°C in the absence of air. Coal that contains more than 15% volatile material is called bituminous coal. Substances released from bituminous coal when it is distilled, in addition to methane, include water, carbon dioxide, ammonia, benzene, toluene, naphthalene, and anthracene. The non-volatile component of coal, which remains after distillation, is coke.

Types of Coal

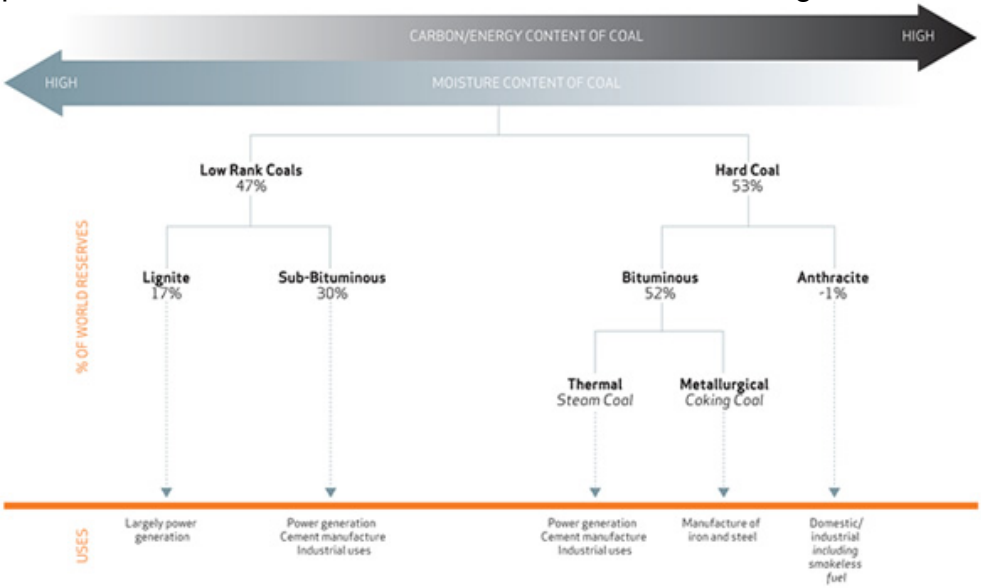
Initially the peat is converted into lignite or 'brown coal' - these are coal-types with low organic maturity. In comparison to other coals, lignite is quite soft and its color can range from dark black to various shades of brown.

Over many more millions of years, the continuing effects of temperature and pressure produces further change in the lignite, progressively increasing its organic maturity and transforming it into the range known as 'sub-bituminous' coals.

Further chemical and physical changes occur until these coals became harder and blacker, forming the 'bituminous' or 'hard coals'. Under the right conditions, the progressive increase in the organic maturity can continue, finally forming anthracite.

In addition to carbon, coals contain hydrogen, oxygen, nitrogen and varying amounts of sulphur. High-rank coals are high in carbon and therefore heat value, but low in hydrogen and oxygen. Low-rank coals are low in carbon but high in hydrogen and oxygen content.

Different types of coal also have different uses, as shown in the diagram below.



PROPERTIES OF MINE GASES

NAME OF GAS	CHEMICAL SYMBOL	SPECIFIC GRAVITY	COM-BUSTIBLE	LBS. PER CU. FT. AT 600f AND 30.00 IN. OF MERCURY	EFFECT ON LIFE	SOURCE OR CAUSE WHERE FOUND	EXPLOSIVE RANGE PERCENT BY VOLUME	COMMON NAME	LOWEST IGNITION TEMPS.	HOW DETECTED	COLOR-LESS	ODOR-LESS	TASTE-LESS
Air		1.000	Supports	.0765	Sup-ports	Atmosphere	None						
Oxygen	O2	1.105	Supports	.0846	Sup-ports	1.5 of atmosphere	None			Flame safety lamp O2 detector	X	X	X
Methane	CH4	.555	Yes	.0424	Inert	Coal carbonaceous shale	5.0% - 15.0%	Marsh gas, fire damp	1200OF	Methanometer	X	X	X
Carbon Dioxide	CO2	1.529	No	.1170	Poisonous in high concentration	Oxid of coal blasting, mine fires, decay, acid waters, breathing	None	Black damp		Colorimetric analysis	X	X	X
Carbon Monoxide	CO	.967	Yes	0.0740	Poisonous	Incomplete combustion, mine fires, explosions, blasting	12.5% - 74.0%	White damp	1190OF	CO detector, canary	X	X	X
Nitrogen	N2	.967	No	.0740	Inert	About 4/5 of atmosphere	None			Analysis	X	X	X
Hydrogen Sulfide	H2S	1.191	Yes	.0911	Poisonous	Explosions, mine fires, blasting	4.3% - 46.0%		655OF	Hydrogen sulfide detector acetate of lead	X	Sulfur odor	X
Nitrogen Peroxide	NO2	1.589	No	.1217	Poisonous	By burning of high explosives	None			Starch & potassium iodide	Turns blue with trace	Odor of burning explosives	X
Nitrogen Dioxide	NO2	1.503	No		Poisonous	Blasting, burning ex-plosives, burning nitrates	None			Analysis	Brownish red		
Sulfur Dioxide	SO2	2.263	No	.1733	Poisonous	By burning pyrites or other	None			Odor, colorimetric analysis	X	Sulfur Odor	Acidic taste
Hydrogen	H2	.070	Yes	.0053	Inert	Charging batteries, mine fires, explosions	4.1% - 74.0%		935OF	Analysis	X	X	X
Acetylene	C2H2	.907	Yes	.0694	Slightly poisonous	Chemical action of water on cal. Car-bide lamps	2.5% - 80.0%		636OF	Odor	X	Garlic odor	X

OXYGEN DEFICIENCY

OXYGEN PRESENT	EFFECT
21%	Breathing easiest
17%	Breathing faster and deeper
15%	Dizziness, buzzing noise, rapid pulse, headache, blurred vision
9%	May faint or become unconscious
6%	Movement convulsive, breathing stops, shortly after heart stops

MINES GASES
Questions for Review

Q: What gases make up the air we breathe?

_____

Q: What are the sources of methane in coal mines?

_____

Q: What other gas must be present in order for methane to explode (when CH4 content is between 5% - 15%)

_____

Q: What is the lowest level of Oxygen that will support life?

_____

Q: Why are small quantities of Carbon Monoxide injurious?

_____

Q: How is Carbon Dioxide formed in a coal mine?

_____

Q: What four gases are of most concern to coal miners?

_____

Q: What element in air is essential for life?

_____

Q: What is the explosive range for Hydrogen Sulfide?

_____

Q: What is the most violent explosive point for methane?

_____

Q: What are some of the uses of Nitrogen?

_____

Q: What percentage of Nitrogen Dioxide will be fatal?

_____

Q: Is Sulfur Dioxide combustible?

_____

Q: Is Hydrogen explosive?

_____

Q: What are some of the effects of breathing in Hydrogen Sulfide?

_____

Q: What effect does Carbon Dioxide have upon life?

_____

Q: At what level would someone begin to feel the effects of Carbon Monoxide exposure?

_____

Q: Where would Hydrogen Sulfide tend to accumulate in a coal mine?

_____

Q: What are some of the hazards posed to humans by Hydrogen?

_____

Q: What are some of the effects of inhaling Sulfur Dioxide?

_____

Q: How can you detect Nitrogen Dioxide?

_____