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**U.S. DEPARTMENT OF ENERGY
DOE NEVADA OPERATIONS OFFICE
NEVADA TEST SITE**

UNDERGROUND SAFETY AND HEALTH STANDARDS

MAY 1993

Prepared by:

**U.S. Department of Energy
Nevada Test Site Underground Safety and Health
Standards Working Group**

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This document is not intended to supersede or replace any relevant portion of DOE Orders. Rather the intent is to collate the multiple safety and health references in DOE Order 5480.4 that have applicability to NTS underground operations into a single Safety and Health Standard.

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REVISION LOG

Revision Number	Date Approved	Pages Affected	Description of Revision

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ACRONYMS

ANSI	American National Standard Institute
CFR	Code of Federal Regulations
CMSO	California Mine Safety Orders
CTSO	California Tunnel Safety Orders
DOE	Department of Energy
DOE/HQ	Department of Energy/Headquarters
DOE/NV	Department of Energy/Nevada Operations Office
DOT	Department of Transportation
DNA	Defense Nuclear Agency
EG&G/EM	EG&G/Energy Measurements, Inc.
IH	Industrial Hygiene
LEL	Lower Explosive Limit
MSHA	Mine Safety and Health Administration
NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NTS	Nevada Test Site
NTS - SOP	Nevada Test Site - Standard Operating Procedure
NTSO	Nevada Test Site Office
OSHA	Occupational Safety and Health Administration
REEC _o	Reynolds Electrical & Engineering Company, Inc.
RSN	Raytheon Services Nevada
SHD	Safety and Health Division (of DOE/NV)
TLV [®]	Threshold Limit Value [®]
U/G	Underground
USBM	United States Bureau of Mines

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DEFINITIONS

The following definitions shall apply in the application of these standards:

Acceptable. Acceptable to the Department of Energy.

Access Shaft. A shaft used primarily as a regular means of worker access to or from underground operations.

Air Supply Lines. Pipe, hose, or combination of pipe and hose, that supplies compressed air to equipment.

ANFO. See "Blasting Agent."

Auxiliary Fan. A fan used to deliver air to a working place off the main airstream; generally used with ventilation tubing.

Back. The roof, ceiling or arch of an underground operation.

Barricade-Artificial. An artificial mound or revetted wall of earth of a minimum thickness of 3 feet or acceptable equivalent.

Barricade-Natural. Natural features of the terrain such as hills.

Barricaded. A building or structure containing explosives effectively screened from another magazine, inhabited building, railway, highway or work area either by a natural or by an artificial barricade of such height that a straight line from the top of any sidewall of the building, or structure, containing explosives to the eave line of any other magazine, inhabited building or a point 12 feet above the center of a railway, highway, or outside work area will pass through such intervening natural or artificial barricade.

Berm. A pile or mound of material capable of restraining a vehicle.

Blast Area. That area near blasting operations that would endanger personnel or property by concussion or flying materials, taking into consideration the material to be blasted, the type of blast, the location of the blast, the number, depth, and spacing of charges to be blasted, and the quantity and type of explosives used.

Blaster. Any certified person designated to supervise blasting operations and who shall be charged with the responsibility of estimating, preparing, loading, and firing explosive charges and the handling of any misfires.

Blasting Accessories. Equipment used when loading and firing explosives. It does not include explosives or detonators.

Blasting Agent. Any material or mixture consisting of a fuel and oxidizer, intended for blasting, not otherwise classified as an explosive, and in which none of the ingredients are classified as an explosive, provided that the finished product, as mixed and packaged for shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined.

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Blasting Cap. A shell containing a charge of detonating compound which is ignited by a safety fuse. It is used for detonating explosives.

Blasting Circuit. An electrical circuit, including leading, leg, and connecting wires and a source of electrical current to initiate the explosive.

Blasting Machine. An electrical device designed to fire electric blasting caps.

Blasting Mat. A heavy mat of woven rope, steel wire, or chain, or improvised from timber, logs, brush, or other materials placed over loaded holes to minimize the amount of rock and other debris that might be thrown into the air.

Blasting Operation. Any method of loosening or shattering masses of solid material by use of explosives.

Blasting Shelter. A shelter for the protection of employees while blasting.

Booster Fan. A fan installed in the main airstream or a split of the main airstream to increase airflow through a section or sections of the underground workings.

Bulkhead. A tight partition or stopping in a tunnel, raise, or shaft.

Bullet Resistant. Material and construction methods capable of preventing penetration of 180 grain, 30 caliber soft-nose, bunting-type bullet, when propelled at a maximum velocity of 2700 feet per second, when fired at a distance not to exceed 100 feet.

Buss Wires. Wires in the blasting circuit to which the leg wires of electric blasting caps are attached for electric blasting.

California Switch. A movable track resting on top of the regular track upon which trains can be diverted for passing.

Cap Crimper. A hand or bench tool specially designed to securely crimp a blasting cap to safety fuse.

Capped Fuse. A length of safety fuse to which a blasting cap has been attached.

Car Pass. A device by which a muck car can be moved to one side of the regular tunnel track to permit passage of the train on said track.

Chamber. An opening, room, or vault excavated completely or partially underground which may be open to the surface at the top or connected to the surface by a tunnel or shaft.

Chlorate Explosives. Explosives or blasting agents that have over one percent chlorate, by weight, in the total mix.

Combustible. Capable of being ignited and consumed by fire.

Competent Person. A person having abilities and experience that fully qualify him to perform the duties he is assigned.

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Connecting Wires. Those wires that connect the leg wire of one electric blasting cap with the leg wire of another electric blasting cap or with leading wires.

Coupling. A device by which two rail-mounted units are connected to each other.

Crown Bars. Timber or steel beams that extend ahead of the jumbo, the last set of timber or rib steel supports for temporary tunnel support and protection of workmen near the face.

Deadman Control. A device placed in any unit of equipment which will cause the brake to set if the operator removes pressure from the operating control.

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

Detonator. A component (such as a blasting cap or an electric blasting cap) in an explosive train which is capable of initiating detonation in a subsequent high explosive component.

Distribution Box. A portable apparatus with an enclosure through which an electric circuit is carried to one or more cables from a single incoming feed line; each cable circuit being connected through individual overcurrent protective devices.

Electric Blasting Cap. A shell containing a charge of detonating compound designed to be fired by an electric current.

Escapeway. A passageway by which persons may leave underground workings.

Explosive. Any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, shock, or other suitable initiation stimulus, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases that exert pressures in the surrounding medium. The term applies to materials that either detonate or deflagrate.

- (A) **Explosives, Class A.** Possessing detonating or otherwise maximum hazard such as, but not limited to, dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, RDX and PETN, more than 1000 blasting caps and detonating primers. This would include Class 7 Military Explosives.
- (B) **Explosives, Class B.** In general these explosives function by rapid combustion rather than detonation, and include such explosives devices as flash powders and propellant explosives which include some smokeless powders. This would include Class 2 Military Explosives.
- (C) **Explosives, Class C.** Includes certain types of manufactured articles which contain Class A or Class B explosives, or both, as components but in restricted quantities.

Extremely Flammable. Having a flash point of 20 degrees Fahrenheit or less when tested by the Tagliabue open-cup method.

Face-Underground. That part of any adit, tunnel, or raise where excavating is progressing, or was last done.

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Fire Door. An openable closure for a passageway, shaft, or other underground opening to serve as barrier to fire, the effects of fire, and air leakage. A fire door shall meet the requirements of NFPA 252.

Fire Resistant. Protected against fire by a covering equivalent to a one-hour fire resistant covering applied in a manner acceptable to the Department of Energy.

Fire Resistant Oils. Approved by the U. S. Bureau of Mines as a fire resistant oil.

Fixed. The machine or device is fastened in place and is not moved about while being operated.

Flammable. Capable of being easily ignited and of burning rapidly.

Flash Point. The temperature at which a material gives off flammable vapor in sufficient quantity to burn instantaneously at the approach of a flame or spark.

Fuse, Safety. A flexible cord containing an internal burning medium by which fire is conveyed at a continuous uniform rate for the purpose of firing blasting caps.

Ground Support System. Wood, steel, concrete, rock bolts, or other materials used for bracing or supporting the ground.

Haulage Vehicle. Rail-mounted or rubber-tired vehicle used to transport muck or materials underground.

High Potential. More than 600 volts.

Hoist-First Class. A hoist which is secured to a permanent, substantial foundation, and which is not intended to be moved from one location to another. It is used to lower and hoist personnel and materials.

Hoist-Material. A hoist for lifting, lowering, or pulling materials. It includes tugger-type and slusher.

Igniter Cord. An external burning medium by which fire is conveyed for the purpose of igniting safety fuses.

Inhabited Building. A building or structure generally used in whole or in part for human occupancy, but excluding any operating building or structure used for manufacture, transportation, storage, or use of explosives.

Insulated. Separated from other conducting surfaces by a dielectric substance permanently offering a high resistance to the passage of current and to disruptive discharge through the substance. When any substance is said to be insulated, it is understood to be insulated in a manner suitable for the conditions to which it is subjected. Otherwise, it is uninsulated.

Insulation. A dielectric substance offering a high resistance to the passage of current and to a disruptive discharge through the substance.

Invert. The floor of an underground worksite.

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Jumbo. A track-mounted or rubber-tired drill machine where the drills, and man basket, if present, are mounted on hydraulically actuated booms. These hydraulically actuated booms provide the capability, once the jumbo is placed, for moving the booms or man basket while drilling or ground support activities are taking place.

Laser. Light Amplification by Stimulated Emission of Radiation and is used as a coherent beam of light for alignment.

Leading Wires. Wires connecting the buss wires or, where buss wires are not used, the leg wires to the end of the permanent blasting wires.

LEL. Lower explosive limit of a flammable gas or vapor.

Low Potential. 600 volts or less.

Magazine. A building, other than the explosives manufacturing building, or other structures especially designed for the storage of explosives, or any cave or other structure adapted to the storage of explosives.

Main Fan. A fan that controls the entire airflow for the underground workings, or the airflow of one of the major air circuits.

Mechanical Tunneling Equipment. Equipment such as mechanical excavators, boring machines, and shields.

Misfire. An explosive charge which partly or completely failed to explode.

Missed Hole. A drill hole or any portion thereof containing an explosive charge that failed to explode.

Mobile Equipment. Wheeled, skid-mounted, track or rail-mounted equipment capable of moving or being moved.

Muck. Excavated rock, earth or other materials.

Mudcapping. Blasting by placing a quantity of explosives with detonator on or against the object to be blasted. This is also known as bulldozing, adobying, or plaster shooting.

Nitro-Carbo-Nitrate. See "Blasting Agent."

Permanent Leading Wires. Those wires between the firing switch and auxiliary switch or between auxiliary switches, when blasts are fired by current from an electric light or power circuit.

Permissible. Applied to any device, equipment, or appliance means that such device, equipment, or appliance is classed as permissible by the U. S. Bureau of Mines.

Portable. The machine or device can be, and usually is, carried about in the course of normal operation.

Powder. Any explosive other than the detonating agent.

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Primary Blasting. The blasting operations by which the original earth or rock formation or other material are broken into fragments.

Primer. Used in blasting, means a cartridge or container of explosives into which a blasting cap, electric blasting cap or detonating cord is inserted or attached.

Raise. A vertical or inclined underground excavation driven from the bottom to top.

Raise Climber. A mechanical powered work platform used to provide access to the raise face.

Rock Drilling. Drilling, cutting, chipping, channeling, or broaching rock by means of machinery.

Rock Fixture. Any tensioned or non-tensioned device inserted into the ground to strengthen or support the rock mass.

Safety Fuse. See "Fuse-Safety."

Scaling. Removal of unsecure material from a face or highwall.

Scrubber. A device used on internal combustion engines to reduce discharge of harmful exhaust gases.

Secondary Blasting. The reduction of oversize material by the use of explosives to a size suitable for handling. This may include mudcapping and block-holing.

Shaft. An excavation such as a surge chamber with a depth much greater than its horizontal cross-sectional dimensions. A shaft is considered to be vertical if its alignment is within 20 degrees of vertical.

Shall. Mandatory.

Short Circuit. An abnormal connection of relatively low resistance, whether made accidentally or intentionally, between two points of different potential on a circuit.

Should. Recommended.

Slurry Explosives. See "Water Gels."

Spoil. See "Muck."

Springing. The creation of a pocket at the bottom of a bore hole by the use of a moderate quantity of explosives in order that larger quantities of explosives may be inserted therein for a primary blast.

Squib-Electric. A device similar in appearance to an electric blasting cap which upon firing by an electric current, provides an intense flame instead of a detonation.

Static Dissipating. Sufficiently conductive to dissipate charges of static electricity but possessing enough electrical resistance to be nonconductive to ordinary stray electrical currents. The electrical characteristics shall be uniform and for hose or tubes shall have a resistance of not less than 5,000 ohms per foot nor more than 30,000 ohms per foot.

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Stemming. inert, noncombustible material used for confining a charge of explosives in a hole.

Stray Current. That portion of a total electric current that flows through paths other than the intended circuit.

Travelway. A passage, walk or way regularly used and designated for persons to go from one place to another.

Trip Light. A light displayed on the opposite end of a train from the locomotive.

Visitor. A person not assigned or regularly associated with an underground event. (Examples: vendors, tour groups.)

Water Gels, Slurry Explosives. A wide variety of materials used for blasting. They all contain substantial proportions of water and high proportions of ammonium nitrate, some of which is in solution in the water. Two broad classes of water gels are:

- (A) Those which are sensitized by a material classed as an explosive, such as TNT or smokeless powder and would therefore be classed as an explosive,
- (B) Those which contain no ingredients classified as an explosive; these are sensitized with metals such as aluminum or with other fuels and therefore would be classified as a blasting agent.

Wet Drilling. The continuous application of water through the central hole of hollow drill steel to the bottom of the drill hole.

Winze. A steeply inclined passageway connecting one underground chamber with a lower one.

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REFERENCES

For information concerning underground safety and health at the NTS, refer to any of the following:

1. Title 10 Code of Federal Regulations, Energy
2. Title 29 Code of Federal Regulations, Labor
3. Title 30 Code of Federal Regulations, Mineral Resources
4. Title 40 Code of Federal Regulations, Protection of Environment
5. Title 49 Code of Federal Regulations, Transportation
6. Tunnel Safety Orders, Administrative Code, Title 8, Chapter 4, Subchapter 20, State of California (CALIF)
7. Mine Safety Orders, Administrative Code, Title 8, Chapter 4, Subchapter 12, State of California (CALIF)
8. DOE Order 5480.1B, Environment, Safety & Health Program for DOE
9. DOE Order 5480.4, Environmental Protection, Safety and Health Protection Standards
10. DOE Order 5480.6, Radiological Control Manual
11. DOE Order 5480.11, Radiation Protection of Occupational Workers
12. DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities
13. DOE Order 5481.1B, Safety Analysis and Review System
14. DOE Order 5500.1B, Emergency Management System
15. DOE Order 5500.2B, Emergency Categories, Classes, and Notification and Reporting Requirements
16. DOE Order 5500.3A, Planning Preparedness for Operational Emergencies
17. ANSI/NFPA 70-1993, "National Electrical Code" (ANSI)
18. ANSI C2-1993, "National Electrical Safety Code" (ANSI)
19. NTS-SOP-5501, Emergency Response Procedures
20. DOE/NV/NTS Radiological Safety Manual, NV54XG-1A
21. DOE/NV/Industrial Hygiene Manual, NV54XH-1
22. DOE/NV Emergency Preparedness Plan

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REFERENCES (Continued)

23. DOE/EV/06194-5, of May 1990, "Department of Energy Explosives Safety Manual"
24. REEC Co Occupational Safety Manual
25. "TLVs® Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes," most current edition (ACGIH)
26. ANSI Standard Z88.2 - 1988, "Practices for Respiratory Protection" (ANSI)

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DOE/NV-353
UC-707
REVISION 1

UNDERGROUND
SAFETY AND HEALTH
STANDARDS

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NEVADA FIELD OFFICE

NEVADA TEST SITE UNDERGROUND SAFETY AND HEALTH STANDARDS

This document is approved as the Safety and Health Standard for the underground operations at the Nevada Test Site (exclusive of Yucca Mountain Site Characterization Project). This report replaces NV-54X Rev. A., dated 11/9/90.

CONCURRENCE:

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Nevada Test Site Office

6/23/93
(Date)

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7/1/93
(Date)

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NTS Underground Safety and Health Standards

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INTRODUCTION

The Nevada Test Site Underground Safety and Health Standards Working Group was formed at the direction of John D. Stewart, Director, Nevada Test Site Office in April, 1990. (See Appendix I, letter of 11/05/90).

The objective of the Working Group was to compile a safety and health standard from the California Tunnel Safety Orders and OSHA for the underground operations at the NTS, (excluding Yucca Mountain). These standards are called the NTS U/G Safety and Health Standards. The Working Group submits these standards as a RECOMMENDATION to the Director, NTSO.

Although the Working Group considers these standards to be the most integrated and comprehensive standards that could be developed for NTS Underground Operations, the intent is not to supersede or replace any relevant DOE orders. Rather the intent is to collate the multiple safety and health references contained in DOE Order 5480.4 that have applicability to NTS Underground Operations into a single safety and health standard to be used in the underground operations at the NTS. Each portion of the standard was included only after careful consideration by the Working Group and is judged to be both effective and appropriate.

The specific methods and rationale used by the Working Group are outlined as follows:

- The letter from DOE/HQ, dated September 28, 1990 cited OSHA and the CTSO as the safety and health codes applicable to underground operations at the NTS.
- These mandated codes were each originally developed to be comprehensive, i.e., all underground operations of a particular type (e.g., tunnels in the case of the CTSO) were intended to be adequately regulated by the appropriate code. However, this is not true; the Working Group found extensive and confusing overlap in the codes in numerous areas. Other subjects and activities were addressed by the various codes in cursory fashion or not at all.

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- The CTSO and OSHA 29 CFR 1926 were selected by the Working Group as the basis for compliance. Where neither of the codes adequately addressed an activity, the principle of "best industry practice" was adopted. The best industry practices commonly are derived from 30 CFR, 29 CFR 1910, 29 CFR 1926, and the California Mine Safety Orders.
- Those activities or subject areas for which there is no direct coverage in the cited codes will be covered by a referenced code selected by the Working Group. These referenced codes will be cited by designation only but will be a portion of the standard. Probably the best example of this situation is the incorporation by reference of the National Electrical Code (NEC).
- Where the code that the Working Group selected for the NTS standard referred to the authority for that particular standard, such as the "District Manager", the "Secretary", the "Division", etc., the Working Group has assigned this responsibility to NTSO.

Since new or revised standards are continually being promulgated by federal or state governments, it is recommended by the Working Group that this body remain to function as a standing committee to meet at least semi-annually to review and revise as appropriate, the NTS Underground Safety and Health Standards. Additionally, this standing committee would convene to evaluate any items relative to interpretation and applicability of any of these standards.

In conclusion, this Working Group has carefully examined, evaluated and finally selected those elements that, in their entirety, are considered by the Working Group to provide comprehensive and appropriate safety and health protection for underground activities at the NTS. All members concur with this document and have so indicated by their signatures. This is included as Appendix II.

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SECTION A - GENERAL SAFETY PROGRAM PROVISIONS

100 - Accident Prevention Program

A-101. Every employer shall inaugurate and maintain an accident prevention program. Use may be made of committees, safety meetings or thorough instruction from management to workers. This program shall provide for regular inspection of all working places and equipment, noting violations of safe practices and safety orders, review and discussions of the cause of accidents occurring to employees and the means for their prevention, safety education among employees and encouragement of safety suggestions from them. All safety suggestions shall be given prompt consideration by the employer and a written record shall be kept on file of the written suggestions and action taken.

[CTSO 8406.(a)]

A-102. Whether or not personal injury results, the person in charge shall notify DOE/NTSO forthwith of every case of:

- (a) Fire threatening injury to persons or underground workings;
- (b) Appearance of dangerous accumulation of gas;
- (c) Breakage of cables or other gear by which persons are hoisted or lowered;
- (d) Overwinding while persons are being hoisted;
- (e) Serious inrush of water;
- (f) Advancing an underground working within 100 feet of any other underground working suspected of containing a dangerous accumulation of water or gases;
- (g) Crushing of active underground workings;
- (h) Any serious problem of ground instability;
- (i) Fatal accidents and accidents resulting in two or more serious injuries;
- (j) Any other accident, occurrence, or change of condition that tends to materially increase the hazards of working underground. **[CMSO 6960.]**

A-103. Any unsafe condition of ground control, defects in or damage to machinery, apparatus, or equipment resulting in unsafe or dangerous conditions, and accidents occurring in course of operations which may result in personal injury, shall be reported to the employer. The employer shall investigate such reports promptly, and shall take such actions as may be required to correct the condition if it is in fact unsafe or dangerous. **[CMSO 6965.]**

A-104. The operator of every underground operation shall appoint a competent person who shall be personally in charge of the work and the employees therein. Some competent person in authority shall be on duty whenever employees are working underground. **[CMSO 6966.(a) and (c)]**

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A-105. A safety bulletin board shall be provided at each underground operation. All notices pertaining to underground safety shall be posted on the safety bulletin board. A second bulletin board may be used for posting other bulletins, pictures, slogans, and circulars. [CMSO 6962.(a) and (b)]

A-106. Oncoming shifts shall be informed of any hazardous occurrences or conditions that have affected or might affect employee safety, including liberation of gas, equipment failures, earth or rock slides, cave-ins, floodings, fires or explosions. The employer shall establish and maintain direct communications for coordination of activities with other employers whose operations at the jobsite affect or may affect the safety of employees underground. [29 CFR 1926.800(e)(1) and (2)]

200 - Training and Safety Meetings

A-201. The employer shall hold meetings at least once each month with supervisory personnel and foremen for a discussion of safety problems and accidents that have occurred. Records of such meetings shall be kept, stating the meeting date, time, place, supervisory personnel present, subjects discussed and corrective action taken, if any. [CTSO 8406.(d)]

A-202. Supervisory personnel shall conduct "toolbox" or "tailgate" safety meetings with their crews at least weekly on the job to emphasize safety. A record of all meetings shall be logged and maintained for inspection. [CTSO 8406.(e)]

A-203. When an employee is first engaged the person in charge shall determine the extent of the employee's experience at the work for which he has been hired. The employee shall be instructed in the hazards of the job and the safe performance of the duties. [CTSO 8407.(a)]

A-204. Pre-job instruction and training shall be given to employees. [CTSO 8455.]

A-205. All employees shall be instructed in the recognition and avoidance of hazards associated with underground construction activities including, where appropriate, the following subjects:

- (a) Air monitoring;
- (b) Ventilation;
- (c) Illumination;
- (d) Communications;
- (e) Flood control;
- (f) Mechanical equipment;
- (g) Personal protective equipment;
- (h) Explosives;
- (i) Fire prevention and protection; and
- (j) Emergency procedures, including evacuation plans and check-in/check-out systems.
[29 CFR 1926.800.(d)]

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300 - Safety Precautions

A-301. Every reasonable precaution shall be taken to insure the safety of workers in all cases, whether or not provided for in these standards. [CMSO 6973.(a)]

A-302. No employee shall be permitted to work in an unsafe place unless for the purpose of making it safe and then only after proper precautions have been taken for protection while doing such work. [CMSO 6973.(b)]

A-303. Intoxicating beverages and narcotics shall not be permitted or used in or around underground operations. Persons under the influence of alcohol or narcotics shall not be permitted on the job. [CMSO 6973.(c)]

A-304. Persons shall examine their working places before starting work and frequently thereafter, and any unsafe condition shall be corrected. [CMSO 6973.(d)]

A-305. Only a bar blunt on one end shall be used for loading at chutes or for barring down loose rock in any part of the underground operation. [CMSO 6973.(e)]

A-306. All spikes, nails, and other sharp objects that protrude and may cause injury shall be bent down or removed. [CMSO 6973.(f)]

A-307. 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. [CMSO 6973.(g)]

A-308. Materials shall not be placed or permitted to remain where they can fall down a shaft, manway, winze, raise or other opening. [CMSO 6973.(h)]

A-309. Employees shall be warned when others are working above or below them so employees will not be injured by falling rock or materials. [CMSO 6973.(i)]

A-310. No other work shall be done in a working place until it has been barred down and made safe for work. The roof and sides shall be examined several times during the working shift. [CMSO 6973.(j)]

A-311. All dangerous places shall be properly fenced off, covered over or otherwise safeguarded. [CTSO 8410.(b)]

A-312. Unnecessary accumulations of muck, timber, rails and similar materials shall be avoided underground. Particular attention shall be given to the maintaining of clear areas at shaft stations and between the track and the sides of underground locations. [CTSO 8410.(k)]

A-313. Guniting and shotcreting hose ends shall be secured with safety chains, and pumpcrete lines shall be secured from accidental displacement. [CTSO 8410.(l)]

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400 - Check-in/Check-out

A-401. The employer shall maintain a check-in/check-out procedure that will ensure that above-ground personnel can determine an accurate count of the number of persons underground in the event of an emergency. [29 CFR 1926.800(c)]

A-402. At least one designated person shall be on duty above ground whenever any employee is working underground. This designated person shall be responsible for securing immediate aid and keeping an accurate count of employees underground in case of emergency. The designated person must not be so busy with other responsibilities that the counting function is encumbered. [29 CFR 1926.800(g)(3)]

500 - Visitors

A-501. Visitors shall not be allowed in any underground operation without proper safety training and shall be accompanied by a person familiar with the operation. [CTSO 8410.(f)]

600 - Care of Injured

A-601. All supervisors and at least one person on each crew shall have had first aid training within the past two years, and be competent to give proper emergency treatment. [CTSO 8421.(a)]

A-602. Some person trained in first aid shall be readily available at surface operations where five or more workers are employed at one time. [CMSO 6969.(b)]

A-603. The training shall be given by an instructor holding an effective Red Cross Instructor's Certificate, or by a licensed physician. [CMSO 6969.(c)]

A-604. Every underground operation shall be provided with an approved mine-type stretcher, a woolen blanket or equally warm covering, and a waterproof covering for injured employees unless ambulance service is readily available to all locations in the operation. [CMSO 6969.(a)]

A-605. If more than 25 persons are working underground at the same time, an additional stretcher, blanket, and waterproof covering for each 25 persons or fraction thereof shall be provided. Each stretcher shall be provided with at least 20 feet of one-half inch rope, or equivalent, for securing an injured person in the stretcher. [CMSO 6969.(b)]

A-606. First-aid materials shall be kept in dry, sanitary, and usable condition, and shall be readily available to employees. [CMSO 6969.(e)]

A-607. Water or neutralizing agents shall be available where corrosive chemicals or other harmful substances are stored, handled, or used. [CMSO 6969.(f)] (NOTE: MSDS will be utilized.)

A-608. Arrangements shall be made in advance for obtaining emergency medical assistance and transportation for injured persons. [CMSO 6969.(g)]

A-609. Emergency telephone numbers shall be posted on the safety bulletin board and at telephones and in the hoist room of underground operations. [CMSO 6969.(h)] (NOTE: A "911" Emergency notification system is operational at the NTS.)

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A-610. Some suitable means of transportation shall be readily available where the services of an ambulance cannot be secured in one hour. [CMSO 6969.(l)]

700 - Drinking Water, Change Houses, Sanitation, and Housekeeping

A-701. Fresh and pure drinking water shall be available to employees during working hours. This may be accomplished by piping water into the worksite and providing drinking fountains, or by providing individual canteens or other sanitary means. Community drinking vessels are prohibited. [CTSO 8432.]

A-702. The operator of every underground operation shall provide a dressing room or a change house, suitable for the use of workers in changing and drying clothing, at a place convenient to the underground opening. No structure made of combustible material shall be within 100 feet of such opening. Such dressing room or change house shall be provided with adequate means of heating and lighting and be equipped with shower baths having sufficient hot and cold water. An adequate number of showers shall be provided for workers on each shift working underground. These facilities shall be available to the workers at all times when they are going on or coming off shift and shall be kept in a reasonably clean and sanitary condition. [CTSO 8431.(a)]

A-703. Working clothes shall be either elevated by suitable means such as chains, to the upper air of the change house or separate adequately ventilated rooms or lockers shall be provided for drying working and changing street clothes. [CTSO 8431.(b)]

A-704. An adequate number of dry or water closets shall be provided at convenient locations on the main working levels or on the surface. Ready means of access shall be provided to each closet. [CMSO 6978.(a)] (NOTE: For purposes of this Section, "convenient" means within five minutes of travel from any working place.)

A-705. Means shall be provided for removing the contents of each closet and for cleansing of the closet. The contents shall be removed often enough to prevent the closet from becoming offensive. [CMSO 6978.(b)]

A-706. Each closet shall be provided with some disinfectant or deodorant to be sprinkled upon the contents thereof. [CMSO 6978.(c)]

A-707. All persons employed at any underground operation where closets are provided shall be required to use such closets. [CMSO 6978.(d)]

800 - Communications

A-801. During periods of major construction or repair, tunnels that will be more than 2,000 feet long shall have at least one underground telephone as soon as the length reaches 1,000 feet. Other phones are to be added as the work progresses so that there is never less than one phone to serve each length-zone of 2,000 feet, and one for any remaining zone exceeding 1,000 feet in length. They shall be conveniently located, properly identified, and tested once each shift. Arrangements shall be such that calls will be answered promptly. A telephone or communication system shall be provided when more than 5 men are underground. [CTSO 8428.(a)]

A-802. The telephone system shall be equipped with telephones on the surface and at each working level 100 feet or more below the surface. [CMSO 7164.(b)]

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A-803. Powered communication systems shall operate on an independent power supply, and shall be installed so that the use of or disruption of any one phone or signal location will not disrupt the operation of the system from any other location. [29 CFR 1926.800(f)(3)]

A-804. When a shaft-sinking or shaft-deepening operation reaches a depth of 100 feet below the shaft-sinking hoist, a telephone system shall be installed for communication between the shaft crew and the hoistman. It is recommended that a portable type of telephone be provided for the shaft crew so that it can be kept near their working place during working hours. [CMSO 7166.]

A-805. Communication systems shall be tested upon initial entry of each shift to the underground, and as often as necessary at later times, to ensure that they are in working order. [29 CFR 1926.800(f)(4)]

900 - Inspections

A-901. At least twice during each working shift, an inspection shall be made of every part of the underground operation where an employee is working or required to be in the course of his duties. One such inspection shall be made during the early part of the work shift and another inspection shall be made during the latter part of the work shift. Such inspections shall be made by a shift boss or other underground official who must be able to speak, read, and write English. [CMSO 7160.(a)]

A-902. The person who makes the inspection shall watch for unsafe conditions and practices that may cause injury to employees. Immediate hazards such as missed holes, dangerous accumulations of gases, and unguarded chutes shall be corrected without unnecessary delay. [CMSO 7160.(b)]

A-903. If any dangerous or questionable ground is found in the roof or sides, it shall promptly be made safe by one or more of the following means:

- (a) Scaling or blasting down.
- (b) Supporting.
- (c) Backfilling.
- (d) Erecting barriers with warning signs to prevent entrance to the dangerous area. [CMSO 7160.(c)]

A-904. A record of these daily inspections shall be kept.

A-905. Some competent person or persons shall make an inspection at least once each month of all active workings of the underground operation and appliances underground, and shall report any unsafe conditions to the employer, who shall take immediate steps to remedy the same. [CMSO 7162.(a)]

A-906. The entire escape exit shall be inspected at least once each month for rock falls, fire hazards, deterioration of ladders, timbers, and other equipment necessary to maintain an adequate escapeway. If any condition is found in an escape exit making it inadequate for an escapeway, repairs shall be commenced immediately and completed with reasonable diligence. A written report shall be made of the escape exit inspection. The report shall list all hazardous conditions found in the escape exit. It shall be signed by the person or persons who made the inspection, and shall be kept at the underground operations office for two years. [CMSO 7162.(b)]

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A-907. Each shaft in which men or materials are hoisted or lowered shall be inspected each week by a person who is competent to make such inspection. The person making the inspection shall list on a form all unsafe conditions found in the shaft and corrective measures necessary to make the shaft safe. The weekly shaft report shall be signed by the person who made the inspection. The weekly shaft inspection report shall be kept at the underground operations office for two years. [CMSO 7161.]

1000 - Dangerous Excavations

A-1001. Access to unattended underground openings shall be restricted by gates or doors, or the openings shall be fenced and posted. [CMSO 7178.(a)]

A-1002. Every dangerous surface excavation in which work has been discontinued, including any shaft, pit, well, septic tank, cesspool, or other abandoned excavation, shall be securely covered over, fenced, or otherwise effectively guarded and appropriate danger notices shall be posted. [CMSO 7178.(b)]

A-1003. All dangerous inactive or abandoned underground workings shall be securely covered over, fenced, or otherwise effectively guarded to prevent entrance of employees into such workings. Where the method of guarding does not positively prevent entrance into the dangerous workings, such entrance shall be plainly marked with legible signs warning unauthorized employees to keep out. [CMSO 7178.(c)]

1100 - Protection Against Water

A-1101. If failure of a water or silt retaining dam will create a hazard, it shall be of substantial construction and inspected at regular intervals. [CMSO 7175.(a)]

A-1102. No restraining dam shall be installed in any underground site where the rupture of such dam would imperil the safety of persons. [CMSO 7175.(b)]

A-1103. No underground working shall be allowed to approach within 16 feet of any part of a winze, stope, or other opening in which there is a known or suspected dangerous accumulation of water. [CMSO 7176.(a)]

A-1104. Notice shall be given to the DOE/NTSO in writing before starting to advance an underground working toward another underground working that is suspected of being filled with water. [CMSO 7176.(b)]

A-1105. A bore hole shall be drilled at least 18 feet ahead of the face when in the vicinity of underground workings suspected of containing a dangerous accumulation of water. When the exact location of such working is not known, additional bore holes at least 18 feet deep shall be drilled in other directions. [CMSO 7176.(c)]

A-1106. In every underground operation where there is danger of a sudden inburst of water, additional raises, drifts, bulkheads, or other workings shall be constructed as are necessary. [CMSO 7176.(d)]

A-1107. No underground working shall be allowed to approach within 50 feet of any stream, pond, or other body of water on the surface. [CMSO 7176.(e)]

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SECTION B - EVACUATION PLAN AND MINE RESCUE

100 - Escape and Evacuation

B-101. An emergency alarm system adequate to give warning to all employees underground shall be installed and maintained in good working order at all underground operations. Warning shall be given immediately to all persons underground upon occurrence of fire or other emergency in or near the underground workings. [CMSO 7075.(a) and (c)]

B-102. A specific escape and evacuation plan and revisions thereof suitable to the conditions and working system of the underground operation and showing assigned responsibilities of all key personnel in the event of an emergency shall be developed by the operator and set out in written form. Also, copies of the plan and revisions thereof shall be posted at locations convenient to all persons on the surface and underground. Such a plan shall be reviewed by the operator at least once every six months and updated as necessary. The plan shall include:

- (a) Underground maps or diagrams showing directions of principal air flow, location of escape routes and locations of existing telephones, primary fans, primary fan controls, fire doors, ventilation doors, and refuge chambers. Appropriate portions of such maps or diagrams shall be posted at all shaft stations and in underground shops, lunchrooms, and elsewhere in working areas where persons congregate. (NOTE: Changes to the ventilation system operation during an emergency will be made ONLY by designated persons specifically authorized to make such decisions.)
- (b) Procedures to show how persons will be notified of emergency.
- (c) An escape plan for each working area in the underground operation to include instructions showing how each working area should be evacuated. Each such plan shall be posted at appropriate shaft stations and elsewhere in working areas where persons congregate.
- (d) A fire fighting plan.
- (e) Surface procedure to follow in an emergency, including the notification of proper authorities, preparing rescue equipment, and other equipment which may be used in rescue and recovery operations.
- (f) A statement of the availability of emergency communication and transportation facilities, emergency power and ventilation and location of rescue personnel and equipment.
[30 CFR 57.11053]

B-103. When persons are working underground, a competent person designated by the underground operator shall be in attendance to take charge in case of an emergency. [30 CFR 57.18009]

B-104. Emergency telephone numbers shall be posted at appropriate telephones. [30 CFR 57.18012]

B-105. A suitable communication system shall be provided at the underground operation to obtain assistance in the event of an emergency. [30 CFR 57.18013]

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200 - Underground Evacuation Drills

B-201. At least once every six months, underground evacuation drills shall be held to assess the ability of all persons underground to reach the surface or other designated points of safety within the time limits of the self-rescue devices that would be used during an actual emergency. [30 CFR 57.4361(a)]

B-202. The evacuation drills shall:

- (a) Be held for each shift at some time other than a shift change and involve all persons underground;
- (b) Involve activation of the fire alarm system; and
- (c) Include evacuation of all persons from their work areas to the surface or to designated central evacuation points; [30 CFR 57.4361(b)]

B-203. At the completion of each drill, the operator shall certify the date and the time the evacuation began and ended. Certifications shall be retained for at least one year after each drill. [30 CFR 57.4361(c)]

300 - Underground Evacuation Instructions

B-301. At least once every twelve months, all persons who work underground shall be instructed in the escape and evacuation plans and procedures and fire warning signals in effect at the underground operation. [30 CFR 57.4363(a)]

B-302. Whenever a change is made in escape and evacuation plans and procedures for any area of the underground operation, all persons affected shall be instructed in the new plans or procedures. [30 CFR 57.4363(b)]

B-303. Whenever persons are assigned to work in areas other than their regularly assigned areas, they shall be instructed about the escapeway for that area at the time of such assignment. However, persons who normally work in more than one area of the underground operation shall be instructed at least once every twelve months about the location of escapeways for all areas of the underground operation in which they normally work or travel. [30 CFR 57.4363(c)]

B-304. At the completion of any instructions given, the underground operator shall certify the date that the instruction was given. Certifications shall be retained for at least one year. [30 CFR 57.4363(d)]

400 - Underground Emergency and Self-Rescuer Training

B-401. On an annual basis, all persons who are required to go underground shall be instructed in the Mine Safety and Health Administration approved course. The instruction shall be given by persons who are certified. [30 CFR 57.18028(a)]

B-402. On an annual basis, all persons who go underground shall be instructed in the Mine Safety and Health Administration course contained in Bureau of Mines Instruction Guide 2, "MSA W-65 Self-Rescuer" (March 1972) or Bureau of Mines Instruction Guide 3, "Permissible Drager 810 Respirator for Self-Rescue" (March 1972). The instruction shall be given by persons who are certified. Any person who has not had self-rescuer instruction within 12 months immediately preceding going underground shall be instructed in the use of self-rescuers before going underground. [30 CFR 57.18028(b)]

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B-403. All instructional material, handouts, visual aids, and other such teaching accessories used by the operator in the courses prescribed in paragraphs B-401 and B-402 of this Section shall be available for inspection. [30 CFR 57.18028(c)]

B-404. Records of all instruction shall be kept at the underground site or nearest underground operation office at least 2 years from the date of instruction. [30 CFR 57.18028(d)]

500 - Escapeways

B-501. Every underground operation shall have two separate escapeways to the surface which are so positioned that damage to one shall not lessen the effectiveness of the other, or a method of refuge shall be provided when only one opening to the surface is possible. [CMSO 7080.(a)]

B-502. Escape routes shall be:

- (a) Inspected at regular intervals and maintained in safe, travelable condition; and
- (b) Marked with conspicuous and easily read direction signs that clearly indicate the ways of escape. [30 CFR 57.11051]

B-503. The surface outlets from escape exits shall be not less than 100 feet from the exit most frequently used by the workers. The surface outlet of no two exits shall be covered by one building or by connected buildings. [CMSO 7080.(e)]

600 - Refuge Areas

B-601. Refuge areas shall be of fire-resistant construction, preferably in untimbered areas of the underground operation. [30 CFR 57.11052(a)]

B-602. Refuge areas shall be large enough to accommodate readily the normal number of persons in the particular area of the underground operation. [30 CFR 57.11052(b)]

B-603. Refuge areas shall be constructed so they can be made gastight. [30 CFR 57.11052(c)]

B-604. Refuge areas shall be provided with compressed air lines, waterlines, suitable handtools, and stopping materials. [30 CFR 57.11052(d)]

B-605. Telephone or other voice communication shall be provided between the surface and refuge areas and such systems shall be independent of the underground power supply. [CMSO 7081.(f)]

B-606. Refuge area locations shall be reviewed and evaluated during the planning of each new event.

700 - Underground Rescue Teams

B-701. The operator of underground operations shall establish at least two underground rescue teams which are available at all times when persons are underground. [30 CFR 49.2(a)(1)]

B-702. Each underground rescue team shall consist of five members and one alternate, who are fully qualified, trained, and equipped for providing emergency underground rescue service. [30 CFR 49.2(b)]

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B-703. To be considered for membership on an underground rescue team, each person must have been employed in an underground operation for a minimum of one year within the past five years. For the purpose of underground rescue work only, persons who are employed on the surface but work, regularly underground shall meet the experience requirement. The underground experience requirement is waived for those persons on an underground rescue team on the effective date of this rule. [30 CFR 49.2(c)]

B-704. Each operator shall arrange, in advance, ground transportation for rescue teams and equipment to the underground operation(s) served. [30 CFR 49.2(d)]

B-705. The required rescue capability shall be present at all existing underground operations, upon initial excavation of a new underground operation entrance, or the reopening of an existing underground operation. [30 CFR 49.2(e)]

B-706. No underground operation served by an underground rescue team shall be located more than two hours ground travel time from the underground rescue station with which the rescue team is associated. [30 CFR 49.2(f)]

B-707. Underground rescue teams shall be considered available where teams are capable of presenting themselves at the underground site(s) within a reasonable time after notification of an occurrence which might require their services. Rescue team members will be considered available even though performing regular work duties or in an off-duty capacity. The requirement that underground rescue teams be available shall not apply when teams are participating in underground rescue contests or providing services to another underground site. [30 CFR 49.2(g)]

800 - Underground Rescue Station

B-801. The operator of an underground operation shall designate, in advance, the location of the underground rescue station serving the underground operation. [30 CFR 49.5(a)]

B-802. Underground rescue stations are to provide a centralized storage location for rescue equipment. This centralized storage location may be either at the underground site, affiliated sites, or a separate underground rescue structure. [30 CFR Part 49.5b]

B-803. Underground rescue stations shall provide a proper storage environment to assure equipment readiness for immediate use. [30 CFR Part 49.5c]

B-804. Each underground rescue station shall be provided with at least the following equipment:

- (a) Twelve self-contained oxygen breathing apparatus, each with a minimum of 2 hours capacity (approved under 30 CFR, Part 11, Subpart H), and any necessary equipment for testing such breathing apparatus;
- (b) A portable supply of liquid air, liquid oxygen, pressurized oxygen, oxygen generating or carbon dioxide absorbent chemicals, as applicable to the supplied breathing apparatus and sufficient to sustain each team for six hours while using the breathing apparatus during rescue operations;
- (c) One extra oxygen bottle (fully charged) for every six self-contained compressed oxygen breathing apparatus;

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- (d) One oxygen pump or a cascading system, compatible with the supplied breathing apparatus;
- (e) Twelve permissible cap lamps and a charging rack;
- (f) Two gas detectors appropriate for each type of gas which may be encountered at the underground operation served;
- (g) Two oxygen indicators or two flame safety lamps;
- (h) One portable underground rescue communication system (approved under 30 CFR. Part 23) or a sound-powered communication system. The wires or cable to the communication system shall be of sufficient tensile strength to be used as a manual communication system. These communication systems shall be at least 1,000 feet in length; and
- (i) Necessary spare parts and tools for repairing the breathing apparatus and communication system. [30 CFR 49.6.(a)]

B-805. Underground rescue apparatus and equipment shall be maintained in a manner which will assure readiness for immediate use. A person trained in the use and care of breathing apparatus shall inspect and test the apparatus at intervals not exceeding 30 days. A record of inspections and tests, including corrective actions taken, shall be maintained at the underground rescue station for a period of one year. [30 CFR 48.6(b)]

900 - Physical Requirements for Underground Rescue Team

B-901. Each member of an underground rescue team shall be examined annually by a physician who shall certify that each person is physically fit to perform underground rescue and recovery work for prolonged periods under strenuous conditions. The first such physical examination shall be completed within 60 days prior to scheduled initial training. A team member requiring corrective eyeglasses will not be disqualified provided the eyeglasses can be worn securely within an approved facepiece. [30 CFR 48.7(a)]

B-902. In determining whether a person is physically capable of performing underground rescue duties, the physician shall take the following conditions into consideration:

- (a) Seizure disorder;
- (b) Perforated eardrum;
- (c) Hearing loss without a hearing aid greater than 40 decibels at 400, 1,000 and 2,000 Hz;
- (d) Repeated blood pressure (controlled or uncontrolled by medication) reading which exceeds 160 systolic, or 100 diastolic, or which is less than 105 systolic, or 60 diastolic;
- (e) Distant visual acuity (without glasses) less than 20/50 Snellen scale in one eye, and 20/70 in the other;
- (f) Heart disease;
- (g) Hernia;

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- (h) Absence of a limb or hand; or
- (i) Any other condition which the examining physician determines is relevant to the question of whether the person is fit for rescue team service. [30 CFR 49.7.(b)]

B-903. The operator shall have a form comparable to MSHA 5000-3 certifying medical fitness completed and signed by the examining physician for each member of an underground rescue team. These forms shall be kept on file at the underground rescue station for a period of one year. [30 CFR 49.7(c)]

1000 - Training for Underground Rescue Teams/Event Reentry Teams

B-1001. Prior to serving on an underground rescue team each member shall complete, at a minimum, an initial 20-hour course of instruction in the use, care, and maintenance of the type of breathing apparatus which will be used by the underground rescue team. [30 CFR 49.8(a)]

B-1002. Upon completion of the initial training, all team members shall receive at least 40 hours of refresher training annually. This training shall be given at least 4 hours each month, or for a period of 8 hours every two months. This training shall include:

- (a) Sessions underground at least once each 6 months;
- (b) The wearing and use of the breathing apparatus by team members for a period of at least two hours while under oxygen every two months;
- (c) Where applicable, the use, care, capabilities, and limitations of auxiliary underground rescue equipment, or a different breathing apparatus;
- (d) Advanced mine rescue training and procedures; as prescribed by MSHA's Office of Educational Policy and Development; and
- (e) Underground map training and ventilation procedures. [30 CFR 49.8(b)]

B-1003. An underground rescue team member will be ineligible to serve on a team if more than 8 hours of training is missed during one year, unless additional training is received to make up for the time missed. [30 CFR 49.8(c)]

B-1004. The training courses required by this Section shall be conducted by approved instructors. The training courses required by this section shall be conducted by instructors who have been employed in an underground mine for a minimum of one year within the past five years, and who have received MSHA approval through:

- (a) Completion of an MSHA or State approved instructors training course and the program of instruction in the subject matter to be taught. [30 CFR 49.8(d)]

B-1005. An instructor's approval for mine rescue training may be revoked for good cause. A written statement revoking the approval together with reasons for revocation shall be provided the instructor. [30 CFR 49.8(e)]

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B-1006. A record of training of each team member shall be on file at the underground rescue station for a period of one year. [30 CFR 49.8(f)]

[NOTE: Section 1100 has been combined with Section 1000]

1200 - Underground Emergency Notification Plan

B-1201. Each underground operation shall have an underground rescue notification plan outlining the procedures to follow in notifying the underground rescue teams when there is an emergency that requires their services. [30 CFR 49.9(a)]

B-1202. A copy of the underground rescue notification plan shall be posted at the underground operation for the underground workers' information. [30 CFR 49.9(b)]

1300 - Underground Rescue Team Operation

B-1301. Except in extreme emergency, only a full rescue crew of not less than five persons shall be permitted to wear breathing apparatus in irrespirable air in any underground operation during an underground fire or for recovery work following an underground explosion. [CMSO 7086.(f)]

B-1302. Except in extreme emergency, no rescue crew shall be permitted to wear breathing apparatus in irrespirable air unless a fully equipped reserve rescue crew is standing by, ready for service, in the most advanced fresh air station. [CMSO 7086.(g)]

B-1303. Communication shall be maintained between the reserve rescue crew and the rescue crew in irrespirable air by means of a signal line. [CMSO 7086.(h)]

B-1304. Care shall be used that the rescue crew does not proceed farther from its fresh air base than it can return safely to such base. [CMSO 7086.(i)]

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SECTION C - PERSONAL PROTECTIVE EQUIPMENT

100 - Personnel Protection (Head, Foot, Eye, Ear, Hand, Skin, Clothing)

C-101. Personal protective equipment shall be maintained in good operating and sanitary condition. Records shall be kept of the issuance of such equipment to each employee. [CTSO 8414.(g)]

C-102. Every employee shall be provided with and required to wear acceptable head protection. Winter liners shall be provided when weather conditions warrant. [CTSO 8414.(a)]

C-103. Every employee exposed to foot injuries shall be required to wear protective footwear. [CTSO 8414.(b)]

C-104. Acceptable eye protection shall be provided and used where eye hazards from flying particles, hazardous substances or injurious light rays are present. Particular attention shall be given to operations involving sandblasting, cleaning with air and water, guniting, welding and shotcreting. [CTSO 8414.(d)]

C-105. When required, acceptable ear protection shall be provided by the employer and shall be worn by the employee. Employees and other persons shall be instructed in the use and care of such ear protection equipment. Whenever the operations reasonably permit, exposures to excessive noise shall be eliminated or at least reduced by engineering or operational controls. [CTSO 8414.(f)] (NOTE: Control of occupational noise exposure shall satisfy the requirements of 29 CFR 1910.95.)

C-106. Protection for the hands and other exposed skin areas shall be provided and used where work involves exposure to cuts, burns, electric shock, corrosives, irritants or other harmful substances, where appropriate. [CTSO 8414.(c)]

C-107. Where the occupational duties of the employee expose him to certain irritants, facilities for proper cleansing of the skin shall be required for the prevention of skin disorders. [CTSO 8414.(e)(4)]

C-108. Clothing appropriate for the work being done shall be worn. Loose clothing shall not be worn around machinery in which it might become entangled. [CTSO 8414.(e)(2)]

200 - Safety Belts and Lifelines

C-201. Safety belts and lines shall be worn when persons work where there is danger of falling. No employee shall be permitted to enter any bin, bunker, or other storage place containing materials which may cave or run unless he is provided with and is wearing a safety belt with life line attached. He shall be attended by another workman, who shall keep the life line reasonably taut at all times. [CMSO 6981.(a)]

C-202. Safety belts and life lines shall be inspected by a qualified person before each use. When fiber ropes show serious abrasion, broken fibers, cuts, fraying, or other defects, such defects shall be reported to the person in charge. [CMSO 6981.(d)]

C-203. Safety belts shall be of an approved type. [CMSO 6981.(f)]

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C-204. Life lines shall meet the following requirements:

- (a) Life lines shall be of three-fourths inch diameter Manila rope or equivalent.
- (b) Life lines subject to excessive fraying or rock damage shall be protected or shall have wire center rope. Seriously worn or damaged rope shall be promptly removed from service.
- (c) When in use, the life line shall be secured so as to prevent it from being accidentally loosened or dislodged. [CMSO 6981.(b), (c), and (e)]

300 - Respirators

C-301. Respirators used at NTS underground operations shall meet the requirements of 29 CFR 1926.103 (Respiratory Protection).

400 - Self Rescuers

C-401. A 1-hour self-rescue device approved by the Mine Safety and Health Administration shall be made available by the operator to all personnel underground. Each operator shall maintain self-rescue devices in good condition. [30 CFR 57.15030]

C-402. Except as provided in C-403 and C-404 below, self-rescue devices meeting the requirements of C-401 shall be worn or carried by all persons underground. [30 CFR 57.15031(a)]

C-403. Where the wearing or carrying of self-rescue devices is hazardous to a person, such self-rescue devices shall be located at a distance no greater than 25 feet from such person. [30 CFR 57.15031(b)]

C-404. Where a person works on or around mobile equipment, self-rescue devices may be placed in a readily accessible location on such equipment. [30 CFR 57.15031(c)]

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SECTION D - VENTILATION, AIR QUALITY, AND RADIATION

100 - Ventilation

D-101. Fresh air shall be supplied to all underground work areas in sufficient quantities to prevent dangerous or harmful accumulation of dusts, fumes, mists, vapors or gases. [29 CFR 1926.800(k)(1)(i)]

D-102. Mechanical ventilation shall be provided in all underground work areas except when the employer can demonstrate that natural ventilation provides the necessary air quality through sufficient air volume and air flow. [29 CFR 1926.800(k)(1)(ii)]

D-103. A minimum of 200 cubic feet of fresh air per minute shall be supplied for each employee underground. [29 CFR 1926.800(k)(2)] (NOTE: See Addendum A for situations where air quantity and velocity cannot be met and equal or better safety and health will be provided by air quality monitoring.)

D-104. The linear velocity of air flow in shafts and in all other underground work areas shall be at least 30 feet per minute where blasting or rock drilling is conducted, or where other conditions likely to produce dust, fumes, mists, vapors, or gases in harmful or explosive quantities are present. The linear velocity of the air flow in the main access drift of an underground operation shall not be less than 60 feet per minute. [29 CFR 1926.800(k)(3) and CTSO 8437.(a)] (NOTE: See Addendum A for situations where air quantity and velocity cannot be met and equal or better safety and health will be provided by air quality monitoring.)

D-105. Where workings are of such size or shape that air does not circulate satisfactorily in the vicinity of the workers, auxiliary ventilation shall be used. [CMSO 7098.(c)]

D-106. Auxiliary fans underground shall be located so as to provide the best air available to the working place. Recirculation of air by auxiliary fans shall be avoided as far as practical. [CMSO 7099.(d)]

D-107. Where flammable gas or air contaminants have been encountered, adequate ventilation shall be maintained to keep the gas or vapor concentrations within safe limits as provided by the Threshold Limit Values®. [CTSO 8437.(e)]

D-108. Fans shall be so arranged that the underground entrances can be used for rescue or other purposes. [CMSO 7099.(b)]

D-109. The main ventilation system shall be so arranged that the air flow can be reversed from the surface if a fire or some other emergency makes this advisable. [CTSO 8437.(b)] (NOTE: Changes to the ventilation system operation during an emergency shall be made ONLY by designated persons specifically authorized to make such decisions. See B-102(a).)

D-110. All surface fans, casings, and air ducts shall be constructed entirely of noncombustible materials. [CMSO 7099.(e)]

D-111. Every fan house and every building within 50 feet of a fan house shall be constructed entirely of noncombustible material, or shall be made fire resistant by the use of gunite, cement plaster, metal sheathing, or by other equally effective means. [CMSO 7099.(f)]

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D-112. Compressed air that does not contain smoke, harmful gases, or excessive oil may be used for ventilating purposes. [CMSO 7099.(g)]

D-113. Where underground fans are operated by electricity, all combustible material in the immediate vicinity shall be removed or made fire resistant. [CMSO 7099.(h)]

D-114. Ventilation doors shall be designed and installed so that they remain closed when in use, regardless of the direction of the air flow. [29 CFR 1926.800(k)(6)]

D-115. Whenever the ventilation system has been shut down with all employees out of the underground area, only competent persons authorized to test for air contaminants shall be allowed underground until the ventilation has been restored and all affected areas have been tested for air contaminants and declared safe. [29 CFR 1926.800(k)(8)]

D-116. Unventilated areas shall be sealed or barricaded and posted against entry. [CMSO 7098.(g)]

200 - Ventilation Plan

D-201. A plan of the underground ventilation system shall be set out by the employer in written form. Revisions of the system shall be noted and updated at least annually. The plan shall, where applicable, contain the following:

- (a) The location of the underground operation.
- (b) The current underground map or schematic or series of maps or schematics of an appropriate scale, not greater than five hundred feet to the inch, showing:
 - (1) Direction and quantity of principal air flows;
 - (2) Locations of seals used to isolate abandoned workings;
 - (3) Locations of areas withdrawn from the ventilation system;
 - (4) Locations of all main, booster and auxiliary fans not shown in paragraph (d) of this section;
 - (5) Locations of air regulators and stoppings and ventilation doors not shown in paragraph (d) of this section;
 - (6) Locations of overcasts, undercasts and other airway crossover devices not shown in paragraph (d) of this section;
 - (7) Locations of known oil or gas wells;
 - (8) Locations of known underground openings adjacent to the underground operation;
 - (9) Locations of permanent underground shops, diesel fuel storage depots, oil fuel storage depots, hoist rooms, compressors, battery charging stations and explosive storage facilities. Permanent facilities are those intended to exist for one year or more; and
 - (10) Significant changes in the ventilation system projected for one year.

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- (c) Fan data for all active main and booster fans including manufacturer's name, type, size, fan speed, blade setting, approximate pressure at present operating point, and motor brake horsepower rating.
- (d) Diagrams, descriptions or sketches showing how ventilation is accomplished in each typical type of working place including the approximate quantity of air provided, and typical size and type of auxiliary fans used.
- (e) The number and type of internal combustion engine units used underground, including make and model of unit, type of engine, make and model of engine, brake horsepower rating of engine, and approval number. [30 CFR 57.8520]

300 - Air Quality and Testing

D-301. Air quality limits and control requirements for underground operations are found in 29 CFR 1926.55 (Gases, Vapors, Fumes, Dusts, and Mists) except as modified by the paragraphs of this subsection. [29 CFR 1926.800(j)(1)]

D-302. The employer shall assign a competent person who shall perform all air monitoring required. Where this subsection requires monitoring of airborne contaminants "as often as necessary," the competent person shall make a reasonable determination as to which substances to monitor and how frequently to monitor, considering at least the following factors:

- (a) Location of jobsite: Proximity to fuel tanks, sewers, gas lines, and old landfills;
- (b) History: Presence of air contaminants in nearby jobsites, changes in levels of substances monitored on the prior shift; and
- (c) Work practices and jobsite conditions: The use of diesel engines, use of explosives, use of fuel gas, volume and flow of ventilation, visible atmospheric conditions, decompression of the atmosphere, welding, cutting and hot work, and employees physical reactions to working underground. [29 CFR 1926.800(j)(1)(i)(A) and (B)]

D-303. The atmosphere in all underground work areas shall be tested as often as necessary to assure that the atmosphere at normal atmospheric pressure contains at least 19.5 percent oxygen and no more than 22 percent oxygen. Tests for oxygen content shall be made before tests for air contaminants. [29 CFR 1926.800(j)(1)(ii)(A) and (B)]

D-304. The atmosphere in all underground work areas shall be tested quantitatively for methane and other flammable gases as often as necessary. [29 CFR 1926.800(j)(1)(iii)(B)] (NOTE: Where action is required, that action shall satisfy D-308, D-309, and D-310 as necessary.)

D-305. If diesel-engine or gasoline-engine driven ventilating fans or compressors are used, an initial test shall be made of the inlet air of the fan or compressor, with the engines operating, to ensure that the air supply is not contaminated by engine exhaust. [29 CFR 1926.800(j)(1)(iii)(C)]

D-306. Testing shall be performed as often as necessary to ensure that the ventilation requirements of subsection 100 of this Section are met. [29 CFR 1926.800(j)(1)(iii)(D)]

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D-307. When the competent person determines, on the basis of air monitoring results or other information, that air contaminants may be present in sufficient quantity to be dangerous to life, the employer shall:

- (a) Prominently post a notice at all entrances to the underground jobsite to inform all entrants of the hazardous condition; and
- (b) Ensure that the necessary precautions are taken. [29 CFR 1926.800(j)(1)(vi)]

D-308. Whenever five percent or more of the lower explosive limit for methane or other flammable gases is detected in any underground work areas(s) or in the air return, steps shall be taken to increase ventilation air volume or otherwise control the gas concentration, unless the employer is operating in accordance with the potentially gassy or gassy operation requirements. Such additional ventilation controls may be discontinued when gas concentrations are reduced below five percent of the lower explosive limit, but shall be reinstituted whenever the five percent level is exceeded.
[29 CFR 1926.800(j)(1)(vii)]

D-309. Whenever 10 percent or more of the lower explosive limit for methane or other flammable gases is detected in the vicinity of welding, cutting, or other hot work, such work shall be suspended until the concentration of such flammable gas is reduced to less than 10 percent of the lower explosive limit.
[29 CFR 1926.800(j)(1)(viii)]

D-310. Whenever 20 percent or more of the lower explosive limit for methane or other flammable gases is detected in any underground work area(s) or in the air return:

- (a) All employees, except those necessary to eliminate the hazard, shall be immediately withdrawn to a safe location above ground; and
- (b) Electrical power, except for acceptable pumping and ventilation equipment, shall be cut off to the area endangered by the flammable gas until the concentration of such gas is reduced to less than 20 percent of the lower explosive limit. [29 CFR 1926.800(j)(1)(ix)]

D-311. A record of all air quality tests shall be maintained aboveground at the worksite. The record shall include the location, date, time, substance and amount monitored. Records of exposures to toxic substances shall be retained in accordance with 29 CFR 1910.20 (Access to Employee Exposure and Medical Records). All other air quality test records shall be retained until completion of the project.
[29 CFR 1926.800(j)(3)]

400 - Environmental Controls

D-401. The exposure to airborne contaminants of a person working underground shall not exceed, on the basis of a time-weighted average, the threshold limit values adopted by the most recent edition of American Conference of Governmental Industrial Hygienists. Excursions above the listed threshold limit values shall not be of a 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 - for example, nitrogen dioxide. [CMSO 7090.(a)]

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D-402. Employees shall be withdrawn from areas 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. [CMSO 7090.(b)]

D-403. Dust, gas, mist, and fume surveys shall be conducted as frequently as necessary to determine the adequacy of control measures. [CMSO 7090.(d)]

D-404. Respirators shall not be substituted for environmental control measures. However, where environmental controls have not been developed or when necessary by nature of the work involved (for example, welding, sandblasting, lead burning), a person may work for reasonable periods of time in concentrations of airborne contaminants which exceed ceiling "C" limits or the limit of permissible excursions referred to in paragraphs T-401 and T-402 above, if such person wears a NIOSH/MSHA-approved respiratory protective device as protection against the particular hazards involved. [CMSO 7090.(e)]

D-405. Carbon tetrachloride shall not be used unless under strict environmental controls. [CMSO 7090.(f)]

D-406. Dusts suspected of being explosive shall be tested for explosibility. If tests prove positive, appropriate control measures shall be taken. [CMSO 7090.(g)]

500 - Rock and Concrete Dust Control

D-501. When drilling rock or concrete, appropriate dust control measures shall be taken to maintain dust levels within limits set in 29 CFR 1926.55 (Gases, Vapors, Fumes, Dusts, and Mists). Such measures may include, but are not limited to, wet drilling, the use of vacuum collectors, and water mix spray systems. [29 CFR 1926.800(k)(9)]

D-502. Rock drilling in underground locations is prohibited unless the dust is controlled by wet drilling or other acceptable means. [CMSO 7093.(b)]

D-503. During wet drilling, the water flow shall be maintained continuously whenever the drill is in operation, including the period of collaring or starting the hole. [CMSO 7093.(d)]

D-504. Water for wet drilling shall be supplied to the drill in adequate quantities at a pressure of at least 40 psi. Should the water supply or pressure for wet drilling become inadequate, such drilling shall be stopped immediately. [CMSO 7093.(e) and (f)]

D-505. The muck pile shall be wet down before mucking begins and shall be kept wet during the entire mucking operation to control the dust. It is recommended that a continuous spray of water be maintained on muck piles where mucking machines are being operated. [CMSO 7094.(a)]

D-506. Water sprinklers shall be installed and used on all chutes from which dusty rock is taken, or other equally effective means shall be used to prevent harmful accumulations of dust in the atmosphere. [CMSO 7094.(b)]

D-507. Whenever a sprinkling device is installed at a chute, it shall be so placed that it can be operated by the workmen who operate the chute gates. The spray shall be directed into the chute and away from the operator's position at the chute. [CMSO 7094.(c)]

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D-508. To prevent spillage from loaded cars and trackless haulage vehicles from adding to the underground dust, the loaded car or vehicle shall not be moved away from the loading spot until the load has been trimmed and leveled so as to prevent spillage. [CMSO 7094.(d)]

D-509. Effective means shall be used to control the dust in manways, haulageways, and other parts of the underground jobsite. It is recommended that dust on haulageways be controlled with water or other equally effective means. In areas of water scarcity, it is recommended that water for dust control be treated with a wetting agent to increase its efficiency. [CMSO 7094.(e)]

D-510. Dust from concrete finishing and grinding operations shall be controlled by use of water or other effective means. [CMSO 8438.(g)]

D-511. Water sprays or other effective methods shall be used to control dust at the face, conveyor transfer points, and other dusty locations. Dust enclosures, dust collectors, and exhaust ventilation shall be used when necessary to control dust. [CTSO 8458]

600 - Control of Dust, Smoke, and Gases After Blasting

D-601. Except as provided in paragraph D-602 below, no blasting shall be done underground during the working shift, except where the ventilating currents are arranged so that dust, smoke, and gases from the blast go out of the worksite without circulating through any active working place. [CMSO 7095.(a)]

D-602. Where it is necessary to do blasting during the working shift and the ventilating currents pass from the blast area through active mine workings, all employees shall be removed from such workings to the fresh air side of the blast area before the shots are fired. [CMSO 7095.(b)]

D-603. After a blast, employees shall not be required or permitted to return to their working places until the atmosphere of such places is reasonably free of smoke, dust, and gases from the blast. [CMSO 7095.(c)]

700 - Underground Radiation Hazards

D-701. For control of underground radiation hazards, the requirements of 29 CFR 1926.53 (Ionizing Radiation), DOE Order 5480.6, Radiological Control Manual, and the REECO Health Protection Department publications, "Tunnel Support Manual" and "General Monitoring Procedures" shall apply.

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SECTION E - ILLUMINATION, EMERGENCY LIGHTING, AND LASERS

100 - Illumination Levels

E-101. Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lighted to not less than the minimum illumination intensities listed in the following table while any work is in progress.

MINIMUM ILLUMINATION
INTENSITIES IN FOOT-CANDLES

Foot-candles:	Area or Operation:
5	General construction area lighting.
3	General construction areas, concrete placement, excavation and waste areas, access-ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts and general underground work areas: (EXCEPTION: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading.)
10	General construction plant and shops (e.g. batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active storerooms, barracks or living quarters, locker or dressing rooms, mess halls, and indoor toilets and workrooms).
30	First aid stations, infirmaries, and offices.

[29 CFR 1926.56(a)]

E-102. For areas or operations not covered above, refer to the ANSI/IES RP7, Practice for Industrial Lighting, for recommended values of illumination. [29 CFR 1926.56(b)]

200 - Emergency Lighting and Cap Lamps

E-201. Each employee underground shall have an acceptable portable hand lamp or cap lamp in his or her work area for emergency use, unless natural light or an emergency lighting system provides adequate illumination for escape. [29 CFR 1926.800(g)(4)]

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300 - Laser Safety (Nonionizing Radiation)

E-301. Only qualified and trained employees shall be assigned to install, adjust, and operate laser equipment. [29 CFR 1926.54(a)]

E-302. Proof of qualification of the laser equipment operator shall be available and in possession of the operator at all times. [29 CFR 1926.54(b)]

E-303. Employees, when working in areas in which a potential exposure to direct or reflected laser light greater than 0.005 watts (5 milliwatts) exists, shall be provided with antilaser eye protection devices. [29 CFR 1926.54(c)]

E-304. Areas in which lasers are used shall be posted with standard laser warning placards. [29 CFR 1926.54(d)]

E-305. Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time, such as during lunch hour, overnight, or at change of shifts, the laser shall be turned off. [29 CFR 1926.54(e)]

E-306. Only mechanical or electronic means shall be used as a detector for guiding the internal alignment of the laser. [29 CFR 1926.54(f)]

E-307. The laser beam shall not be directed at employees. [29 CFR 1926.54(g)]

E-308. When it is raining or snowing, or when there is dust or fog in the air, the operation of laser systems shall be prohibited where practicable; in any event, employees shall be kept out of range of the area of source and target during such weather conditions. [29 CFR 1926.54(h)]

E-309. Laser equipment shall bear a label to indicate maximum output. [29 CFR 1926.54(i)]

E-310. Employees shall not be exposed to light intensities above:

- (a) Direct staring: 1 micro-watt per square centimeter;
- (b) Incidental observing: 1 milliwatt per square centimeter;
- (c) Diffused reflected light: 2 1/2 watts per square centimeter. [29 CFR 1926.54(j)]

E-311. Laser unit in operation should be set up above the heads of the employees, when possible. [29 CFR 1926.54(k)]

E-312. Employees shall not be exposed to microwave power densities in excess of 10 milliwatts per square centimeter. [29 CFR 1926.54(l)]

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SECTION F - ACCESS, EGRESS AND TRAVELWAYS

100 - Travelways

F-101. Clear unobstructed walkways shall be maintained throughout the underground workings. It is recommended that the walkway be located on the lighted side of the underground workings unless other conditions preclude this side. [CTSO 8490.(a)]

F-102. Workers shall be protected from sump holes or other excavations which might cause tripping or falling, by secure barricades, covers, or railings. Abandoned sumps shall be filled. [CTSO 8490.(b)]

F-103. Where practicable, walkways shall be separate and apart from railway or vehicle roads. [CMSO 7046.(a)] (Also see J-1401)

F-104. Walkways shall be kept free from stumbling hazards. [CMSO 7046.(b)]

F-105. Safe means of access shall be provided and maintained to all working places. [CMSO 7046.(d)]

F-106. Openings above, below, or near travelways through which persons or materials may fall shall be protected by railings, barriers, or covers. Where it is impractical to install such protective devices, adequate warning signals shall be installed. [CMSO 7046.(e)]

F-107. Crossovers, walkways, ramps, stairways, railings, and toeboards shall be constructed, installed, and maintained in conformance with 29 CFR 1926 Subpart M (Floors and Wall Openings). [CMSO 7046.(f)]

F-108. The employer shall control access to all openings to prevent unauthorized entry underground. Unused chutes, manways, or other openings shall be tightly covered, bulkheaded, or fenced off, and shall be posted with warning signs indicating "Keep Out" or similar language. Completed or unused sections of the underground facility shall be barricaded. [29 CFR 1926.800(b)(3)]

F-109. Ready access and escape exit shall be provided for workers at a heading. [CTSO 8459.(g)]

F-110. Any manway through which employees are required or permitted to pass shall be kept in good repair to allow ready passage. [CMSO 7044.(m)]

F-111. Active manways, shafts, and winzes shall be kept clear of loose rocks and other obstructions. [CMSO 7062.(d)]

F-112. Trap doors or adequate guarding shall be provided in ladderways at each level. Doors shall be kept operable so that they are easily opened. [CMSO 7044.(n)]

200 - Ladders

(Surface)

F-201. Ladders used in surface operations shall be constructed, installed, and maintained in conformance with provisions of 29 CFR 1926 Subpart L (Ladders and Scaffolding). [CMSO 7040.]

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(Underground - Wooden)

F-202. Wooden ladders shall be substantially constructed of sound lumber of strength equivalent to No. 1 Select Douglas Fir of the following dimensions:

- (a) Side rails shall be not less than 2 inches by 4 inches nominal, in cross section;
- (b) Ladder steps shall be clear, straight-grained, and absolutely free of knots;
- (c) Ladder steps shall be not less than 1 inch by 4 inches nominal, in cross section.
[CMSO 7041.(a)]

F-203. The distance between the tops of the steps of a ladder shall not exceed 14 inches and shall not vary more than 1 inch in any one ladderway. [CMSO 7041.(b)]

F-204. Ladders shall be constructed so there is at least 10 inches clear space between the side rails.
[CMSO 7041.(c)]

F-205. Ladder steps shall be securely fastened to the side rails with nails or other equivalent fastenings, and shall be secured against pulling loose by one or more of the following methods:

- (a) Mortised in the side rails so as to be flush with the surface, provided this is done without unduly weakening the side rails;
- (b) Fastened to the surface of the side rails with filler pieces between the ends of the steps. Filler pieces shall be the same width as the side rail and the same thickness as the ladder steps;
- (c) Fastened on the surface of the side rails with continuous wooden strips nailed over the ends of the steps for the full length of the ladder. [CMSO 7041.(d)]

F-206. Nails and other metal fasteners used in ladders that are exposed to corrosive water or corrosive underground atmosphere shall be made of metal that is resistant to corrosion of the type to which they are exposed. [CMSO 7041.(e)]

(Underground - Metal)

F-207. Metal ladders shall be substantially constructed. Side rails shall have at least equal strength as that of No. 1 Select Douglas Fir, 2 inches by 4 inches in cross section. [CMSO 7042.(a)]

F-208. Steps shall be secured to the side rails in such manner as to prevent them from coming loose.
[CMSO 7042.(b)]

F-209. Round ladder steps shall be at least 1-inch outside diameter. The steps of metal ladders shall be smooth and free of ribs or projections. [CMSO 7042.(c)]

F-210. The distance between the tops of the steps of a ladder shall not exceed 14 inches and shall not vary more than 1 inch in any one ladderway. [CMSO 7042.(d)]

F-211. Ladders shall be constructed so there is at least 10 inches clear space between the side rails.
[CMSO 7042.(e)]

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F-212. Metal ladders and ladder fasteners for use where exposed to corrosive waters or corrosive underground atmosphere shall be constructed of materials that are resistant to corrosion of the type to which they are exposed. [CMSO 7042.(f)]

(Underground - Flexible)

F-213. Flexible ladders shall have sides made of chain, connecting links, wire rope, or fiber rope. [CMSO 7043.(a)]

F-214. Each side of a flexible ladder shall have a tensile strength not less than that of 1-inch best Manila rope. If chain is used, the links shall be made of stock not less than three-eighths inch. [CMSO 7043.(b)]

F-215. There shall be at least 12 inches of clear space between the sides of a flexible ladder. [CMSO 7043.(c)]

F-216. Each step of a flexible ladder shall be made of stiff material and shall be strong enough to safely support a weight of 300 pounds at the center of the step. The distance between the tops of the steps of a ladder shall not exceed 14 inches. [CMSO 7043.(d)]

F-217. The steps shall be fastened to the sides in such manner that they will be held securely in place without damage to the sides of the ladder. [CMSO 7043.(e)]

300 - Manway and Ladder Installation

F-301. No ladder or stair need be provided in a passageway if the slope is less than 20 degrees from the horizontal and the footing is such that persons can walk safely. [CMSO 7044.(b)]

F-302. Every ladderway having an inclination of more than 60 degrees from the horizontal, and where the distance between the top and bottom of the ladderway is more than 30 feet, shall have substantial platforms at intervals of not more than 20 feet. If possible, the sections of the ladders shall be staggered at each platform so that no section shall be directly in line with the section above or below it. [CMSO 7044.(c)]

F-303. The ladder opening in any platform shall be large enough to permit ready passage of rescue persons wearing breathing apparatus, and in no case shall such opening be less than 24 inches by 24 inches. [CMSO 7044.(d)]

F-304. Distance from the step to the nearest permanent object on the climbing side of the ladder shall not be less than 24 inches. There shall be a clear width of at least 12 inches from the center line of the ladder on each side across the front of the ladder. [CMSO 7044.(e)]

F-305. The front side of the step of a ladder shall in no case be less than 4 inches from any obstruction. [CMSO 7044.(f)]

F-306. Ladders shall project at least 3 feet above every platform in the ladderway, and at least 3 feet above the collar of the shaft, winze, or raise, unless convenient and secure hand holds are fixed at such places. [CMSO 7044.(g)]

F-307. All ladders shall be securely fastened. [CMSO 7044.(h)]

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F-308. Under no circumstances shall any ladder be installed in such manner that it leans backwards from the vertical. [CMSO 7044.(i)]

F-309. In all shafts which are in the process of sinking or enlarging, a fixed ladder, stair, or ramp shall be provided to within such distance from the bottom of the shaft as will secure it from the danger of blasting. Access shall be provided from the bottom of the shaft to the bottom of the fixed ladder, stair, or ramp. Such access may be by means of an extension ladder or flexible ladder or by a handline or chain. [CMSO 7044.(j)]

F-310. Ladders, stairways, and ramps shall be installed at such distance from power and light wires that a person on them cannot accidentally contact an electric conductor. [CMSO 7044.(k)]

F-311. Every shaft shall be provided with a continuous means of egress from the bottom of such shaft to the nearest active underground level. Such means of egress may be by stairs or fixed ladders or ramps, or by a combination of the above. [CMSO 7044.(l)]

400 - Shafts

F-401. A safe means of access and egress shall be provided for all shafts and inclines. If a ladderway is used for this purpose, it may terminate above the bottom provided that chain, wire, rope, or wooden extension ladders extend the remaining distance.

Ramps for inclinations of 0° to 20°.

Stairways for inclinations of 20° to 45°.

Ladders for inclinations of 35° to 90°.

[CTSO 8497.(a)]

F-402. No shaft or incline used for hoisting shall have the center line of the ladder width closer than 36 inches from any part of the moving skip, cage or bucket. Unless ladderway is in a separate, closed compartment, it shall be used only in emergency or occasional service. [CTSO 8497.(b)]

F-403. All ladders shall be of such design, material, and construction that they will safely support all normal loads imposed upon them. Side rails of wood construction shall be the equivalent of Douglas Fir graded as suitable for a bending stress of 1,500 psi and shall not have knots, except for an occasional one less than one-half inch in diameter that appears only on the wide face and is at least one-half inch back from either edge. [CTSO 8497.(c)]

F-404. Every shaft ladderway more than 30 feet in length shall have an enclosed manway with platforms at intervals not exceeding 20 feet or a ladder cage. In all vertical shafts and where practicable in incline shafts (more than 60°), the sections of the ladders shall be staggered at each platform so that no section shall be directly in line with the section above or below it. [CTSO 8497.(d)]

F-405. All outside edges of platforms shall be protected by railings. [CTSO 8497.(e)]

F-406. All ladders shall be securely fastened. [CTSO 8497.(g)]

F-407. Under no circumstances shall any ladder be installed inclining backward from the vertical. [CTSO 8497.(h)]

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F-408. Ladderways and platforms shall be kept clear of loose rock and obstructions. [CTSO 8497.(I)]

500 - Scaffolds

F-501. Scaffolds and working platforms shall be of substantial construction and provided with guardrails and maintained in good condition. Floor boards shall be laid properly and the scaffolds and working platform shall not be overloaded. Working platforms shall be provided with toeboards when necessary. Scaffolds shall be in conformance with 29 CFR 1926 Subpart L (Ladders and Scaffolds). [CMSO 7048.]

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SECTION G - FIRE PREVENTION AND CONTROL

100 - Fire Alarm System

G-101. Fire alarm systems shall be provided and maintained in operating condition or adequate fire alarm procedures shall be established to warn promptly all persons endangered by a fire.
[CMSO 7055.(n)]

200 - Fire Fighting Equipment

G-201. Each underground operation shall have available or be provided with suitable fire-fighting equipment adequate for the size of the operation. **[CMSO 7055.(j)]**

G-202. Firefighting equipment which is provided on the underground property shall be strategically located, readily accessible, plainly marked, properly maintained, and inspected periodically. Records shall be kept of such inspections. **[CMSO 7055.(k)]**

G-203. One or more fire extinguishers of a type suitable for use underground shall be provided at all locations where electrical equipment is in service in the underground. **[CMSO 7063.(a)]**

G-204. Underground operations in which the main working shaft is timbered and such timber is not protected against fire by being made fire resistant or by being constantly wet shall be provided with water and equipment for fighting fires as follows:

- (a) A supply of water so distributed that a stream of water can be made readily available at any underground station at which a fire hazard exists and throughout all combustible portions of the shaft. "Readily available" means that all necessary piping, valves, and hose connections must be in place and a supply of hose sufficient for the need kept conveniently near such hose connections. Attention is called to the advisability of having connections for hose so placed that a stream of water can be directed upon any station from above and below the station in the event of a fire at the station.
- (b) Hose shall be kept at the underground entrances, on each working level, and at such other places as may be required.
- (c) The threads and couplings for hose for fighting fire shall be of standard sizes so that hose coupling of a given size may be readily connected to a pipe coupling of like size.
- (d) All equipment intended solely for fire fighting purposes shall be tested or carefully inspected at monthly intervals and defective equipment repaired or replaced immediately.
- (e) Special provision shall be made to protect fire extinguishers whose effectiveness is destroyed by cold.
- (f) The location of each fire extinguisher shall be marked conspicuously so that it may be easily found in an emergency. **[CMSO 7063.(d) and (e)]**

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300 - Smoking, Open Flames and Other Heat Sources

G-301. No person shall smoke or use an open flame:

- (a) Where flammable solvents, liquids, fluids, or other flammable materials are stored, transported, handled, or used; or
- (b) Where oil or grease is stored, transported, handled, or used, if smoking or the use of an open flame may cause a fire; or
- (c) Within an unsafe distance of any area where smoking or the use of an open flame may cause a fire or an explosion. [CMSO 7055.(a)]

G-302. 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. [CMSO 7055.(b)]

G-303. Fire for space heating shall not be permitted underground. Torches, acetylene lamps, and candles shall not be left unattended in any underground operation in the vicinity of wood or other flammable material. [CMSO 7061.(a)]

G-304. All heat sources, including lighting equipment, capable of producing combustion shall be insulated or isolated from combustible materials. [CMSO 7055.(e)]

400 - Housekeeping

G-401. All oily rags or waste shall be deposited in covered metal receptacles. The contents shall be sent to the surface every week, and also when the receptacle is full. [CMSO 7062.(b)]

G-402. Waste materials for which no underground storage facilities are provided shall be promptly removed from underground. [CTSO 8446.(h)]

G-403. No combustible materials shall be permitted in any oil or grease storage place. [CMSO 7065.(h)]

G-404. Leaks and spills of flammable or combustible fluids shall be cleaned up immediately. [29 CFR 1926.800(m)(10)]

500 - Combustible Structures/Materials

G-501. Change houses, timber frame sheds, storage sheds, or piles of combustible materials shall not be placed or permitted to remain within 100 feet of any underground opening, shaft house, hoist house, explosives magazine, or ventilating fan. [CMSO 7056.(a)]

G-502. Every building and structure within 100 feet of any underground opening shall be constructed of noncombustible materials or shall be of not less than one-hour fire resistive construction, except that wooden headframes with built-in wooden bins for dumping the shaft conveyance may be erected and used over underground shafts. [CMSO 7056.(b)]

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600 - Flammable Liquids

G-601. 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 appropriately labeled safety cans. [CMSO 7055.(c)]

G-602. Fuel lines shall be equipped with valves to cut off fuel at the source and shall be located and maintained to minimize fire hazards. [CMSO 7055.(d)]

G-603. The use of volatile solvents underground which have a flash point below 100° F is prohibited. [CTSO 8446.(f)]

G-604. Combustible liquids and gases shall be stored at least 100 feet from the following:

- (a) Underground openings;
- (b) Buildings and snow sheds connected to underground openings;
- (c) Ventilation fan houses;
- (d) Hoist houses; and
- (e) Explosive magazines.

The storage place shall be located where contents of leaking containers cannot run over the surface to any point within 100 feet of the above-mentioned places and structures. (NOTE: Certain petroleum gases, such as butane and propane, are compressed to liquid form in pressure tanks. When a tank containing liquefied petroleum gases leaks or is ruptured, the contents vaporize in the atmosphere. These vapors are heavier than air and will flow downhill over the surface of the ground much like water until the vapors are diffused. For this reason, tanks containing liquefied petroleum gases must be stored at locations which are in compliance with the provisions of this section.) [CMSO 7064.(a)]

G-605. Oils, greases, and rope dressings taken underground shall be transported and stored in closed metal containers that will not permit the contents to leak or spill. [CMSO 7065.(a)]

G-606. The underground storage place for oils and greases shall be located in a remote place where there will be the least danger to persons in the underground operation should a fire occur. Where practical, the storage place shall be at least 25 feet from any timbers. Where it is necessary to store oils or greases nearer than this distance to underground timbers, such timbers shall be made fire resistant. Should the amount of oil or grease stored on any 1 level exceed 60 gallons, it shall be stored in an acceptable manner. [CMSO 7065.(c)]

G-607. The storage place shall be so arranged that the contents of leaking containers cannot run from the storage place. [CMSO 7065.(d)]

G-608. Adequate drip pans shall be provided at the storage places of oils and greases. [CMSO 7065.(e)]

G-609. Leaking containers or fittings shall be promptly cleaned up and sent to the surface. [CMSO 7065.(f)]

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G-610. Gasoline shall not be carried, stored, or used underground. [29 CFR 1926.800.(m)(5)(I)]

G-611. The use of liquefied petroleum gases shall be limited to maintenance work. [CMSO 7065.(j)]

G-612. Oils and other dangerous flammable material shall be stored at least 100 feet from any shaft or underground opening, or building over an underground opening, and at least one hundred feet from any powder magazine. Where oils are stored in buildings, such buildings shall not be used for other purposes. LPG storage tanks shall be located away from underground openings to prevent the contents from flowing underground. Tanks and drums containing flammable liquids shall be so located that the escaping liquid cannot run over the surface from such tank to any powder magazine or to any building, within 100 feet of any underground opening. Under no circumstances shall oxygen or any flammable gas be stored in proximity to oil. [CTSO 8446.(a)]

G-613. Lubricating oils, greases and rope dressings taken underground shall be in closed metal containers that will not permit the contents to leak out or spill. When taken underground, they shall be stored in a secluded place away from shafts, winzes, hoists, powder magazines and timbers in such manner that the oil from a ruptured or overturned container will not flow from its storage place. Quantities of oil and grease underground shall be limited to a one-day supply. [CTSO 8446.(c)]

700 - Underground Exit Protection

G-701. Each underground operation required to maintain an escape exit shall protect underground employees against the hazard of all exits becoming impassable because of fire or fire gases by one or more of the following methods:

- (a) By fireproofing the main shaft and shaft stations where there is a fire hazard sufficient to interrupt use of the main shaft hoist for rescue purposes;
- (b) By maintaining a connecting passageway between working levels of such underground operation and an adjoining underground operation which has a safe access to the surface;
- (c) By mechanical control of the air currents that will permit good air to be supplied through any shaft or escape-way by reversal of air currents;
- (d) By installation of fire doors and ventilation doors installed at every underground opening connected to a surface building or snowshed. Such fire door shall be installed as near to the surface as is practical, and shall be so arranged that it will close automatically in case of fire. [CMSO 7056.(d) and 7057.(a)]

G-702. If none of the foregoing methods can be made applicable to a particular underground operation, such underground operation may be required to install a hoist in an escape exit and keep it in a usable condition. [CMSO 7057.(a)(5)]

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800 - Fire Doors and Bulkheads

G-801. Fire doors shall be constructed of steel and shall be set in steel or concrete walls so constructed that fire on one side cannot pass to the other side when the door is closed. [CMSO 7058.(b)]

G-802. Fire doors shall fit closely so they can be readily made gas tight when closed. They shall be provided with suitable latches or devices so they can be readily opened from either side without the use of tools, but cannot be opened by a reversal of the air current. [CMSO 7058.(c)]

G-803. Fire doors shall be tested each month and maintained in good working order. [CMSO 7058.(d)]

G-804. Where practical, fire bulkheads shall be installed in solid rock away from timbers and stoped-out areas. Fire bulkheads shall be of noncombustible construction if located within 100 feet of underground timbers or other combustible materials. [CMSO 7058.(e)]

G-805. Fire bulkheads shall be installed in such manner that fire, smoke, and gases on one side of the bulkhead cannot pass to the other side. (NOTE: In order to provide for sampling air or gas behind the bulkhead, in case fire or other emergency makes such sampling desirable, it is recommended that a metal pipe be installed through the bulkhead. Such pipe should be not less than 1-inch inside diameter and provided with a cap or gate-type valve on the outer end.) [CMSO 7058.(f)]

900 - Electrical Installations and Equipment

G-901. All electrical equipment which might communicate fire to adjacent flammable material shall be of a type which will confine the heat and flames within the equipment, or it shall be so located and installed that flammable material will not be exposed. [CMSO 7060.(a)]

G-902. Electrical installations in underground areas where oil, grease, or diesel fuel are stored shall be used only for lighting fixtures. [20 CFR 1926.800.(m)(9)(i)]

G-903. Lighting fixtures in storage areas, or within 25 feet (7.62 m) of underground areas where oil, grease, or diesel fuel are stored shall be approved for Class I, Division 2 locations, in accordance with 29 CFR 1926 Subpart K (Electrical). [29 CFR 1926.800.(m)(9)(ii)]

G-904. Electric heaters underground shall be of a type in which the heating elements do not become hot enough to ignite combustible materials. [CMSO 7061.(b)]

1000 - Battery Charging Stations

G-1001. Battery charging stations shall be located in well-ventilated areas. [CMSO 7055.(h)]

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1100 - Fire Retardant Materials Underground

G-1101. Fire retardant lagging and lumber shall be used in all shafts and shaft stations. Fire retardant lumber shall be used for underground enclosures, tables, benches, racks, and decking on work platforms used for welding and cutting. [REEC Co Fire Protection Code FP-5]

G-1102. Lumber or plywood used for concrete forms, stemming and shielding bulkhead, temporary work platforms, and the like need not be fire retardant if a pressurized water system for fire control is readily available. Ordinary lumber shall be removed promptly when it is no longer needed. [REEC Co Fire Protection Code FP-5]

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SECTION H - GROUND CONTROL

100 - Ground Support (Surface)

H-101. Portal openings and access areas shall be guarded by shoring, fencing, head walls, shotcreting or other equivalent protection to ensure safe access of employees and equipment. Adjacent areas shall be scaled or otherwise secured to prevent loose soil, rock, or fractured materials from endangering the portal and access area. [29 CFR 1926.800(o)(1)]

H-102. The employer shall ensure ground stability in hazardous subsidence areas by shoring, by filling in, or by erecting barricades and posting warning signs to prevent entry. [29 CFR 1926.800(o)(2)]

200 - Ground Support (Underground)

H-201. Every working place underground shall be kept securely supported with timber, steel sets, or otherwise protected by installing wire mesh, rock bolts, gunite, shotcrete, or a combination of methods when necessary for the safety of workers. [CTSO 8441.(a)]

H-202. Ground conditions along haulageways and travelways shall be inspected as frequently as necessary to ensure safe passage. [29 CFR 1926.800.(o)(3)(ii)]

H-203. Loose ground that might be hazardous to employees shall be taken down, scaled or supported. [29 CFR 1926.800.(o)(3)(iii)]

H-204. Scaling bars shall be available at scaling operations and shall be maintained in good condition at all times. Blunted or severely worn bars shall not be used. [29 CFR 1926.800.(q)(9)]

H-205. Adequate protection shall be provided for workers exposed to the hazard of falling ground while installing support systems. [CTSO 8441.(e)]

H-206. All sets, including horseshoe-shaped or arched rib steel sets, shall be of adequate design and installed so that the bottoms will have sufficient anchorage to prevent pressures from pushing them inward. Adequate lateral bracing shall be provided between sets to stabilize the support. [CTSO 8441.(b)]

H-207. After each blast, supports near the face must be checked, tightened, or rewedged as necessary. [CTSO 8441.(c)]

H-208. Damaged or dislodged ground supports that create a hazardous condition shall be promptly repaired or replaced. When replacing supports, the new supports shall be installed before the damaged supports are removed. [29 CFR 926.800.(o)(3)(vii)]

H-209. Rock bolt systems, when used, shall be installed in uniform patterns. These patterns shall be determined by competent persons with a thorough knowledge of rock mechanics and geology. Plans and specifications of the rock bolting installation shall be available at the job site. These plans shall include bolt spacing, diameter, length, type, tension in the bolts, angle of bolts to the support surface, and type of washers and bearing plates. Additional rock bolts shall be installed as necessary to support the ground. [CTSO 8441.(d)]

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H-210. Torque wrenches shall be used wherever bolts that depend on torsionally applied force are used for ground support. [29 CFR 1926.800.(o)(3)(iv)(A)]

H-211. A competent person shall determine whether rock bolts meet the necessary torque, and shall determine the testing frequency in light of the bolt system, ground conditions and the distance from vibration sources. [29 CFR 1926.800.(o)(3)(iv)(B)]

H-212. A shield or other type of support shall be used to maintain a safe travelway for employees working in dead-end areas ahead of any support replacement operation. [29 CFR 1926.800(o)(3)(viii)]

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SECTION I - DRILLING AND UNDERGROUND EQUIPMENT

100 - Drilling Operations

I-101. A competent person shall inspect all drilling and associated equipment prior to each use. Equipment defects affecting safety shall be corrected before the equipment is used.
[29 CFR 1926.800(q)(1)]

I-102. The drilling area shall be inspected for hazards before the drilling operation is started.
[29 CFR 1926.800(q)(2)]

I-103. Drilling machines shall be in good condition. The drill chucks shall be the proper size to keep the drills secured therein. [CMSO 7005.(a)]

I-104. Iron or steel hammers used for removing detachable bits shall be malleable or annealed, so that they will not readily chip or break while being used. [CMSO 7005.(b)]

I-105. It is strictly prohibited to drill in or deepen any hole that contains or may have contained explosives. [CMSO 7005.(c)]

I-106. No hole shall be drilled within 2 feet of any hole or chamber that contains or may contain explosives, and no hole shall be drilled at such an angle as to approach within 2 feet of such hole or chamber. [CMSO 7006.(a)]

I-107. Rock drilling operations shall be performed from a safe floor, platform, or staging which will provide a secure support for both the drilling machine and the operator. [CMSO 7006.(b)]

I-108. In the event of power failure, drill controls shall be placed in the neutral position until power is restored. [CMSO 7005.(j)]

I-109. While in operation, drills shall be attended at all times. [CMSO 7005.(k)]

I-110. Workers shall not hold the drill steel while collaring holes, or rest their hands on the chuck or centralizer while drilling. [CMSO 7005.(l)]

I-111. Receptacles or racks shall be provided for storing drill steel located on jumbos.
[29 CFR 1926.800(q)(5)]

I-112. When a drill machine is being moved from one drilling area to another, drill steel, tools, and other equipment shall be secured and the mast or booms shall be placed in a safe position.
[29 CFR 1926.800.(q)(4)]

I-113. Drills on columns shall be anchored firmly before starting drilling, and shall be retightened as necessary thereafter. [29 CFR 1926.800(q)(7)]

I-114. Jumbos shall be chocked to prevent movement while employees are working on them.
[29 CFR 1926.800(q)(8)(iv)(B)]

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I-115. Blasting holes shall not be drilled through blasted rock (muck) or water.
[29 CFR 1926.800(q)(10)(I)]

I-116. Employees in a shaft shall be protected either by location or by suitable barrier(s) if powered mechanical loading equipment is used to remove muck containing unfired explosives.
[29 CFR 1926.800(q)(10)(II)]

I-117. A caution sign reading "Buried Line," or similar wording shall be posted where air lines are buried or otherwise hidden by water or debris. [29 CFR 1926.800(q)(11)]

I-118. When electric blasting caps are used, all electrical circuits to the jumbo shall be disconnected and the live ends removed to a minimum distance of 100 feet from the jumbo before explosives are brought up to heading or bench. [CTSO 8450.(h)]

200 - Underground Equipment and Practices

I-201. Hand-held power tools, other than rock drills, 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. [CMSO 6995.(a)]

I-202. Unsafe equipment or machinery shall be removed from service immediately. [CMSO 6995.(b)]

I-203. When a signalman is used during slushing operations, he shall be positioned in a safe place.
[CMSO 6995.(c)]

I-204. 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. [CMSO 6995.(d)]

I-205. Persons 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-platform. [CMSO 6995.(e)]

I-206. Drive belts shall not be shifted while in motion unless the machines are provided with mechanical shifters. [CMSO 6995.(f)]

I-207. 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.
[CMSO 6995.(g)]

I-208. Pulleys of conveyors shall not be cleaned manually while the conveyor is in motion.
[CMSO 6995.(h)]

I-209. Belt dressing shall not be applied manually while belts are in motion unless an aerosol-type dressing is used. [CMSO 6995.(i)]

I-210. Machinery shall not be lubricated while in motion where a hazard exists, unless equipped with extended fittings or cups. [CMSO 6995.(j)]

I-211. Welding operations shall be shielded and well-ventilated. [CMSO 6995.(k)]

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I-212. Overhead belts shall be guarded as required by 29 CFR 1926.555 (Conveyors).
[CMSO 6995.(m)]

I-213. Grinding machines and grinding wheels shall be operated in conformance with 29 CFR 1926.303 (Abrasive Wheels and Tools). [CMSO 6995.(n)]

I-214. Power transmission equipment, hazardous moving parts, and conveyors shall be guarded as required by 29 CFR 1926 Subpart I (Tools - Hand and Powered) and N (Cranes, Derricks, Hoists, Elevators, and Conveyors). [CTSO 8459.(d)]

I-215. Fire resistant hydraulic fluids shall be used in hydraulically-actuated underground machinery and equipment unless such equipment is protected by a fire suppression system or by multi-purpose fire extinguisher(s) rated at of sufficient capacity for the type and size of hydraulic equipment involved, but rated at least 4A:40B:C. [29 CFR 1926.800(m)(8)]

I-216. Hydraulic lines subject to contact that operate at temperatures above 160° F. shall be insulated or otherwise guarded. [CTSO 8457.(a)]

I-217. Excessive heat shall be exhausted into the vent line or other controls shall be used to provide reasonable working conditions. [CTSO 8457.(b)]

I-218. Equipment operators and workers shall be protected from the hazard of being sprayed by hot hydraulic oil. [CTSO 8457.(c)]

300 - Boilers and Pressure Vessels

I-301. All boilers and pressure vessels shall be constructed, installed and maintained in accordance with the standards and specifications of the ASME Boiler and Pressure Vessel Code. [CMSO 6996.(a)]

I-302. Repairs involving the pressure system of compressors, receivers, or compressed-air-powered equipment shall not be attempted until the pressure has been held off. [CMSO 6996.(b)]

400 - Compressed Air Hose and Pipe

I-401. The ends of every compressed air hose 3/4 inch or larger inside diameter shall be chained or otherwise secured to prevent whipping in case of a disconnected hose. When 2 or more hoses are connected to each other, the connecting ends shall be secured together. [CMSO 6997.(a) and 30 CFR 57.13021]

I-402. Material used to secure the hose ends shall be chain made of three-sixteenths-inch stock or of other material of equivalent strength. [CMSO 6997.(b)]

I-403. When an auxiliary compressed air tank is located on a jumbo or at any other place away from the rigid compressed air supply line, both ends of every length of connecting hose shall be secured. [CMSO 6997.(c)]

I-404. Air pipe lines 2 inches or more in diameter shall be adequately secured against unnecessary movement. Such pipe lines shall be protected against accidental impact from vehicles and falling objects at points where breakage of lines would constitute a hazard to employees. [CMSO 6997.(d)]

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I-105. 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. [CMSO 6997.(e)]

500 - Working Space for Machine Operation

I-501. Unobstructed working space shall be provided at the operating controls of every fixed machine. Such working space shall be at least 3 feet wide, and long enough to provide access to all operating controls. [CMSO 7000.(a)]

I-502. Adequate unobstructed working space shall be provided at the operating controls of every movable machine. Such unobstructed working space shall be at least 3 feet wide and 6-1/2 feet in height, except when the operator works in a sitting position, in which case he shall be provided with an overhead clearance of at least 2 feet. [CMSO 7000.(b)]

I-503. Where the operating controls are located at the side of the machine, at least 2 feet of unobstructed space shall be maintained between the operating controls and the nearest wall or object while the machine is in operation. [CMSO 7000.(c)]

I-504. Boom and rocker-type mucking machines shall be equipped with a substantial device to keep them from upsetting. [CMSO 7000.(d)]

600 - Power Shut-off for Underground Machines

I-601. In addition to the operating controls, a positive power shutoff shall be provided for every prime mover. [CMSO 7001.(a)]

I-602. The positive power shutoff shall be located where it is readily accessible to the machine operator and, except for hand-held machines and tools, not more than 10 feet from the machine. It is recommended that it be placed on the machine when practical. [CMSO 7001.(b)]

700 - Excavation Equipment

I-701. An audible and visual warning shall be sounded before starting excavating or conveyor machinery. [CTSO 8459.(a)]

I-702. Excavating machines shall be equipped with a deadman control. [CTSO 8459.(c)]

I-703. Tunnel support systems shall have adequate strength to resist the thrust of hydraulic jacks. [CTSO 8459.(j)]

I-704. Safety cables shall be provided on jacking shoes located above the spring line. [CTSO 8459.(k)]

I-705. A thorough examination of the heading shall be made before starting excavation equipment. [CTSO 8459.(l)]

800 - Conveyors

I-801. Pull cords or conveniently located shut down switches shall be provided for emergency shutdown of conveyors. [CTSO 8459.(b)]

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I-802. A device to prevent inclined conveyors from rolling back shall be provided. **[CTSO 8459.(e)]**

I-803. Fire extinguishers or equivalent protection shall be provided at the head and tail pulleys of underground belt conveyors and at 300-foot intervals along the belt line. **[CTSO 8456.(a)]**

I-804. Screw conveyors 7 feet or less above floor or other working level shall be completely covered with substantial lids except that screw conveyors the top of which is 2 feet or less above the floor or other working level, or below the floor level may be guarded by standard railing guards having toeboards of midrail height or shall be guarded by substantial covers or gratings. **[CMSO 7030.(a)]**

I-805. All belt conveyor head pulleys, tail pulleys, single tension pulleys and dip take-up pulleys shall be so guarded that the entire sides of the pulleys are covered. The guard shall extend in the direction of the run of the belt to such a distance that a person cannot reach behind it and become caught in the nip point between the belt and pulley. **[CMSO 7030.(b)]**

I-806. Portable inclined conveyors shall have head and tail pulleys or sprockets and other power transmission equipment guarded. **[CMSO 7030.(c)]**

I-807. Crossovers shall be provided and used where it is necessary to pass over exposed chain, belt, bucket, screw, or roller conveyors. Such crossovers shall be bridges or runways properly equipped with standard railings and toeboards, and shall have a fixed ladder, ramp, or stairway as a safe means of access. **[CMSO 7030.(d)]**

I-808. Conveyors passing over areas that are occupied or used by employees shall be so guarded as to prevent the material handled from falling on and causing injury to employees. **[CMSO 7030.(e)]**

I-809. Where persons pass under the return strands of chain conveyors, a shallow trough or other effective means of sufficient strength to carry the weight of the broken chain shall be provided. **[CMSO 7030.(f)]**

I-810. No employee shall be permitted to ride a power-driven chain, belt or bucket conveyor. **[CMSO 7030.(g)]**

I-811. 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. **[CMSO 7030.(h)]**

I-812. Unguarded conveyors with walkways shall be equipped with emergency stop devices or cords along their full length. **[CMSO 7030.(i)]**

I-813. Employees shall not be permitted to ride a power-driven chain, belt, or bucket conveyor unless the conveyor is specifically designed for the transportation of persons. **[29 CFR 1926.800(r)(6)(i)(A)]**

I-814. Endless belt-type manlifts are prohibited in underground construction. **[29 CFR 1926.800(r)(6)(i)(B)]**

I-815. Safe passageway shall be provided along every conveyor where employees are required or permitted to travel in the course of their operating duties. **[CMSO 7031.(a)]**

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I-816. Conveyor tunnels shall have an unobstructed passageway at least 2 feet wide and 6-1/2 feet high. [CMSO 7031.(b)]

I-817. Passageways adjacent to conveyors shall be kept free of spillage from the conveyor. Means shall be taken to minimize spillage on the passageway. [CMSO 7031.(c)]

900 - Aerial Lifts

I-901. For use of aerial lifts, the provisions of 29 CFR 1926.556 (Aerial Lifts) shall apply.

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SECTION J - LOADING, HAULING AND DUMPING

100 - General

J-101. Equipment defects affecting safety shall be corrected before the equipment is used.
[CMSO 7010.(a)]

J-102. When traveling between work areas, the equipment shall be secured in the travel position.
[CMSO 7010.(b)]

J-103. Powered mobile equipment, including trains, shall not be left unattended unless the master switch or motor is turned off; operating controls are in neutral or park position; and the brakes are set, or equivalent precautions are taken to prevent rolling. [29 CFR 1926.800(r)(7)]

J-104. Where overhead clearance is restricted, warning devices shall be installed and the restricted area shall be conspicuously marked. [CMSO 7010.(e)]

J-105. Chute loading installations shall be designed so that the persons pulling chutes are not required to be in a hazardous position while loading cars. [CMSO 7010.(f)]

J-106. Employees shall not be permitted to get on or off moving vehicles or equipment.
[CMSO 7010.(g)]

J-107. Only authorized persons shall be present in areas of loading or dumping operations.
[CMSO 7010.(h)]

J-108. Industrial trucks, tractors, haulage vehicles, and earthmoving equipment shall meet the canopy, roll-over protection, and other requirements of 29 CFR 1926 Subpart W (Rollover Protective Structures; Overhead Protection) for surface equipment and SAE J231 (Falling Object Protective Structure) for underground equipment. [CMSO 7010.(i)]

J-109. In those cabs where glazing is used, the glass shall be safety glass, or its equivalent, and shall be maintained and cleaned so that vision is not obstructed. [29 CFR 1926.800(r)(4)]

J-110. The operator shall assure that lights which are visible to employees at both ends of any mobile equipment, including a train, are turned on whenever the equipment is operating.
[29 CFR 1926.800(r)(3)(ii)]

J-111. The driver's seat shall be maintained in good condition. [CTSO 8483.(h)]

J-112. A safe means of access shall be provided and maintained from the ground to the driver's location. [CTSO 8483.(g)]

J-113. Equipment to be hauled shall be loaded and secured to prevent sliding or dislodgement.
[29 CFR 1926.800(r)(ii)]

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J-114. Whenever self-propelled equipment is used underground, a fire extinguisher shall be on the equipment. This standard does not apply to compressed-air powered equipment without inherent fire hazards. A fire suppression system may be used as an alternative to fire extinguishers if the system can be manually actuated. Fire extinguishers or fire suppression systems shall be of a type and size that can extinguish fires of any class in their early stages which could originate from the equipment's inherent fire hazards. The fire extinguishers or the manual actuator for the suppression system shall be readily accessible to the equipment operator. **[30 CFR 57.4260]**

J-115. Self-propelled mobile equipment shall be equipped with a service brake system capable of stopping and holding the equipment with its typical load on the maximum grade it travels. This standard does not apply to equipment which is not originally equipped with brakes unless the manner in which the equipment is being operated requires the use of brakes for safe operation. This standard does not apply to rail equipment. If equipped on self-propelled mobile equipment, parking brakes shall be capable of holding the equipment with its typical load on the maximum grade it travels. All braking systems installed on the equipment shall be maintained in functional condition. **[30 CFR 57.14101]**

J-116. Seat belts shall be provided on all material handling and earth moving equipment equipped with roll-over protective structures (ROPS). **[29 CFR 1926.602(a)(2)(i)]**

200 - Inspection

J-201. The employer shall require that wire ropes, bearings, friction clutches, chain drives, and other parts subject to wear be inspected at adequate intervals in order that any unsafe conditions may be corrected. **[CMSO 7011.(a)]**

J-202. The intervals between the inspections shall be short enough to enable the employer to be reasonably certain that the crane, hoist, derrick, excavating or loading equipment will not be operated when in an unsafe condition. **[CMSO 7011.(c)]**

J-203. Mechanically or electrically operated brakes shall be inspected periodically, and necessary repairs and adjustments shall be made. **[CMSO 7011.(d)]**

J-204. A competent person shall inspect haulage equipment before each shift.
[29 CFR 1926.800(r)(1)(i)]

300 - Cranes and Loading Devices

J-301. The control area for every crane or other lifting device, and for every power-driven shovel or loading device, shall be protected with a strong guard where there is danger from falling or flying materials. **[CMSO 7012.(a)]**

J-302. Employees shall not be permitted under suspended loads or buckets. **[CMSO 7012.(e)]**

J-303. Any person desiring to go on board any crane which is in operation shall first signal the operator of such equipment. He shall not go aboard until the operator stops the equipment and signals that it is safe to proceed. **[CMSO 7012.(f)]**

J-304. The operator of any crane or loader shall signal other persons in the vicinity before he begins operations or moves the equipment. **[CMSO 7012.(g)]**

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J-305. The loader or crane shall not be started to travel until it is first determined that the travel way is clear of persons and equipment. [CMSO 7012.(h)]

J-306. When equipment is traveling under its own power, the operator shall so turn the cab that he has clear vision in the direction of travel. [CMSO 7012.(i)]

J-307. Where practicable, haulage vehicles shall be loaded in such way that the bucket or boom does not pass over the vehicle driver's position. If the bucket or boom has to pass over the driver's position, no loading shall be done until the driver is in a safe location away from the vehicle. [CMSO 7012.(j)]

J-308. The crane, excavator, or loader shall not be left unattended until the load or bucket is lowered to the ground. [CMSO 7012.(k)]

J-309. Stockpile and muckpile faces shall be trimmed to prevent hazards to personnel. [CMSO 7012.(l)]

J-310. Rocks too large to be handled safely shall be broken before loading. [CMSO 7012.(m)]

400 - Roads

J-401. Roads used for two-way traffic on which vehicles do not travel on the right side all the way shall be posted with signs indicating the side of the road to travel. [CMSO 7014.(e)]

J-402. Roads should be maintained free from holes and deep ruts. Action should be taken to keep the dust to a minimum. [CMSO 7014.(f)]

J-403. Mid-axle height berms or guards shall be provided on the outer bank of elevated roadways. [CMSO 7014.(g)]

J-404. Berms, bumper blocks, safety hooks, or similar means shall be provided to prevent overtravel and overturning at dumping locations. [CMSO 7014.(h)]

J-405. Public and permanent railroad crossings shall be posted with warning signs or signals or shall be guarded when trains are passing and shall be planked or otherwise filled between the rails. [CMSO 7014.(i)]

500 - Surface Haulage Vehicle - Construction and Maintenance

J-501. Equipment and accessories installed on haulage vehicle shall be so arranged as to not seriously impair the driver's vision to the front or sides. [CMSO 7016.(b)]

J-502. Vehicles shall be equipped with headlights and taillights in good condition. Such equipment shall be equipped with back-up lights and alarms which function automatically when the vehicle is put in reverse gear. [CTSO 8483.(d)]

J-503. Vehicles shall be provided with a warning device audible from 200 feet. [CTSO 8483.(f)]

J-504. Haulage vehicles shall be provided with a safe means of access from the ground to the driver's location. Such means of access shall be maintained in good condition. [CMSO 7016.(h)]

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J-505. The vehicle seat shall be maintained in good repair at all times. [CMSO 7016.(i)]

J-506. Liquids shall be drained from the compressed air tanks each day. [CMSO 7016.(j)]

J-507. 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. [CMSO 7016.(k)]

J-508. Trucks, shuttle cars, and front-end loaders operated on the surface shall be equipped with emergency brakes separate and independent of the regular braking system when generally available for a particular class of equipment. [CMSO 7016.(l)]

600 - Canopy Guard

J-601. Except as provided in paragraph J-306 of this Section every haulage vehicle that is loaded by means of any device which employs a swinging boom to load the vehicle shall be equipped with a suitable canopy guard for the driver's seat. [CMSO 7020.(a)]

J-602. The canopy guard shall be strongly constructed to afford adequate protection for the driver. It shall be of sufficient width and height so as not to hamper the movement of the driver or prevent immediate escape from the vehicle in emergency. [CMSO 7020.(b)]

J-603. The canopy shall be steel plate at least three-sixteenths inch thick. It shall be substantially supported by steel members of adequate strength attached to the frame or body of the vehicle. [CMSO 7020.(c)]

J-604. A canopy guard is not required on any haulage vehicle which is provided with a cab so constructed that it will afford at least as much protection as a canopy guard. [CMSO 7020.(d)]

700 - Trackless Haulage Vehicle Operation

J-701. When operating vehicles, consideration shall be given to the condition of the roadway, weather, curves, grades and mechanical condition of the vehicle. The vehicle shall not be operated at a speed which will endanger the driver or traffic. On curves, the vehicle speed shall be limited so that it can be stopped within one-half the visible distance of the roadway. [CMSO 7021.(a)]

J-702. Haulage vehicles shall at all times be operated under positive control. When descending grades, the vehicle shall be kept in gear. [CMSO 7021.(b)]

J-703. Where other warning signals are not provided, the vehicle's warning device shall be sounded before moving the haulage vehicle. [CMSO 7021.(c)]

J-704. The loaded haulage vehicle shall not be moved away from the shovel or loader until the load is balanced and trimmed. [CMSO 7021.(d)]

J-705. Haulage vehicles shall not be driven unnecessarily while the body is in the dump position. [CMSO 7021.(e)]

J-706. No worker shall be permitted under the raised body of a haulage vehicle until such body is secured in its raised position. [CMSO 7021.(f)]

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J-707. The hands or feet shall not be used to guide a hoist or winch cable on a haulage vehicle. When necessary to control a moving cable, the drum and sheaves shall be equipped with a device that will guide the cable to its proper position without being handled, or the employee shall be provided with a device which will enable him to guide the cable safely. **[CMSO 7021.(g)]**

J-708. Cabs of mobile equipment shall be kept free of extraneous materials. **[CMSO 7021.(h)]**

J-709. Equipment which is to be hauled shall be loaded and protected so as to prevent sliding or spillage. **[CMSO 7021.(i)]**

J-710. 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. **[CMSO 7021.(j)]**

J-711. Lights, flares, or other warning devices shall be posted when parked equipment creates a hazard to vehicular traffic. **[CMSO 7021.(k)]**

800 - Locomotives and Trains

J-801. No person shall be allowed to operate a haulage locomotive in a tunnel without satisfying the requirements of A-203 and A-204 of this standard.

J-802. Every locomotive shall be provided with an audible warning device capable of being heard at a distance of 200 feet. Such a warning device shall be maintained in good working condition. Operators shall sound warning before starting trains, when trains approach crossings or other trains on adjacent tracks, and where vision is obscured. **[CMSO 7024.(a)]**

J-803. Every locomotive shall be equipped with brakes of sufficient capacity to control the train with reasonable safety and railroad cars with braking systems shall be equipped with effective brake shoes. **[CMSO 7024.(d)]**

J-804. Before a locomotive is moved, the engineer shall make certain that the brakes are in operating condition. When the locomotive is not in operation the hand brake shall be set. **[CMSO 7024.(e)]**

J-805. Every locomotive, when in motion, shall continuously display a white light in the direction of travel which will provide sufficient illumination to make men or objects clearly visible at a distance of 100 feet in the direction in which the locomotive is travelling. **[CMSO 7025.(c)]**

J-806. Each train shall be equipped with a red taillight of sufficient intensity as to be clearly visible from a distance of 100 feet. **[CMSO 7025.(d)]**

J-807. Locomotives shall be equipped with steps or footboards. Steps and footboards shall be made of nonslip material and handholds shall be provided. No person shall ride on any part of locomotives not so equipped. **[CTSO 8471.(f)]**

J-808. Locomotives and cars moved by locomotives that are coupled and uncoupled in the course of their regular operation shall be equipped with automatic couplings with extension handles. **[CMSO 7024.(g)]**

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J-809. A safe seat shall be provided for the operator of every locomotive. The seat shall be constructed so it will prevent the operator from accidentally slipping over the back or sides of the seat. [CMSO 7025.(e)]

J-810. To prevent runaway cars should a coupling part, the locomotive shall be operated on the downgrade end of the train, except:

- (a) When transporting workers;
- (b) When transporting materials which cannot be pushed safely;
- (c) When the construction of the locomotive is such that it seriously obstructs the operator's view of the roadway; in which case, the locomotive shall be placed ahead of the train with the seat end turned in the direction in which the locomotive is traveling. [CMSO 7025.(f)]

J-811. Locomotives must be equipped with some type of "deadman" control. [CTSO 8471.(c)]
(NOTE: See "deadman control" in definitions.)

900 - Rail Haulage Practices

J-901. When railed equipment is left standing on a track, a positive means shall be provided and used to prevent accidental movement of such equipment. Safety chains shall be used to connect cars when grades exceed one percent. [CTSO 8473.(e)]

J-902. Workers, except the train crew, shall not ride in muck cars. Rocker-bottom or bottom-dump cars shall be equipped with positive locking devices to prevent unintended dumping. [CTSO 8473.(d) and 29 CFR 1926.800(r)(10)]

J-903. Mobile equipment, including rail-mounted equipment, shall be stopped for manual connecting or service work. [29 CFR 1926.800(r)(12)(i)]

J-904. Employees shall not reach between moving cars during coupling operations. [29 CFR 1926.800(r)(12)(ii)]

J-905. Couplings shall not be aligned, shifted, or cleaned on moving cars or locomotives. [29 CFR 1926.800(r)(12)(iii)]

J-906. When cars are uncoupled from a train they shall be secured against accidental movement. [CMSO 7024.(j)]

J-907. No materials shall be carried on any locomotive unless such locomotive is equipped so that the materials can be carried safely. Materials may be carried on locomotives equipped with fixed boxes or trays or with raised edges high enough to keep the materials safely in place. No material that extends over the side or end of a locomotive shall be carried on the locomotive. [CMSO 7024.(k)]

J-908. The material on loaded cars shall be balanced and trimmed in order to prevent dislodging during transportation. [CMSO 7024.(l)]

J-909. Railroad equipment shall not be operated at a speed which will endanger employees. [CMSO 7024.(m)]

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J-910. Railcars shall not be left on side tracks unless ample clearance is provided for traffic on adjacent tracks. [CMSO 7024.(n)]

J-911. Persons shall not go over, under, or between cars unless the train is stopped and the motorman has been notified and the notice acknowledged. [CMSO 7024.(o)]

J-912. Inability of a motorman to clearly recognize the brakeman's signals, when the train is under the direction of the brakeman, shall be construed by the motorman as a stop signal. [CMSO 7024.(p)]

J-913. A bumper or other device that will effectively prevent cars from going over the end of the track shall be provided at all dump points for ore or waste. [CMSO 7024.(q)]

J-914. When dumping cars by hand, the car dumps shall have tiedown chains, bumper blocks, or other locking or holding devices to prevent the cars from overturning. [29 CFR 1926.800(r)(9)]

J-915. Rerailing equipment shall be available and used to put derailed cars and locomotives on the track. It is recommended that rerailers and jacks be provided. [CMSO 7025.(b)]

J-916. Concrete cars shall be equipped with flashing or rotating lights visible from the front and rear. [CTSO 8472.(c)]

J-917. Timber or similar material that extends over the side or end of a car shall be secured and positioned so that it will clear obstructions, especially when traveling around curves. [CMSO 7025.(g)]

1000 - Block Signals

J-1001. If there are curves underground where more than one train or locomotive operates, block signals for each curve shall be installed and used. These signals may be manually operated from each approach to the curve or turn if arranged so as to give effective notice that a train is on the curve. [CTSO 8477.]

1100 - Transportation of Workers

J-1101. Persons shall not ride in dippers, shovel buckets, forks, clamshells, or in the beds of dump trucks for the purpose of transportation. [CMSO 7037.(b)]

J-1102. Persons shall not ride on top of loaded haulage equipment. [CMSO 7037.(c)]

J-1103. Only authorized persons shall be permitted to ride on trains or locomotives and they shall ride in a safe position. [CMSO 7037.(d)]

J-1104. Persons shall not ride outside the cabs or beds of mobile equipment. [CMSO 7037.(e)]

J-1105. Facilities used to transport workers to and from work areas shall not be overcrowded. [CMSO 7037.(f)]

J-1106. Supplies, materials, and tools other than small hand tools shall not be transported with workers in man trip vehicles unless such vehicles are specifically designed to make such transportation safe. [CMSO 7037.(g)]

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J-1107. Transportation of employees over railroads when going on or coming off shift shall be in man cars especially designed for such transportation. [CMSO 7038.(a)]

J-1108. All man cars carrying workers going on or coming off shift shall be secured with safety chains to prevent such cars from running away should a coupling fail. [CMSO 7038.(c)]

J-1109. A train transporting workers shall be pulled, not pushed, by the locomotive, and shall be operated at a safe speed. [CMSO 7038.(e)]

J-1110. Every man car, truck, or other vehicle used for transportation of employees shall be provided with safe and secure seats, and shall be protected on sides and ends to prevent falls from the vehicle. Means shall be provided whereby employees can safely mount or dismount the vehicle. [CMSO 7038.(f)]

J-1111. Vehicles transporting workers shall be operated cautiously and with due regard for the safety of employees. Such vehicles shall be operated at a safe speed. [CMSO 7038.(g)]

J-1112. Employees shall not be required or permitted to get on or off a moving vehicle. [CMSO 7038.(h)]

J-1113. Supplies, materials, and tools other than small hand tools shall not be transported with workers in man cars or vehicles. Man cars shall be operated independently of muck and supply trips. [CMSO 7038.(i)]

J-1114. During shift changes, the movement of rock or material trains shall be limited to areas where such trains could not present a hazard to employees coming on or going off shift. [CMSO 7038.(j)]

J-1115. Workers shall not ride in or on cars loaded with items such as timbers, rib-steel, rail, pipe, muck or other similar material. [CTSO 8473.(c)]

1200 - Brakemen and Switching

J-1201. Where switching of cars is being performed, a brakeman shall be provided, in addition to the motorman, to assist in the switching. [CTSO 8474.(d)]

J-1202. Brakemen shall be equipped with whistles or hand lights for signaling the movement of trains. If whistles are used, one whistle to stop; two whistles, move toward brakeman; three whistles, move away from brakeman. [CTSO 8474.(h)]

J-1203. Flying switches are prohibited. [CTSO 8474.(j)]

J-1204. While a mucker, jumbo or other equipment which seriously interferes with motorman's vision is pushed underground, a person with a whistle or other signaling device shall be stationed in a safe position on the equipment to watch for workers in danger of being struck, or other hazards. [CTSO 8475.(a)]

J-1205. A brakeman shall be used to observe the movement of a train when visibility is limited. The brakeman shall be located at a safe location at the head end of the train. [CTSO 8475.(b)]

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1300 - Switches, Car Passers and Tracks

J-1301. Frogs, guard rails and lead rails of switches shall be so filled as to eliminate the danger of a foot being caught therein. [CTSO 8481.]

J-1302. California type portable switches shall be planked between rails to prevent workers from falling or tripping in openings. [CTSO 8478.]

J-1303. Where car passers of any type are used, a colored light operated by a worker at the car passer shall be used to signal the motorman when regular track is blocked or clear. [CTSO 8479.(a)]

J-1304. A reverse grade away from the main track, or a positive stop or lock shall be provided on the car passer track to avoid the unexpected rolling of a car onto the main travelway. [CTSO 8479.(b)]

J-1305. Surface and underground tracks shall be kept in good condition, reasonably level and free of dips, bumps, and obstructions, commensurate with the safe passage of trains at reasonable operating speeds. [CTSO 8476.(a)]

J-1306. Track joints and fish plates shall be installed directly over ties or other suitable support. [CTSO 8476.(b)]

J-1307. A securely anchored bumper equivalent to a 6 x 8 inch timber, at least larger than the wheel radius, shall be placed at the end of surface waste dump tracks to prevent cars from going over the embankment. [CTSO 8480.(a)]

J-1308. Dump track areas shall be maintained reasonably level and properly ballasted or the ties planked over to prevent workers from tripping. [CTSO 8480.(b)]

J-1309. Standard walkways with railings shall be provided on elevated trestles. [CTSO 8480.(c)]

1400 - Places of Refuge

J-1401. Refuge stations for pedestrians shall be provided at intervals not exceeding 200 feet along the haulageway on every underground level where a 30-inch passageway cannot be maintained. [CMSO 7026.(a)]

J-1402. Each refuge station shall be not less than 4 feet long and shall afford a space at least 2-1/2 feet in width between the widest portion of the car or train running on the railroad track and the side of the refuge. [CMSO 7026.(b)]

J-1403. Refuge stations shall be plainly marked and kept free of rubbish. [CMSO 7026.(c)]

J-1404. Ample passing space shall be provided along haulageways where trackless haulage is used. [CMSO 7026.(d)]

1500 - Engines - Internal Combustion

J-1501. Internal combustion engines, except diesel-powered engines on mobile equipment, are prohibited underground. [29 CFR 1926.800(k)(10)(i)]

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J-1502. Mobile diesel-powered equipment used underground in atmospheres other than gassy operations shall be either approved by MSHA in accordance with the provisions of 30 CFR Part 32 (formerly Schedule 24), or shall be demonstrated by the employer to be fully equivalent to such MSHA-approved equipment, and shall be operated in accordance with that Part: (Each brake horsepower of a diesel engine requires at least 100 cubic feet (28.32 m³) of air per minute for suitable operation in addition to the air requirements for personnel. Some engines may require a greater amount of air to ensure that the allowable levels of carbon monoxide, nitric oxide, and nitrogen dioxide are not exceeded.) [29 CFR 1926.800(k)(10)(ii)] (NOTE: See Addendum A for situations where air quantity and velocity cannot be met and equal or better safety and health will be provided by air quality monitoring.)

J-1503. The flow of fresh air in any air course shall never be less than 100 cubic feet of air per minute per brake horsepower of the aggregate diesel equipment operating in such air course, plus 200 cubic feet of air per minute for each employee therein. [CMSO 7070.(f)(10)]

J-1504. No internal-combustion engine shall be permitted on the surface within 50 feet of any underground opening. **EXCEPTION:** This does not apply to self-propelled vehicles which are not operated as stationary equipment. [CMSO 7068.]

J-1505. The diesel fuel used shall not contain over .35 percent sulphur, by weight. [CTSO 8470.(c)(5)]

J-1506. The diesel fuel supply shall not be stored or taken underground in amounts greater than required for eight hours of operation. [CTSO 8470.(c)(6)]

J-1507. Diesel engines shall not be fueled underground where it is practical to fuel them on the surface. [CMSO 7071.(a)]

J-1508. When fueled underground, the engine shall be taken to the fuel storage place, if practical, and the fuel pumped directly from the storage container to the engine fuel tank. [CMSO 7071.(b)]

J-1509. When the engine must be fueled away from the fuel storage place, the fuel shall be transported in closed metal containers that will not permit the contents to leak or spill should the container be overturned. [CMSO 7071.(c)]

J-1510. The engine shall be shut down during fueling operations. [CMSO 7071.(d)]

J-1511. Precautions shall be taken to prevent spilling during fueling operations. Spilled fuel shall be promptly cleaned up and removed. [CMSO 7071.(e)]

J-1512. The use of compressed air to force fuel from a container is prohibited. [CMSO 7071.(f)]

J-1513. No fire, smoking, open lights, or other source of ignition shall be permitted near fueling operations. (NOTE: See paragraph G-604 pertaining to storage of fuels and lubricants.) [CMSO 7071.(g)]

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SECTION K - ELECTRICAL SAFETY

100 - Electrical Standards and Regulations

K-101. In addition to the requirements of this Section, electrical installations, equipment, and operations shall comply with the applicable requirements of 29 CFR 1926 Subpart K (OSHA Standards for the Construction Industry, Electrical) and the National Electrical Code (NFPA 70).

200 - Electrical Equipment, Wiring, and Installations

K-201. Electric cords and cables shall be located to minimize mechanical damage. [CTSO 8460.(c)]

K-202. Electric power lines shall be insulated or located away from water lines, telephone lines, air lines, or other conductive materials so that a damaged circuit will not energize the other systems.
[29 CFR 1926.800(s)(1)]

K-203. Lighting circuits shall be located so that movement of personnel or equipment will not damage the circuits or disrupt service. [29 CFR 1926.800(s)(2)]

K-204. Circuits shall be protected against excessive overload by fuses or circuit breakers of the correct type and capacity. [CMSO 7183.(a)(1)]

K-205. Electric equipment and circuits shall be provided with switches or other controls. Such switches or controls shall be of approved design and construction and shall be properly installed.
[CMSO 7183.(a)(2)]

K-206. High-potential transmission cables shall be covered, insulated, or placed to prevent contact with low-potential circuits. [CMSO 7183.(a)(5)]

K-207. All switches, automatic cutouts, or other control devices shall be located or marked as to clearly indicate the equipment controlled by them, and switches (excepting magnetic switches) shall indicate whether they are open or closed. [CMSO 7183.(a)(9)]

K-208. 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, noncurrent-carrying parts of the power switches to be operated may be used.
[CMSO 7183.(a)(10)]

K-209. Suitable danger signs shall be posted at all major electrical installations. [CMSO 7183.(a)(11)]

K-210. Electrical connections and resistor grids that are difficult or impractical to insulate shall be guarded, unless protection is provided by location. [CMSO 7183.(a)(12)]

K-211. All metal enclosing or encasing electrical circuits shall be grounded or provided with equivalent protection. This requirement does not apply to battery-operated equipment. [CMSO 7183.(a)(13)]

K-212. Metal fencing and metal buildings enclosing transformers and switchgear shall be grounded.
[CMSO 7183.(a)(14)]

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K-213. Frame grounding or equivalent protection shall be provided for mobile equipment powered through trailing cables. [CMSO 7183.(a)(15)]

K-214. Continuity and resistance of grounding systems shall be tested immediately after installation. [CMSO 7183.(a)(16)]

K-215. When a potentially dangerous condition is found, it shall be corrected before equipment or wiring is energized. [CMSO 7183.(a)(17)]

K-216. Hand-held electric tools shall not be operated at high potential voltages. [CMSO 7183.(a)(18)]

K-217. Fuses shall not be removed or replaced by hand in an energized circuit, and they shall not otherwise be removed or replaced in an energized circuit unless equipment and techniques especially designed to prevent electrical shock are provided and used for such purpose. [CMSO 7183.(a)(19)]

K-218. Fuse tongs or hot line tools shall be used when fuses are removed or replaced in high-potential circuits. [CMSO 7183.(a)(20)]

K-219. Operating controls shall be installed so that they can be operated without danger of contact with energized conductors. [CMSO 7183.(a)(21)]

K-220. Switches and starting boxes shall be of safe design and capacity. [CMSO 7183.(a)(22)]

K-221. Power wires and cables shall be adequately insulated. Flexible cords and cables shall not be used as a substitute for fixed wiring and shall be adequately protected when subject to physical damage. [CMSO 7183.(a)(26)]

K-222. Abandoned electrical circuits shall be deenergized and isolated so that they cannot become energized inadvertently. [CMSO 7183.(a)(27)]

300 - Lock-out/Tag-out Procedures

K-301. "Lockout/Tagout" procedures shall meet the requirements of 29 CFR 1910.147 and 29 CFR 1926.417.

400 - Trailing Electrical Power Cables

K-401. Trailing electric power cables shall be used only in continuous lengths except when connections are made with a connector or splice box of approved design. [CMSO 7181.(a)]

K-402. Branch circuits shall not be installed on trailing electric power cables. [CMSO 7181.(b)]

K-403. Trailing electric power cables shall be connected to mobile equipment in such manner that tension will not be transmitted to the joints or terminal screws of the fittings. This shall be accomplished by a special fitting designed for such purpose, or by other equally effective means. [CMSO 7181.(e)]

K-404. Trailing electric power cables shall be maintained in good repair. [CMSO 7182.(a)]

K-405. Trailing cables and power-cable connections to junction boxes shall not be made or broken while energized. [CMSO 7183.(a)(4)]

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K-406. Individual overload protection and short circuit protection shall be provided for the trailing cables of mobile equipment. [CMSO 7183.(a)(3)]

K-407. Insulated gloves or tongs shall be used to handle energized trailing electric power cables. If insulated gloves are used, they shall be tested every 30 days for leakage. [CTSO 8460.(d)]

500 - Transformers Underground

K-501. Oil-filled transformers shall not be used underground unless they are located in a fire-resistant enclosure suitably vented to the outside and surrounded by a dike to retain the contents of the transformer in the event of rupture. [29 CFR 1926.800(s)(3)]

K-502. Transformer stations shall be enclosed to prevent persons from unintentionally or inadvertently contacting energized parts. The exception shall be transformers and mining load centers which are totally enclosed by design and have no exposed parts. [CMSO 7183.(a)(35)]

600 - Electrical Installations Aboveground

K-601. Overhead high-potential powerlines shall be installed as specified by the National Electrical Safety Code (ANSI C-2). [CMSO 7183.(a)(23)]

K-602. Guy wires of poles supporting high-potential conductors shall be equipped with insulators installed near the pole end. [CMSO 7183.(a)(24)]

K-603. Telephone or signal wires shall not be installed on the same crossarm with power conductors. When carried on poles supporting powerlines, they shall be installed as specified by the National Electrical Safety Code (ANSI C-2). [CMSO 7183.(a)(25)]

K-604. Powerlines and telephone circuits shall be protected against short circuits and lightning. [CMSO 7183.(a)(28)]

K-605. Where metallic tools or equipment can come in contact with bare powerlines, the lines shall be guarded or deenergized. [CMSO 7183.(a)(29)]

K-606. Transformers shall be totally enclosed, located on poles or shall be enclosed in compliance with the National Electrical Safety Code (ANSI C-2). [CMSO 7183.(a)(30)]

K-607. Transformer enclosures shall be kept locked against unauthorized entry. [CMSO 7183.(a)(31)]

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SECTION L - WELDING AND CUTTING

100 - General

L-101. Noncombustible barriers shall be installed below welding, cutting, or other hot work being done in or over a shaft or raise. [29 CFR 1926.800(n)(2)]

L-102. Acetylene taken underground shall be in cylinders and shall be limited to necessary quantities. It shall be stored in a well-ventilated, fire-resistant location. Empty cylinders shall be removed from underground without unnecessary delay. [CMSO 7061.(c)]

200 - Precautions

The following precautions shall be taken when welding equipment, blow torches, or other heat-producing devices or materials are used underground.

L-201. All flammable materials within a radius of 10 feet shall be made wet with water before hot work is begun and again after hot work is finished. [CMSO 7061.(d)(1)]

L-202. Any flammable materials at a greater distance than 10 feet upon which sparks or hot metal can fall shall be made wet with water before hot work is begun and again after hot work is finished. [CMSO 7061.(d)(2)]

L-203. Before hot work is commenced in a shaft, a non-combustible barrier shall be installed to prevent sparks from falling below. [CMSO 7061.(d)(3)]

L-204. A fire extinguisher or water hose ready for use shall be at the operation until the hot work is finished. [CMSO 7061.(d)(4)]

L-205. The area where hot work was done shall be inspected for smoldering fires between one and two hours after hot work is finished. [CMSO 7061.(d)(5)]

L-206. Gauges and regulators used with oxygen or acetylene cylinders shall be kept clean and free of oil and grease. [CMSO 7055.(p)]

L-207. In addition to precautions listed in this Section for underground work, the provisions of 29 CFR 1926 Subpart J (Welding and Cutting) shall be applied where applicable.

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SECTION M - SHAFTS, INCLINES AND RAISES

100 - Shafts and Inclines

M-101. Every shaft shall be guarded at the top and at every shaft station. [CMSO 7110.(a)]

M-102. Guards for shafts shall conform to the following standards:

- (a) The guards shall be substantially constructed, preferably of solid materials, to keep objects from falling into the shaft. If solid materials are not used, openings in the guard shall not exceed one-half inch;
- (b) The guards shall be securely fastened in place and, except when necessarily opened, the gates shall be kept securely closed;
- (c) The guards and gates shall be at least 6 feet high and shall fit as closely to the floor as feasible;
- (d) Any alternate means of guarding which will afford at least equal protection to employees and is acceptable. [CMSO 7110.(b)]

M-103. The guards for all shafts shall be kept closed except when necessarily opened to:

- (a) Load or unload the shaft conveyance;
- (b) Make repairs to shaft;
- (c) Perform other operations that cannot be performed with the guard in place. At all times when a guard is removed, the employer shall provide other effective means to prevent persons or materials from falling into the shaft. [CMSO 7110.(c)]

M-104. When a bucket or skip is used for hoisting, means shall be provided that will prevent material from falling into the shaft while being dumped. [CMSO 7110.(d)]

M-105. All stations, levels, and skip pockets shall have a passageway around the working shaft where it is necessary for employees to cross through the shaft. [CMSO 7110.(e)]

M-106. Entering or crossing through a shaft, except to ascend or descend or for the purpose of inspecting or effecting repairs, is prohibited. [CMSO 7110.(f)]

M-107. In inclined shafts where the dip exceeds 45 degrees from the horizontal and persons are hoisted in skips, the space between the hoisting compartments at each level station shall be closed by lining boards; and an iron bar or pipe of approximately 1-inch diameter shall be placed overhead above the divider in order to give employees an easy and secure overhead handhold while walking on the divider. [CMSO 7110.(g)]

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M-108. Positive stopblocks or a derall switch shall be installed on all tracks leading to a shaft collar or landing. [CMSO 7110.(h)]

M-109. There shall be two safe means of access in shafts at all times. This may include the ladder and hoist. [CTSO 8496.(l)]

M-110. Two effective means of communication, at least one of which shall be voice communication, shall be provided in all shafts which are being developed or used either for personnel access or for hoisting. [29 CFR 1926.800(f)(2)]

200 - Maintenance and General Repair

M-201. Before maintenance or repair work is begun in a shaft, the person in charge of such work shall inform the hoistman of the nature of the work to be done. [CMSO 7111.(a)]

M-202. A sign warning that work is being done in the shaft shall be installed at the shaft collar, at the operator's station, and at each underground landing. [29 CFR (t)(1)(iv)(B)]

M-203. All planks, timbers, bulkheads, and other materials used in repair work shall be removed to a safe place before regular hoisting operations are resumed. [CMSO 7111.(d)]

M-204. Whenever practical, maintenance work shall be carried on from the hoisting conveyance used in the shaft. [CMSO 7111.(e)]

M-205. If maintenance work is carried on from the top of the conveyance, a substantial platform or other safe footing securely fastened to the conveyance shall be provided for the workers. In vertical shafts, an auxiliary bonnet shall be secured to the hoisting rope as closely above such platform as is practical for the work being done. [CMSO 7111.(f)]

M-206. Unless protected by other acceptable means, approved safety belts shall be provided employees while working:

- (a) In or over shafts or winzes inclined more than 45 degrees from the horizontal;
- (b) In any portion of any shaft where, because of slippery footing or other local conditions, a serious fall may result. [CMSO 7111.(g)]

300 - Major Repairs

M-301. To prevent injury to workers and keep materials from falling down the shaft while extensive repair work is carried on, the following precautions shall be taken:

- (a) A substantially constructed bulkhead shall be secured in place in the compartment where the repair operations are carried on, and as close below where the persons are working as is practical;

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- (b) When the shaft conveyance is lowered to the working place, it shall be stopped at least 15 feet above the working place and shall be held there until a further signal is given by the repair crew. [CMSO 7112.(a)]

M-302. Before repairs are commenced in a shaft or incline served by a hoist-operated conveyance, the hoisting engineer shall be informed concerning the details and given appropriate instructions. [CTSO 8496.(c)]

400 - Protection Against Falling Materials

M-401. When a bucket or skip is used for hoisting while sinking a new shaft or deepening a shaft already in operation, workers in the shaft shall be protected against falling rocks and materials by one or both of the following means:

- (a) Trap doors shall be installed at the shaft collar over openings in pentices and bulkheads, and under dumping points in the shaft for buckets and skips. Such trap doors shall be substantially constructed and so arranged that they can be readily and easily opened and closed;
- (b) It is recommended that trap doors at the collar be operated by compressed air and that the controls be located convenient to the hoistman. [CMSO 7113.(a)]

M-402. When persons enter the sump of a shaft or incline a positive stop must be provided to prevent the skip from being lowered on top of them, or the hoist engineer shall be notified that the skip is not to be moved until the persons working in the sump give him clearance. [CTSO 8496.(d)]

M-403. When a bucket is used for hoisting materials, buckets shall be trimmed prior to hoisting and means shall be provided that will prevent material from falling into the shaft or incline while the bucket is being dumped. [CTSO 8496.(b)]

M-404. When persons are working in a shaft without a bulkhead over their heads and the skip, cage or bucket is stopped to avoid hazard to them, it shall not be moved unless it can be done with safety. Moving shall not be attempted without permission from those who issued the hold order. [CTSO 8500.(i)]

M-405. When persons are working in a shaft without a bulkhead over their heads, the skip, cage or bucket shall not be moved until the employees in the shaft are in the clear. [CTSO 8500.(j)]

500 - Deepening an Operating Shaft or New Shaft Construction

M-501. No hoisting or other work shall be permitted in the upper part of the shaft while persons are in the lower part, unless the persons are protected by one or more of the following means:

- (a) By leaving a rock pentice at the bottom of the shaft that is to be deepened. The depth of such pentice shall be not less than one and one-half times the least dimension of the shaft;

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- (b) By installing a substantial bulkhead at the bottom of the shaft to be deepened. Such bulkhead shall consist of not less than 2 layers of heavy timbers placed with the layers at right angles to each other, and shall be covered with loose rock to a depth of not less than 15 feet.
[CMSO 7114.(a)]

M-502. Any opening through the pentice or bulkhead shall be not larger than is necessary to accommodate the sinking operations, and shall not be located under the hoisting compartments of the shaft being deepened. [CMSO 7114.(b)]

M-503. If buckets or cages without guides are used for handling persons and material, the arrangements must be such that:

- (a) The work bucket shall have all sides enclosed by a heavy screen or equivalent to a height of at least 42 inches, and have a protective canopy top. Shaft crews shall be hoisted or lowered in a man cage enclosure with bonnet;
- (b) The connection between the hoisting rope and the man-cage shall be a shackle, or equivalent, of a nonspinning type;
- (c) All parts of the rigging shall provide a safety factor of 10 or more when persons are being transported;
- (d) The hoist or crane shall be of such design that the manload is powered up and down, so arranged that the load stops or creeps slowly if the motor stops. No system of lowering against the brake or friction, with the spool in free wheeling, is to be allowed;
- (e) The drum operating lever shall be of a type that returns automatically to the "stop" position when the operator's hand is removed, unless as a substitute, the throttle that controls the drum speed automatically stops or slows the engine to idling speed when throttle is released;
- (f) Adequate level landing areas shall be provided for the use of getting on or off buckets or cages;
- (g) Makeshift hoisting operations shall not be permitted for persons or materials. [CTSO 8494.(a)]

M-504. During sinking operations no cage, skip, bucket, or other conveyance shall be lowered directly to the bottom of a shaft or incline steeper than 30 degrees from the horizontal when persons are working there. All such equipment shall be stopped at least 15 feet above the bottom of such excavation, and remain there until the signal to lower further is received from the bottom of the shaft.
[CTSO 8494.(b)]

M-505. During sinking operations in access shafts or inclines steeper than 20 degrees from the horizontal, no other work in any other place in the shaft shall be executed, nor shall any material or tools be hoisted or lowered from or to any other place in the shaft or incline while persons are at work in the bottom of the shaft, unless the men so engaged are covered by a well-constructed barrier, or otherwise protected from the danger of falling material. [CTSO 8494.(c)]

M-506. Means shall be provided to prevent equipment from rolling into shaft excavations.
[CTSO 8494.(d)]

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M-507. Open pilot raises in shafts being enlarged shall be covered or railed, except when necessarily open for the passage of muck. Safety belts and lifelines shall be worn when the raise is not guarded. [CTSO 8494.(e)]

M-508. Means of unplugging shafts, such as chains or cables that can be worked up and down, shall be provided. "Bombs" shall not be used to unplug shafts from the bottom. [CTSO 8494.(f)]

M-509. Shaft bottoms shall be cleaned of muck and an examination made for misfires before resuming drilling. [CTSO 8494.(g)]

M-510. After blasting operations in shafts, a competent person shall determine if the walls, ladders, timbers, blocking, or wedges have loosened. If so, necessary repairs shall be made before employees other than those assigned to make the repairs are allowed in or below the affected areas. [29 CFR 1926.800(o)(4)(iii)]

M-511. Bearing sets shall be installed in all vertical shafts and in all inclined shafts where it is necessary to support the shaft timbers. [CMSO 6991.(a)]

M-512. Bearing sets shall be installed as close to the shaft collar as is practical, and along the shaft at necessary intervals. It is recommended that the distance between bearing sets be no more than 100 feet. [CMSO 6991.(b)]

M-513. Cage and skip compartments shall be screened or timbered off from other shaft compartments. This divider must extend high enough upon the head frame to confine in the skip compartment any muck that might become dislodged during the dumping of the skip. If a shaft or incline has a separate, unenclosed compartment for the handling of materials there must be some means provided to give prior warning to workers at the bottom of the shaft or incline and at any intermediate stations whenever this compartment is to be used. The area around the shaft shall be barricaded. [CTSO 8496.(g)]

M-514. In shafts and inclines precautions shall be taken to prevent materials being hoisted from catching on rocks, timbers or other obstructions. All timbers, tools, etc., longer than the depth of the bucket, skip, cage or other conveyance in which they are to be hoisted or lowered must be lashed at their upper ends to the cable or otherwise secured. [CTSO 8496.(h)]

600 - Manway Compartment

M-601. Every underground shaft, winze, or raise used for hoisting, and through which persons are required or permitted to climb, shall be wide enough to accommodate a ladder, stairway, or ramp at a safe distance from the moving conveyance. [CMSO 7117.]

700- Shaft Pillars

M-701. No stoping shall be done within 20 feet of a shaft that is regularly used for hoisting persons or is used as the main passageway for persons entering or leaving the underground worksite. In no case shall stoping be done so as to endanger the shaft. [CMSO 7118.]

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800 - Raises and Chutes

M-801. Unless a raise-climber, suspended drill cage or similar method is used, raises over 30 feet in length and steeper than 30 degrees with the horizontal shall have separate compartments for muck and ladderway during the driving operation. [CTSO 8491.(a)]

M-802. The employer shall control access to all openings to prevent unauthorized entry underground. Unused chutes, manways, or other openings shall be tightly covered, bulkheaded, or fenced off, and shall be posted with warning signs indicating "Keep Out" or similar language. Completed or unused sections of the underground facility shall be barricaded. [29 CFR 1926.800(b)(3)]

M-803. Chutes and ore passes shall be guarded. [CMSO 7052.(a)]

M-804. Active chutes and ore passes shall be kept in good repair so that material will not spill into a manway. [CMSO 7052.(c)]

M-805. Chute gates shall be maintained in safe and easily operable condition. [CMSO 7052.(d)]

M-806. To protect the hands and arms of trammers and train crews, a safe clearance of not less than 6 inches shall be maintained between any part of a chute and the top of every car that is operated under such chute. [CMSO 7052.(e)]

M-807. Ample warning shall be given to persons who may be affected by the draw or otherwise exposed to danger from chute-pulling operations. [CMSO 7052.(f)]

M-808. Persons shall not stand on broken rock over draw points if there is danger that the chute will be pulled. Suitable platforms or safety lines shall be provided when work must be done in such areas. [CMSO 7052.(g)]

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SECTION N - HOISTING

100 - Hoists

N-101. In addition to the regular operating controls, every hoist shall be provided with adequate means for disconnecting the power from the hoist. [CMSO 7123.(a)]

N-102. The means for disconnecting the power shall be located where it can be easily and safely manipulated by the hoist operator at his operating station. [CMSO 7123.(b)]

N-103. Power shall be disconnected from the hoist when:

- (a) Movement of the hoist would endanger persons working on or about the hoist or equipment moved by the hoist;
- (b) The hoist is left unattended. [CMSO 7123.(c)]

N-104. Hoists shall have rated capacities consistent with the loads handled and the recommended safety factors of the ropes used. [CMSO 7123.(d)]

N-105. Hoists shall be anchored securely. [CMSO 7123.(e)]

N-106. Automatic hoists shall be provided with devices that automatically apply the brakes in the event of power failure. [CMSO 7123.(f)]

N-107. Whenever glazing is used in the hoist house, it shall be safety glass, or its equivalent, and be free of distortions and obstructions. [29 CFR 1926.800(t)(3)(ix)]

N-108. A systematic procedure of inspection, testing and maintenance of shaft and hoisting equipment shall be developed and followed. If it is found or suspected that any part is not functioning properly, the hoist shall not be used until the malfunction has been located and repaired or adjustments have been made. [30 CFR 57.19120]

N-109. At the time of completion, the person performing inspections, tests, and maintenance of shafts and hoisting equipment required in standard 57.19120 shall certify, by signature and date, that they have been done. A record of any part that is not functioning properly shall be made and dated. Certifications and records shall be retained for one year. [30 CFR 57.19121]

200 - Shafts With Only One Exit

N-201. At any underground operation which is entered by a shaft inclined at an angle more than 20 degrees from the horizontal, the hoist shall be a first-class hoist that complies with the standards set forth in Subsection 400 of this Section. [CMSO 7124.]

300 - Power Driven Material Hoists

N-301. Material hoists shall not be used to hoist or lower persons. [CMSO 7121.(a)]

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N-302. Material hoists shall be installed in a safe location where falling materials from the load cannot endanger either the hoist or hoistman. **[CMSO 7121.(b)]**

N-303. Provision shall be made to prevent a pile-up of rope on the drum from overflowing the drum flange. It is recommended that vertical rollers be installed at each end of the drum to guide the incoming rope. **[CMSO 7121.(c)]**

N-304. Hands or feet shall not be used to guide the rope onto the drum. A mechanical guide may be used for this purpose, provided it is a type that can be used safely. **[CMSO 7121.(d)]**

N-305. A substantial screen or other suitable guard shall be installed in front of each scraper hoist to protect the operator in event of a broken rope. **[CMSO 7121.(e)]**

400 - Hoisting and Lowering Personnel (First Class)

N-401. In access shafts the hoist control shall be such that it will return to the "stop" position when the hand of the operator is removed from the control lever. The brakes shall be automatically applied and the power cut off whenever the control lever is in the "stop" position. All hoisting equipment shall be tested before it is placed in operation to see that it performs properly. **[CTSO 8493.(b)]** (Specifically, all hoisting equipment shall comply with the requirements of REEC Occupational Safety Code U-1.)

N-402. Belt, rope, or chains shall not be used to connect driving mechanisms to manholts. **[CMSO 7126.(a)]**

N-403. The hoist shall be provided with ample power to hoist the fully loaded and unbalanced shaft conveyance from the lowest point in the shaft. **[CMSO 7126.(b)]**

N-404. The hoist shall be equipped with 2 independent and separate braking systems, either of which shall be capable of holding 150 percent of the weight of the fully loaded and unbalanced shaft conveyance at any point in the shaft.

Such brakes shall be so arranged that the failure of one will not interfere with the proper operation of the other. One such braking system shall operate directly on the hoist drum. **[CMSO 7126.(c)]**

N-405. Brakes and other control devices shall be arranged and maintained so that they can be easily and safely manipulated by the hoistman at his/her operating station. **[CMSO 7126.(d)]**

N-406. In access shafts the hoist shall be of such design that the load is powered up and down. There shall be no friction gearing or clutch mechanism by which the motor or other power source can be disconnected from the hoisting drum. **[CTSO 8493.(b)(3)]**

N-407. Every hoist shall be provided with an indicator that will accurately show at any moment the position of the conveyance in the shaft. It is recommended that the indicator be of a type that is operated by the hoist drum through a system of gears. Belt-driven indicators are not acceptable because of the danger of the belt slipping or breaking. **[CMSO 7126.(h)]**

N-408. Man hoists shall be provided with devices to prevent overtravel and overspeed. **[CMSO 7126.(q)]**

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N-409. The hoist drums shall be provided with flanges that extend at least three diameters of the hoisting rope radially beyond the last layer of rope when all of the rope is coiled on the drum. [CMSO 7126.(i)]

N-410. Bolts and other fittings of the hoist shall be made secure by suitable locking devices. [CMSO 7126.(j)]

N-411. The hoist shall be maintained in good operating condition. Parts that are defective, broken, cracked, or dangerously worn shall be repaired or replaced without delay. [CMSO 7126.(k)]

N-412. The hoist drum and head sheave shall be so aligned that the head sheave is at a right angle to the centerline of the hoist drum. [CMSO 7126.(l)]

N-413. The distance between the hoist drum and the nearest fixed sheave shall be not less than 15 feet for each foot of drum width. The fleet angle should not be more than 1-1/2° for smooth drums and 2° for grooved. [CMSO 7126.(m) and 30 CFR 57.19037]

N-414. Each hoist drum and head sheave where persons are hoisted or lowered shall have a minimum diameter according to the type of rope used, as given below:

- 6-strand 7-wire rope - 42 times rope dia.
- 6-strand 19-wire rope - 30 times rope dia.
- 6-strand 37-wire rope - 18 times rope dia.
- 8-strand 19-wire rope - 21 times rope dia.

[CMSO 7126.(n)]

N-415. The hoisting rope shall be securely fastened to the hoist drum with at least four cable clips, or equivalent, and shall have at least three full wraps of cable on the drum when the hoisting conveyance is at its greatest depth. [CMSO 7126.(o)]

N-416. Hoists shall be equipped with limit switches to prevent overtravel at the top and bottom of the hoistway. [29 CFR 1926.800(t)(3)(xii)]

N-417. Limit switches are to be used only to limit travel of loads when operational controls malfunction and shall not be used as a substitute for other operational controls. [29 CFR 1926.800(t)(3)(xiii)]

500 - Hoisting Conveyances

N-501. Every shaft conveyance shall be constructed of steel or other metal of equivalent strength. [CMSO 7129.(a)]

N-502. Safety dogs or catches shall be substantially constructed of steel. They shall be kept well oiled and in good working condition. [CMSO 7129.(b)]

N-503. A performance drop test of hoist conveyance safety catches shall be made at the time of installation, or prior to installation, in a mockup of the actual installation. The test shall be certified to in writing by the manufacturer or by a registered professional engineer performing the test. [30 CFR 56.19132.(a)]

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N-504. After installation and before use, and at the beginning of any seven day period during which the conveyance is to be used, the conveyance shall be suitably rested and the hoist rope slackened to test for the unrestricted functioning of the safety catches and their activating mechanisms.

[30 CFR 56.19132(b)]

N-505. The safety catches shall be inspected by a competent person at the beginning of any 24-hour period that the conveyance is to be used. **[30 CFR 56.19132(c)]**

N-506. Should the safety dogs or catches fail to function properly while being tested, the shaft conveyance shall be removed from service until the safety dogs or catches have been put into satisfactory working condition. **[CMSO 7129.(d)]**

N-507. Except when using a bucket for sinking or repairing a shaft, every shaft conveyance in which employees are required or permitted to ride shall be provided with a man-deck for use of employees. **[CMSO 7132.(a)]**

N-508. Every conveyance used for hoisting or lowering employees in a vertical shaft shall be covered by a bonnet to protect persons riding therein. **[CMSO 7132.(b)]**

N-509. The bonnet shall be constructed of mild steel plates at least three-sixteenths-inch thick, or equivalent, which shall slope toward each side and shall be so arranged that they may be readily pushed upward to afford egress to persons in the conveyance. **[CMSO 7132.(c)]**

N-510. Cages shall be provided with sheet iron or steel side-casings not less than six feet in height and not less than one-sixteenth inch thick or with netting composed of wire not less than one-sixteenth inch in diameter (the maximum size of openings of wire netting shall not be greater than one inch), and with gates of not less than four and one-half feet in height and made of such materials as specified for side-casing, either hung on hinges or working in slides; provided, however, that this order does not preclude the use of other materials having equivalent strength and providing equal safety. The man-cage should have handholds provided so that each person will have a convenient means for steadying himself. **[CTSO 8493.(c)(3)]**

N-511. To prevent accidental opening while the shaft conveyance is in motion, doors shall be equipped with safety catches or other approved devices. The doors of the shaft conveyance shall be so arranged that they cannot be opened outward. **[CMSO 7132.(f)]**

N-512. Conveyances in vertical shafts shall have a least 1-inch clearance from all timbers and other objects in the shaft except guides for the conveyance. **[CMSO 7132.(g)]**

N-513. Every shaft conveyance in which employees are required or permitted to ride shall travel in guides and be equipped with safety dogs or catches of standard design to hold the fully loaded conveyance should the hoisting rope fail. **[CMSO 7132.(h)]**

N-514. Every hoisting bucket used in a shaft more than 50 feet deep shall be provided with a crosshead that travels upon guides and is equipped with safety dogs or catches of standard design. The height of the crosshead shall be not less than its width. **[CMSO 7132.(i)]**

N-515. Buckets used to hoist workers during shaft sinking operation shall have devices to prevent accidental dumping. **[CMSO 7132.(j)]**

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N-516. Employees shall not ride on top of any cage, skip or bucket except when necessary to perform inspection or maintenance of the hoisting system, in which case they shall be protected by a body belt/harness system to prevent falling. [29 CFR 1926.800(t)(3)(v)]

N-517. Persons shall not be permitted to ride on any trip in which the cage, skip, or bucket is loaded with explosives. **EXCEPTION:** This order shall not apply in the case of a person in charge of the explosives or the cage operator. [CTSO 8493.(c)(6)]

N-518. Personnel and materials (other than small tools and supplies secured in a manner that will not create a hazard to employees) shall not be hoisted together in the same conveyance. However, if the operator is protected from the shifting of materials, then the operator may ride with materials in cages or skips which are designed to be controlled by an operator within the cage or skip. [29 CFR 1926.800(t)(3)(vi)]

600 - Hoisting Ropes and Sheaves

N-601. Every hoisting rope used on a mechanically driven hoist shall be made of steel or alloy steel. The rope center may be fiber. [CMSO 7135.(a)]

N-602. All rope to be used for regular hoisting shall be wire rope providing a factor of safety not less than five when new, which shall be calculated by dividing the breaking strength of the wire rope as given in the manufacturer's published tables, by the total load to be hoisted including the total weight of the wire rope in the shaft when fully let out, plus a proper allowance for impact and acceleration. The acceleration allowance should be in accord with manufacturer's recommendations, but in all cases the factor of safety of five or more must be maintained when the load, used in determining it, is greater than the actual weight by a percentage that is numerically three times the acceleration or deceleration, whichever is greatest. For example, a deceleration or acceleration of two feet per second per second that increases the load would require use of an effective load 6 percent greater than the actual weight, in the calculation of a factor of safety. [CTSO 8495.(a)]

N-603. At least once every fourteen calendar days, each wire rope in service shall be visually examined along its entire active length for visible structural damage, corrosion, and improper lubrication or dressing. In addition, visual examination for wear and broken wires shall be made at stress points, including the area near attachments, where the rope leaves the drum, at drum crossovers, and at change-of-layer regions. When any visible condition that results in a reduction of rope strength is present, the affected portion of the rope shall be examined on a daily basis. [30 CFR 57.19023(a)]

N-604. Before any person is hoisted with a newly installed wire rope or any wire rope that has not been examined in the previous fourteen calendar days, the wire rope shall be examined in accordance with paragraph N-603 of this section. [30 CFR 57.19023(b)]

N-605. At least once every six months, nondestructive tests shall be conducted of the active length of the rope, or rope diameter measurements shall be made:

- (a) Wherever wear is evident;
- (b) Where the hoist rope rests on sheaves at regular stopping points;
- (c) Where the hoist rope leaves the drum at regular stopping points; and

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(d) At drum crossover and change-of-layer regions. [30 CFR 57.19023(c)]

N-606. At the completion of each examination, the person making the examination shall certify, by signature and date, that the examination has been made. If any condition listed in paragraph N-603 of this Section is present, the person conducting the examination shall make a record of the condition and the date. Certifications and records of examinations shall be retained for one year.

[30 CFR 56.19023(d)]

N-607. The person making the measurements or nondestructive tests as required by paragraph N-605 of this section shall record the measurements or test results and the date. This record shall be retained until the rope is retired from service. [30 CFR 57.19023(e)]

N-608. Unless damage or deterioration is removed by cutoff, wire ropes shall be removed from service when any of the following conditions occurs:

- (a) The number of broken wires within a rope lay length, excluding filler wires, exceeds either (i) five percent of the total number of wires; or (ii) fifteen percent of the total number of wires within any strand;
- (b) On a regular lay rope, more than one broken wire in the valley between strands in one rope lay length;
- (c) A loss of more than one-third of the original diameter of the outer wires;
- (d) Rope deterioration from corrosion;
- (e) Distortion of the rope structure;
- (f) Heat damage from any source;
- (g) Diameter reduction due to wear that exceeds six percent of the baseline diameter measurement;
- (h) Loss of more than ten percent of rope strength as determined by nondestructive testing.

[30 CFR 57.19024]

N-609. In event of an accident which may have caused damage to the hoisting rope, such rope shall not be used to hoist or lower workers until it has been inspected by a competent person and found to be safe. [CMSO 7135.(h)]

700 - Hoist Rope Maintenance

N-701. No hoisting rope shall be allowed to drag or rub on any part of the hoistway, but shall be supported by rollers or guide pulleys located so as to prevent dragging or rubbing. [CMSO 7136.(a)]

N-702. Spliced hoisting ropes shall not be used. [CMSO 7136.(b)]

N-703. Every hoisting rope shall be kept well lubricated at all times. [CMSO 7136.(c)]

N-704. In all shafts containing acid water or a corrosive atmosphere, an acid-resistant preservative shall be used regularly on the hoisting rope, or a corrosion-resistant rope shall be used. [CMSO 7136.(d)]

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800 - Method of Attachment to Conveyance

N-801. The hoisting rope shall be attached to the shaft conveyance by one of the following methods:

- (a) The rope shall be attached to the load by passing one end around an oval thimble that is attached to the load and bending the end back so that it is parallel to the long or "live" end of the rope and fastening the two parts of the rope together with clips or clamps. The "U" bolt of each clip shall encircle the short or "dead" end of the rope, and the distance between clips shall not be less than the figures given in the table below. The following number of clips shall be used for various diameters of 6-strand 19-wire plow steel ropes. (Follow manufacturer's recommendations for other kinds of wire rope.)

<u>Diameter of rope (inches)</u>	<u>Number of Clips</u>	<u>Space between clips (inches)</u>
3/4	5	4 1/2
7/8	5	5 1/4
1	5	6
1 1/2	5	7
1 1/4	6	8
1 3/8	7	9
1 1/2	8	10
1 5/8	8	10
1 3/4	8	11
1 7/8	8	12
2	8	12

Where clamps other than "U" bolts are used, the manufacturer's recommendations shall be used. For all wire ropes less than three-fourths inch in diameter, at least four clips shall be used. When clips or clamps are installed on a hoisting rope, they shall be carefully tightened. A full load shall then be applied to the rope and the clips or clamps retightened under load before the rope is put into service. During the first few days, the clips shall be inspected at frequent intervals and retightened as necessary;

- (b) For wire ropes over 1-1/4 inches in diameter, it is recommended that the zinc socketing method be used. If used, the work shall be done by a person experienced in this kind of work. Babbitt metal or lead for socketing wire ropes is prohibited. **[CMSO 7137.(a)(2)]**

900 - Safety Hook and Safety Bridle

N-901. No open hook shall be used with a shaft conveyance in hoisting, but some form of safety hook or shackle shall be used. **[CMSO 7138.(a)]**

N-902. In all shafts where workers are hoisted or lowered, an emergency sling, double clevis pin, or other attachment shall be used from the cable to the conveyance, so that should the clevis pin break, the emergency attachment will prevent the conveyance from falling. **[CMSO 7138.(b)]**

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1000 - Hoist Signal System

N-1001. Every shaft shall be provided with an efficient means of interchanging distinct and definite signals between the top of the shaft and the lowest level and all other levels from which hoisting is done. [CMSO 7139.(a)]

N-1002. Every shaft in which hoisting is done shall be provided with an emergency signal system that can be operated from the shaft conveyance at any point in the shaft. [CMSO 7139.(b)]

N-1003. Special care shall be taken to keep all signalling apparatus in good order, and necessary precautions shall be taken to prevent electric signal and telephone wires from coming into contact with other electric conductors, whether insulated or not. [CMSO 7139.(c)]

N-1004. Every shaft in which men are hoisted or lowered shall be provided with a dual electrical system for shaft signaling. [CMSO 7140.(a)]

N-1005. When a dual method of signaling is employed, one shall be a bell system to signal for movement of the shaft conveyance. It shall be used for no other purpose. The second method shall be used to call for the shaft conveyance and may also be used for other communications, except to signal for movement of the shaft conveyance. This method shall consist of a system of telephones with buzzers or horns loud enough to be heard clearly. [CMSO 7140.(b)]

N-1006. The control for the signal for movement of the shaft conveyance shall be located at the shaft, within easy reach of a person in the shaft conveyance. [CMSO 7140.(c)]

N-1007. The control for the signal used to call for the shaft conveyance shall be in a convenient location well away from the shaft. [CMSO 7140.(d)]

N-1008. Hoist controls shall be placed or housed so that the noise from machinery or other sources will not prevent hoist workers from hearing signals. [CMSO 7140.(e)]

1100 - Hoisting Signal Code

N-1101. When using signals for hoisting or lowering, the following system or code shall be used:

Hoisting Signals

2-1	bells,	to hoist rock.
1	bell,	to stop if in motion.
1-2-1	bells,	to release skip.
2	bells,	to lower.
3-1	bells,	person on; run slowly; persons to be hoisted.
3-2	bells,	person on; run slowly; person to be lowered.
7	bells	and repeat, accident. Follow this signal with station signal.
3-3-1	bells,	hoist cautiously.
3-3-2	bells,	lower cautiously.
3-2-1	bells,	ready to blast.

After receiving the signal "ready to blast," the hoistman shall give the signal when he/she is ready to hoist. The hoistman's signal "ready to hoist" is to raise the shaft conveyance 2 feet and lower it again. [CMSO 7141.(a)]

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N-1102. When a signal system is used to call for the shaft conveyance, the following code shall be used:

1-2	bells,	collar of shaft
1-3	bells,	1st level
1-4	bells,	2nd level
1-5	bells,	3rd level
2-1	bells,	4th level
2-2	bells,	5th level
2-3	bells,	6th level
2-4	bells,	7th level

ETC.

[CMSO 7141.(b)]

N-1103. Easily legible copies of the hoisting signals shall be posted in a convenient location at the collar of the shaft, at each shaft station, and in the hoist room. (NOTE: When there are two or more shafts with hoists in the same underground operation, similarly identified levels shall have the same signal code number.) **[CMSO 7141.(c)]**

N-1104. Any person responsible for receiving or giving signals for cages, skips, and man trips when workers or materials are being transported shall be familiar with the posted signaling code.

[CMSO 7141.(d)]

N-1105. There shall be placed at each station a signboard on which shall be displayed the number of the level and the method for calling the shaft conveyance. **[CMSO 7142.]**

1200 - Lubricating Sheaves, Rollers, and Hoisting Equipment

N-1201. The hoist shall not be operated or moved while the sheaves, rollers, or other hoisting equipment are being lubricated, except as directed by the oiler. **[CMSO 7143.(b)]**

N-1202. The hoist shall not be operated and the cage, skip or bucket moved while oiling operations are under way unless clearance is obtained from the oiler. The hoisting engineer shall be notified when oiling operations are to commence and when they are finished. **[CTSO 8500.(h)]**

1300 - Hoisting Practices

N-1301. The person in charge of the underground operation shall determine the maximum number of people allowed to ride in the shaft conveyance at one time. **[CMSO 7146.(a)]**

N-1302. Legible signs stating the number of persons allowed to ride in the shaft conveyance at one time shall be posted conspicuously at the shaft collar and or each shaft station where employees board the shaft conveyance. **[CMSO 7146.(b)]**

N-1303. Some responsible person or persons shall be designated to supervise the loading of the shaft conveyance while the shift is being hoisted or lowered. Such person or persons shall see that the workers board the conveyance in an orderly fashion, that the posted maximum number of persons allowed on the conveyance at one time is not exceeded, and that the proper hoisting signals are used. **[CMSO 7146.(c)]**

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N-1304. It is forbidden to place boards across the top of a bucket or skip and permit persons or materials to ride thereon. [CMSO 7146.(d)]

N-1305. Persons shall be provided with a safe means for getting in and out of the shaft conveyance. Where it is necessary for workers to climb up or down inside the shaft conveyance for a distance of more than 4 feet, a ladder or some other acceptable device shall be kept in such conveyance while workers are being hoisted or lowered. [CMSO 7146.(e)]

N-1306. Persons shall not be permitted to ride on the ball or edge of the shaft conveyance. [CMSO 7146.(f)]

N-1307. The gates of the man-deck shall be closed and latched before a signal is given to move the shaft conveyance. [CMSO 7146.(g)]

N-1308. No smoking or open-flame lights shall be permitted in the shaft conveyance while the shift is being hoisted or lowered. [CMSO 7146.(h)]

N-1309. Crowding or scuffling of persons in the vicinity of a shaft is prohibited. [CMSO 7146.(i)]

1400 - Hoisting and Lowering Persons

N-1401. The safe rate of speed for the shaft conveyance shall be fixed by the employer for each shaft, and shall not be exceeded when hoisting or lowering workers. A notice of such speed limitation shall be posted in a conspicuous place near the hoist. [CMSO 7147.(a)]

N-1402. When hoisting or lowering workers with a bucket, the speed shall not exceed 200 feet per minute except in case of apprehended danger. [CMSO 7147.(b)]

N-1403. At the beginning of each shift, the shaft conveyance shall make one full trip up and down each hoisting compartment before persons are hoisted or lowered. Such trips before carrying persons shall also be made by the hoist conveyance in each hoist compartment after repair work has been performed in the shaft and after the hoist has not been operated for a period of one hour or more. [CMSO 7147.(c)]

N-1404. When the shaft conveyance has been released to the hoistman, it shall not be left at a landing but shall be hung up at least 10 feet above the shaft collar or level. [CMSO 7147.(d)]

N-1405. A careful watch shall be kept over all hoisting equipment. A daily inspection shall be made of all such equipment and a report of any defect shall be made to the person in charge. [CMSO 7147.(e)]

N-1406. Only authorized visitors and employees shall be permitted in the hoist room. [CMSO 7147.(f)]

N-1407. When persons are being hoisted in a skip or bucket, means shall be taken to prevent the lip of the skip from catching on the shaft timbers should the conveyance dip downward. [CMSO 7147.(g)]

N-1408. It is forbidden to get on or off a shaft conveyance while it is in motion. [CMSO 7147.(h)]

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N-1409. Persons shall not ride in skips or buckets with muck, supplies, materials, or tools other than small hand tools. [CMSO 7147.(j)]

N-1410. Rock or supplies shall not be hoisted in the same shaft as workers during shift changes, unless the compartments and dumping bins are partitioned to prevent spillage into the cage compartment. [CMSO 7147.(k)]

1500 - Hoisting Tools and Materials

N-1501. All timbers, tools, and other materials that are longer than the shaft conveyance in which they are being hoisted or lowered shall be securely lashed to the cable at their upper ends, or otherwise secured so they will safely ride up or down the shaft without catching on timbers, rocks, or other obstructions. [CMSO 7148.(a)]

N-1502. Other material shall be secured to the shaft conveyance or enclosed in such manner that it cannot fall from the conveyance or catch on obstructions along the shaft. [CMSO 7148.(b)]

N-1503. Where underground cars are hoisted by cage or skip, means for blocking cars shall be provided at all landings, and also on the cage. [CMSO 7148.(c)]

1600 - Hoisting While Sinking or Enlarging Shaft

N-1601. In order to protect persons working below the shaft conveyance, only first class hoists shall be used to hoist or lower workers or materials through any shaft or winze which is being deepened or enlarged. This is not intended to prohibit the material hoist from auxiliary use, such as lifting equipment from the hoist conveyance, raising timbers into place, and similar work, when such use is confined to the immediate area of the working place. When a material hoist is used, no one shall be permitted under the suspended load. [CMSO 7116.(a)]

N-1602. When the shaft conveyance is lowered to the working place, it shall be stopped at least 15 feet above the working place and shall be held there until a further signal is given by the shaft workers. [CMSO 7116.(b)]

1700 - Hoistman Qualifications

N-1701. At every underground operation where persons are hoisted or lowered, there shall be one or more qualified hoistmen who shall operate the hoist while persons are being hoisted or lowered. [CMSO 7150.(a)]

N-1702. At all shafts or inclines where persons or materials are hoisted or lowered, hoisting engineers shall be not less than 21 years of age. Only those familiar with the details and workings of a shaft hoist shall be assigned to this work and, except in cases of emergency, no one but the duly appointed hoisting engineers shall run such hoist. [CTSO 8499.(c)]

N-1703. The hoistman shall be able to speak and read English readily, and must have had practical experience in operating shaft hoists. Each hoisting engineer shall pass a thorough physical examination, at least once a year, by a medical physician. [CTSO 8499.(a)]

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N-1704. Persons who have not had practical experience in hoisting workers or material shall not be assigned to duty as hoisting operators without prior training under the direction of an experienced hoisting engineer. Training shall include experience in operation of the hoist handling material only, until such time as the employer considers the learner competent to hoist and lower employees. Training shall be done at such times and under such circumstances as to avoid the creation of any unusual hazard. [CTSO 8499.(b)]

1800 - Hoistman Required to be on Duty

N-1801. A qualified hoistman shall be in immediate charge of the hoist at all times when persons are being hoisted or lowered. Should any of the hoistman's duties be delegated to a learner, they shall be performed under the direct personal supervision of the qualified hoistman. [CMSO 7149.(a)]

N-1802. A hoistman shall be on duty, within hearing of the hoist signal, as long as any person remains in an underground operation into which he has been lowered. The hoistman shall not at any time be more than 300 feet from the hoist. [CMSO 7149.(c)]

N-1803. There shall be no conversation involving the hoisting engineer while the engine is in motion, or while the engineer is attending to signals, except to receive orders or instructions. [CTSO 8500.(d)]

1900 - Headframes

N-1901. The headframe shall be so designed and constructed that it will resist a pull in the direction of the hoisting engine greater than the breaking strength of the hoisting rope employed. [CMSO 7128.(a)]

N-1902. There shall be at least 15 feet of unobstructed hoistway clearance between the bottom of the head sheave and the top of the shaft conveyance or top connection for the hoisting rope, whichever is higher, when the bottom of such conveyance is at the top landing. [CMSO 7128.(b)]

N-1903. Every head sheave shall be provided with a platform for inspection and maintenance. Such platform shall be conveniently located, shall be of adequate size for men to work from safely and shall be equipped with standard railings and toeboards. [CMSO 7128.(c)]

N-1904. Safe access shall be provided to the head sheave platforms. [CMSO 7128.(d)]

N-1905. The headframe, sheaves, bearings, and all accessories shall be maintained in safe and usable condition. [CMSO 7128.(e)]

2000 - Shaft Guides and Tracks

N-2001. All shaft guides shall be Select Douglas Fir or equivalent, and shall be large enough in cross section to absorb the shock of stopping the fall of a shaft conveyance when gripped by the safety dogs or catches. [CMSO 7130.(a)]

N-2002. Shaft guides shall be securely fastened in place with bolts or lag screws. Lag screws shall be screwed and not driven into place. [CMSO 7130.(b)]

N-2003. The tracks for the shaft conveyance in inclined shafts shall be made of steel or other metal of equal strength. **EXCEPTION:** Wooden rails or skids may be used with a bucket when enlarging or deepening a shaft. [CMSO 7131.(a)]

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N-2004. Rails shall be well aligned and securely fastened in place. [CMSO 7131.(b)]

N-2005. The connecting ends of rails shall be fastened together by use of splice bars or welds. [CMSO 7131.(c)]

N-2006. Rail joints shall be supported adequately to prevent bending. It is recommended that rail joints be staggered for better stability. [CMSO 7131.(d)]

2100 - Emergency Provisions

N-2101. When a shaft is used as a means of egress, the employer shall make advance arrangements for power-assisted hoisting capability to be readily available in an emergency, unless the regular hoisting means can continue to function in the event of an electrical power failure at the jobsite. Such hoisting means shall be designed so that the load hoist drum is powered in both directions of rotation and so that the brake is automatically applied upon power release or failure. [29 CFR 1926.800(g)(1)]

2200 - Requirements for Cranes

N-2201. Cranes shall be equipped with a limit switch to prevent overtravel at the boom tip. Limit switches are to be used only to limit travel of loads when operational controls malfunction and shall not be used as a substitute for other operational controls. [29 CFR 1926.800(t)(2)]

N-2202. Other requirements for cranes are found in 29 CFR 1926.550 (Cranes and Derricks) and in REEC Occupational Safety Codes H-1 and H-2.

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SECTION O - EXPLOSIVES - GENERAL REQUIREMENTS

100 - Training

O-101. All persons who handle or transport detonators or explosives shall be trained in the hazards of the job and safe performance of their duties. Trainees shall be under the direct supervision of a competent person. [CMSO 7201.]

200 - Deteriorated/Frozen Explosives

O-201. Deteriorated, damaged, or scrap explosives which are unfit for use shall be destroyed in a safe place by a competent person in accordance with NTS Explosives Ordnance Disposal procedures. EXPLOSIVES SHALL NEVER BE BURIED OR COVERED OVER BY ANY MATERIALS AS A MEANS OF DISPOSAL. [CMSO 7202.]

O-202. Explosives shall be of a type that will not freeze at any temperature that may reasonably be expected. [CMSO 7203.(b)]

O-203. Advice or service should be sought from the manufacturer before using or attempting to thaw frozen explosives. [CMSO 7203.(c)]

300 - Explosives Classifications

O-301. Water gels containing an explosive shall be classified as an explosive and manufactured, transported, stored, and used as specified for explosives. [CMSO 7204.(a)]

O-302. Water gels containing no explosives, but which are cap-sensitive, shall be classified as an explosive and manufactured, transported, stored, and used as specified for explosives. [CMSO 7204.(b)]

O-303. Water gels containing no substance in itself classified as an explosive and which are not cap-sensitive shall be classified as blasting agents and manufactured, transported, stored, and used as specified for blasting agents. [CMSO 7204.(c)]

O-304. Explosives for underground use shall be classified according to the volume of oxygen and of carbon monoxide and hydrogen sulfide produced by a test explosion of a standard cartridge. [CMSO 7206.(a)]

O-305. A standard cartridge is 1-1/4 inches in diameter and 8 inches long. Any explosive which is not packed in standard cartridges shall be tested by use of a volume of such explosive comparable to that contained in a standard cartridge. [CMSO 7206.(b)]

O-306. Tests required shall be made in a Bichel Gauge according to the standard procedure of the U.S. Bureau of Mines. [CMSO 7206.(c)]

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O-307. The volume of carbon monoxide plus hydrogen sulfide produced by an explosive shall be expressed in terms of cubic feet per standard cartridge and except as provided in paragraph O-308 below, the fume class of such explosive shall be as given in the following table:

Fume Class 1 - Less than 0.16 cubic foot
Fume Class 2 - From 0.16 to 0.33 cubic foot
Fume Class 3 - From 0.33 to 0.67 cubic foot [CMSO 7206.(d)]

O-308. No explosive shall be classified as Fume Class 1 or shall be used underground if the gases emitted in tests in the Bichel Gauge according to the standard procedure of the U.S. Bureau of Mines show more oxygen than is sufficient to burn the combustible gases to their maximum oxidizable state. [CMSO 7206.(e)]

O-309. The fume class of explosives for underground use shall be clearly marked on the case in letters not less than 1/4-inch high. [CMSO 7206.(f)]

O-310. Except as provided in paragraph O-311 below, explosives used underground shall comply with the requirements for Fume Class 1. [CMSO 7206.(g)]

O-311. If the use of Fume Class 1 explosives may endanger employees by ignition of combustible dusts or gases, permissible explosives may be used and the ventilation increased to compensate for the resulting increase of poisonous gases. (NOTE: The composition of permissible explosives is such that they are less likely to ignite combustible dusts and gases than explosives which comply with Fume Class 1. On the other hand, the volume of poisonous gases produced by some permissible explosives is several times greater than that generated by Fume Class 1 explosives. When permissible explosives are used, additional ventilation shall be provided.) [CMSO 7206.(h)]

O-312. Only pre-mixed blasting agents where composition control is assured shall be used underground. [CTSO 8510.(i)]

400 - Prohibitions

O-401. Chlorate explosives shall not be used for blasting operations. [CTSO 8508.(a)]

O-402. The use of black powder shall be prohibited. [29 CFR 1926.900(p)]

O-403. Smoking, firearms, matches, open flame lamps, and other fires, flame or heat producing devices and sparks shall be prohibited within 50 feet of explosive magazines or while explosives are being handled, transported or used. [29 CFR 1926.900(b)]

O-404. Powder and primers or detonators shall not to be lowered or hoisted together in the same cage, skip or bucket, unless in a powder car. [CTSO 8513.(a)]

O-405. Explosives shall not be lowered or hoisted in the same cage, skip or bucket with other materials, supplies or equipment. Explosives must be promptly transferred from cage, skip or bucket to the powder car. They must not be temporarily stored or stacked around the shaft collar or station. [CTSO 8513.(a)]

O-406. Delivery and issue of explosives shall only be made by and to authorized persons and into authorized magazines or approved temporary storage or handling areas. [29 CFR 1926.900(n)]

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O-407. Vehicles containing explosives or detonators shall not be taken to a repair garage or shop for any purpose. [CTSO §526.(l)]

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SECTION P - STORAGE OF EXPLOSIVES

100 - General Storage of Explosives

P-101. All explosives, including special industrial high explosives and any newly developed and unclassified explosives, shall be stored in either a first-class magazine or in a second-class magazine except while being transported or in use. [CMSO 7210.(a)]

P-102. A first-class magazine shall be required for the storage of quantities of explosives in excess of 50 pounds. **(EXCEPTIONS:** This shall not be construed as applying to small arms ammunition nor Class C explosives such as explosive power packs in the form of explosive cartridges or explosive-charged construction devices, explosive rivets, explosive bolts, explosive charges for driving pins or studs, and cartridges for explosives actuated power devices when in quantities of less than 50 pounds net weight of explosives.) [CMSO 7210.(b)]

P-103. Blasting caps and electric blasting caps shall never be stored in a magazine which contains other explosives or blasting agents. [CMSO 7210.(c)]

P-104. Detonating cord shall not be kept or stored with blasting caps, but may be stored with other explosives. [CMSO 7210.(d)]

P-105. Blasting agents shall be transported, stored, and used in the same manner as explosives. [CTSO 8514.(1)]

P-106. In all operations involving the transferring, handling and restorage of explosives, reasonable precautions must be taken against unauthorized access. [CTSO 8514.(m)]

200 - Magazine Protection

P-201. All magazines shall be located or protected as to minimize accidental impact from vehicles or falling objects. [CMSO 7210.(e)]

P-202. Area surrounding magazines shall be kept clear of brush, dried grass, leaves, and other combustible materials for a distance of 50 feet. Magazine contents shall be protected from flooding. [CMSO 7210.(f)]

P-203. Keys or combinations for magazine locks shall be kept in a safe place. Only persons authorized by the employer shall be permitted to unlock or remove supplies from a magazine. [CMSO 7210.(9)]

P-204. Except when opened for use by authorized persons, the magazine shall be kept closed and securely locked at all times. [CMSO 7210.(h)]

P-205. Magazines shall be located at least 25 feet from overhead low-voltage electrical lines and 100 feet from overhead high-voltage electrical lines. Care should be taken that they be placed in such a manner that should a line break, it would not fall within this distance except for underground service. [CMSO 7210.(j)]

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P-206. Electric power lines shall be kept at least 5 feet away from the exterior of any underground magazine except underground service. [CMSO 7210.(l)]

P-207. Permanent underground storage magazines shall be at least 300 feet from any shaft, adit, or active underground working area. [29 CFR 1926.904(e)]

P-208. Oil, grease, and diesel fuel stored underground shall be kept in tightly sealed containers in fire-resistant areas at least 300 feet (91.44 m) from underground explosive magazines, and at least 100 feet (30.48 m) from shaft stations and steeply inclined passageways. Storage areas shall be positioned or diked so that the contents of ruptured or overturned containers will not flow from the storage area. [29 CFR 1926.800(m)(6)]

300 - Quantity and Distance Table for Storage

P-301. The quantity of explosives or blasting caps that may be kept or stored in any magazine shall conform to the following Table of Distances, which sets forth the minimum distance that a magazine in which a specified quantity of blasting caps or explosives subject to mass detonation is kept, be situated from the nearest inhabited building, railroad, highway, or other magazine. Class B explosives not subject to mass detonation may be stored in accordance with other quantity and distance tables of recognized authority such as the Department of Defense. [CMSO 7211.(a)]

P-302. When an inhabited building or magazine containing explosives is not barricaded, the distances shown in the following table shall be doubled. [CMSO 7211.(b)]

P-303. When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railroads, and highways, and in addition, they shall be separated from each other by not less than the distances shown for "separation of magazines" except that the quantity of explosives contained in cap magazines shall govern in regard to spacing of said cap magazines, from magazines containing explosives or blasting agents. If any two or more magazines are separated from each other by less than specified "separation of magazines" distance, then the total amount of explosives or blasting agents therein must be treated as if stored in a single magazine. [CMSO 7211.(c)]

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QUANTITY AND DISTANCES TABLE
FOR THE STORAGE OF CLASS A EXPLOSIVES
Distances in Feet When Storage Is Barricaded

<u>Pounds Over</u>	<u>Pounds Not Over</u>	<u>Separation of Magazines</u>
2	5	6
5	10	8
10	20	10
20	30	11
30	40	12
40	50	14
50	75	15
75	100	16
100	125	18
125	150	19
150	200	21
200	250	23
250	300	24
300	400	27
400	500	29
500	600	31
600	700	32
700	800	33
800	900	35
900	1,000	36
1,000	1,200	39
1,200	1,400	41
1,400	1,600	43
1,600	1,800	44
1,800	2,000	45
2,000	2,500	49
2,500	3,000	52
3,000	4,000	58
4,000	5,000	61
5,000	6,000	65
6,000	7,000	68
7,000	8,000	72
8,000	9,000	75
9,000	10,000	78

(For quantities over 10,000 pounds, consult the American Table of Distances for Storage of Explosives published by the Institute of Makers of Explosives.)

P-304. All types of blasting caps in strength through No. 8 shall be rated at 1-1/2 pounds of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the manufacturer. [CMSO 7211.(d)]

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P-305. For quantity and distance purposes, detonating cord up to 60 grains per foot shall be calculated as equivalent to 9 pounds of Class A explosives per 1,000 feet. Heavier detonating cord shall be rated proportionately. [CMSO 7211.(e)]

P-306. The quantity and distance table is not applicable to any magazine if the nearest inhabited building, railroad, or highway is effectually screened from the magazine by a natural barrier which:

- (a) Is 40 feet or more in height at any point, above a straight line drawn from the top of any sidewall of the magazine to any part of the inhabited building, or to any point 12 feet above the center of the railroad or highway, and
- (b) Has a natural thickness of not less than 2 feet at the point where it is intersected by the straight line. [CMSO 7211.(f)]

P-307. If at any time the distance from a magazine to the nearest inhabited building, highway, or railroad is decreased through the construction of a new inhabited building, building intended to be occupied, highway, or railroad, the quantity of explosives kept or stored in the magazine shall be reduced to correspond with that specified for the new distance by the Quantity and Distance Table. [CMSO 7211.(g)]

P-308. This table applies only to the manufacture and storage of commercial explosives. It is not applicable to transportation of explosives, any handling, temporary storage necessary, or incident thereto. It is not intended to apply to bombs, projectiles, or other heavily encased explosives. [CMSO 7211.(h)]

400 - Quantity and Distance Table for Storage of Explosives - Class B

P-401. These explosives normally will be confined to pressure ruptures of containers and will not produce propagating shock waves or damaging blast over pressure beyond the magazine distance specified for this class. These distances are unbarricaded. [CMSO 7212.(a)]

**QUANTITY AND DISTANCES TABLE
FOR THE STORAGE OF CLASS B EXPLOSIVES
Distances in Feet When Storage Is Unbarricaded**

<u>Pounds Over</u>	<u>Pounds Not Over</u>	<u>Separation of Magazines</u>
0	1,000	50
1,000	5,000	75
5,000	10,000	100
10,000	20,000	125
20,000	30,000	145
30,000	40,000	155
40,000	50,000	165

P-402. Distances are not to be reduced by the presence of barricades or earth cover. [CMSO 7212.(b)]

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500 - Construction of First-Class Magazines

P-501. Magazines for the storage of Class A explosives shall be bullet resistant, weather resistant, fire resistant, and ventilated sufficiently to protect the explosive in the specific locality. [29 CFR 1910.109(c)(2)(ii)]

P-502. First-class magazines shall be of masonry construction or of wood or of metal construction, or a combination of these types. Thickness of masonry units shall not be less than 8 inches. Hollow masonry units used in construction, required to be bullet resistant, shall have all hollow spaces filled with weak cement or well-tamped sand. Wood constructed walls, required to be bullet resistant, shall have at least a 6-inch space between interior and exterior sheathing and the space between sheathing shall be filled with well-tamped sand. Metal wall construction, when required to be bullet resistant, shall be lined with brick at least 4 inches in thickness or shall have at least a 6-inch sandfill between interior and exterior walls. [29 CFR 1910.109(c)(3)(i)]

P-503. All wood at the exterior of magazines, including eaves, shall be protected by being covered with black or galvanized steel or aluminum metal of thickness of not less than No. 26 gage. All nails exposed to the interior of magazines shall be well countersunk. [29 CFR 1910.109(c)(3)(iv)]

P-504. Magazine interiors shall be of a smooth finish without cracks or crevices with all nails, screws, bolts and nuts countersunk. Exposed metal or material capable of emitting sparks shall be covered so as not to come in contact with packages of explosives. [CTSO 8517.(f)]

P-505. Openings to magazines shall be restricted to that necessary for the placement and removal of stocks of explosives. Doors for openings in magazines for Class A explosives shall be bullet resistant. [29 CFR 1910.109(c)(3)(vii)]

P-506. Floors and roofs of masonry magazines may be of wood construction. Wood floors shall be tongue and grooved lumber having a nominal thickness of 1 inch. [29 CFR 1910.109(c)(3)(ii)]

P-507. Roofs required to be bullet resistant shall be protected by a sand tray located at the line of eaves and covering the entire area except that necessary for ventilation. Sand in the sand tray shall be maintained at a depth of not less than 4 inches. [29 CFR 1910.109(c)(3)(iii)]

P-508. Foundations for magazines shall be of substantial construction and arranged to provide good cross ventilation. [29 CFR 1910.109(c)(3)(v)]

P-509. Magazines shall be ventilated sufficiently to prevent dampness and heating of stored explosives. Ventilating openings shall be screened to prevent the entrance of sparks. [29 CFR 1910.109(c)(3)(vi)]

P-510. Provisions shall be made to prevent the piling of stocks of explosives directly against masonry walls, brick-lined or sand-filled metal walls and single-thickness metal walls. Such provisions, however, shall not interfere with proper ventilation at the interior of side and end walls. [29 CFR 1910.109(c)(3)(ix)]

P-511. Property upon which first-class magazines are located shall be posted with signs reading "Explosives - Keep Off." [29 CFR 1910.109(c)(2)(iii)]

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600 - Construction of Second-Class Magazines

P-601. Second-class magazines shall be of wood or metal construction, or a combination thereof.
[29 CFR 1910.109(c)(4)(i)]

P-602. Wood magazines of this class shall have sides, bottom, and cover constructed of 2-inch hardwood boards well braced at corners and protected by being entirely covered with sheet metal of not less than No. 20 gage. All nails exposed to the interior of the magazine shall be well countersunk. All metal magazines of this class shall have sides, bottom, and cover constructed of sheet metal, and shall be lined with three-eighths-inch plywood or equivalent. Edges of metal covers shall overlap sides at least 1 inch. [29 CFR 1910.109(c)(4)(ii)]

P-603. Covers for both wood- and metal-constructed magazines of this class shall be provided with substantial strap hinges and shall be provided with substantial means for locking.
[29 CFR 1910.109(c)(4)(iii)]

P-604. Magazines of this class shall be painted red and shall bear lettering in white, on all sides and top, at least 3 inches high, "Explosives - Keep Fire Away." Second-class magazines, when located inside buildings, shall be provided with substantial wheels or casters to facilitate easy removal in the case of fire. Where necessary due to climatic conditions, second-class magazines shall be ventilated.
[29 CFR 1910.109(c)(4)(iv)]

700 - Storage Within First-Class Magazines

P-701. When lights are necessary inside the magazine, electric safety flashlight or electric safety lanterns shall be used. [29 CFR 1910.109(c)(2)(vi)]

P-702. Packages of explosives shall be laid flat with top side up. Corresponding grades and brands shall be stored together in such a manner that brands and grade marks show. All stocks shall be stored so as to be easily counted and checked. Packages of explosives shall be piled in a stable manner. When any kind of explosive is removed from a magazine for use, the oldest explosive of that particular kind shall always be taken first. [29 CFR 1910.109(c)(5)(i)]

P-703. Packages of explosives shall not be unpacked or repacked in a magazine nor within 50 feet of a magazine or in close proximity to other explosives. Tools used for opening packages of explosives shall be constructed of nonsparking materials, except that metal slitters may be used for opening fiberboard boxes. A wood wedge and a fiber, rubber, or wood mallet shall be used for opening or closing wood packages of explosives. Opened packages of explosives shall be securely closed before being returned to a magazine. [29 CFR 1910.109(c)(5)(ii)]

P-704. Magazines shall not be used for the storage of any metal tools nor any commodity except explosives, but this restriction shall not apply to the storage of blasting agents and blasting supplies.
[29 CFR 1910.109(c)(5)(iii)]

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P-705. Magazine floors shall be regularly swept, kept clean, dry, free of grit, paper, empty used packages, and rubbish. Brooms and other cleaning utensils shall not have any spark-producing metal parts. Sweepings from floors of magazines shall be properly disposed of. Magazine floors stained with nitroglycerin shall be cleaned according to instructions by the manufacturer.

[29 CFR 1910.109(c)(5)(iv)]

P-706. When any explosive has deteriorated to an extent that it is in an unstable or dangerous condition, or if nitroglycerin leaks from any explosives, then the person in possession of such explosive shall immediately notify the NTS Explosive Ordnance Disposal representative. Only experienced persons shall be allowed to do the work of destroying explosives. **[29 CFR 1910.109(c)(5)(v)]**

P-707. When magazines need inside repairs, all explosives shall be removed therefrom and the floors cleaned. In making outside repairs, if there is a possibility of causing sparks or fire, the explosives shall be removed from the magazine. Explosives removed from a magazine under repair shall either be placed in another magazine or placed a safe distance from the magazine where they shall be properly guarded and protected until repairs have been completed, when they shall be returned to the magazine.

[29 CFR 1910.109(c)(5)(vi)]

P-708. Smoking, matches, open flames, spark-producing devices, and firearms (except firearms carried by guards) shall not be permitted inside of or within 50 feet of magazines. **[29 CFR 1910.109(c)(5)(vii)]**

P-709. Magazines shall be in the charge of a competent person at all times and who shall be held responsible for the enforcement of all safety precautions. **[29 CFR 1910.109(c)(5)(viii)]**

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SECTION Q - TRANSPORTATION OF EXPLOSIVES

This Section does not apply to vehicles transporting explosives over public highways under regulations of the Department of Transportation.

100 - Aboveground Transportation Vehicle Requirements

Q-101. Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty and be in good mechanical condition. If vehicles do not have a closed body, the body shall be covered with a flameproof and moisture-proof tarpaulin or other effective protection against moisture and sparks. All vehicles used for the transportation of explosives shall have tight floors and any exposed spark-producing metal on the inside of the body shall be covered with wood or other nonsparking materials to prevent contact with packages of explosives. Packages of explosives shall not be loaded above the sides of an open-body vehicle. [29 CFR 1910.109(d)(2)(i)]

Q-102. Exterior markings or placards required on applicable vehicles shall be as follows for the various classes of commodities:

<u>Commodity</u>	<u>Type of Marking or Placard</u>
Explosives, Class A, any quantity or a combination of Class A and Class B explosives.	Explosive A (Black letters on orange background).
Explosives, Class B, any quantity.	Explosive B (Black letters on orange background).
Oxidizing materials, 1,000 pounds or more gross weight. [29 CFR 1910.109(d)(2)(ii)(a)]	Oxidizer (Black letters on yellow background).

Q-103. Such markings or placards shall be displayed at the front, rear, and on each side of the motor vehicle or trailer, or other cargo carrying body while it contains explosives or other dangerous articles of such type and in such quantity as specified in paragraph Q-102 above. The front marking or placard may be displayed on the front of either the truck, truck body, truck tractor or the trailer. [29 CFR 1910.109(d)(2)(ii)(c)]

Q-104. In any combination of two or more vehicles containing explosives or other dangerous articles, each vehicle shall be marked or placarded as to its contents and in accordance with paragraphs Q-102 and Q-103 above. [29 CFR 1910.109(d)(2)(ii)(e)]

Q-105. Each motor vehicle used for transporting explosives shall be equipped with a minimum of two extinguishers, each having a rating of at least 10-BC. Only extinguishers listed or approved by a nationally recognized testing laboratory shall be deemed suitable for use, on explosives-carrying vehicles. [29 CFR 1910.109(d)(2)(iii)(a)]

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Q-106. Extinguishers shall be filled and ready for immediate use and located near the driver's seat. Extinguishers shall be examined periodically by a competent person. [29 CFR 1910.109(d)(2)(iii)(b)]

Q-107. A motor vehicle used for transporting explosives shall be given the following inspection to determine that it is in proper condition for safe transportation of explosives:

- (a) Fire extinguishers shall be filled and in working order.
- (b) All electrical wiring shall be completely protected and securely fastened to prevent short-circuiting.
- (c) Chassis, motor, pan, and underside of body shall be reasonably clean and free of excess oil and grease.
- (d) Fuel tank and feedline shall be secure and have no leaks.
- (e) Brakes, lights, horn, windshield wipers, and steering apparatus shall function properly.
- (f) Tires shall be checked for proper inflation and defects.
- (g) The vehicle shall be in proper condition in every other respect and acceptable for handling explosives. [29 CFR 1910.109(d)(2)(iv)]

Q-108. Explosives, blasting agents, and blasting supplies shall not be transported with other materials or cargoes. Blasting caps (including electric) shall not be transported in the same vehicle with other explosives. [29 CFR 1926.902(d)]

Q-109. No driver of a vehicle containing explosives shall leave the cab without first stopping the motor and setting the parking brake. All reasonable precautions shall be taken to prevent the movement of such vehicle. [CTSO 8526.(i)]

Q-110. Explosives shall not be left unattended during transportation. The attendant must be trained in the hazards of explosives and have an emergency plan. [CTSO 8526.(j)]

200 - Underground Transportation of Explosives - General

Q-201. Explosives shall not be left on the station level near the shaft collar or underground entrance, but shall be taken to the place of use or storage without delay. [CMSO 7222.(b)]

Q-202. Detonators, capped fuses, and other explosives transported in any car, vehicle, or shaft conveyance shall be enclosed in substantially constructed containers equipped with tight-fitting covers. Such containers, including the covers shall be made of wood, metal, fiber, or other acceptable material and shall be lined with nonconductive material. (NOTE: Except for primers, the original cases or DOT shipping containers in which the explosives were packaged, will be accepted as being in compliance with this paragraph.) [CMSO 7222.(c)]

Q-203. Except as provided in subsection 200 above, detonators, primers, or capped fuses shall not be transported in the same container or compartment with other explosives. [CMSO 7222.(d)]

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Q-204. Except when being transported manually, primers shall be transported in a closed container constructed as described in Q-202 above and arranged so that each primer is separated from the others by a partition of nonmetallic material. No explosive, other than that which is contained in the primer, shall be transported in the same container with the primers. [CMSO 7222.(e)]

Q-205. Explosives shall not be transported with materials or equipment other than those used in blasting. [CMSO 7222.(f)]

300 - Transportation of Explosives - Hoisting or Lowering

Q-301. No employees, except those specifically required and designated by the person in charge of the underground operation, shall be permitted to ride in any shaft conveyance at the same time as explosives are being transported in such shaft. [CMSO 7223.(a)]

Q-302. The hoistman shall be notified before explosives are transported in the shaft conveyance. [CMSO 7223.(b)]

Q-303. Explosives shall be in a suitable conveyance while being hoisted from or lowered to any place underground. [CMSO 7223.(c)]

Q-304. Hoisting of muck, or other materials in adjacent shaft compartments shall be stopped while explosives are being handled. [CMSO 7223.(d)]

Q-305. Powder and primers or detonators shall not be lowered or hoisted together in the same cage, skip or bucket, unless in a powder car. [CTSO 8528.(e)]

Q-306. Explosives shall not be lowered or hoisted in the same cage, skip or bucket with other materials, supplies or equipment. Explosives must be promptly transferred from cage, skip or bucket to the powder car. They shall not be temporarily stored or stacked around the shaft collar or station. [CTSO 8528.(f)]

400 - Underground Transportation of Explosives - By Rail

Q-401. Only the train crew and powder men shall be permitted to ride on a train transporting explosives. [CMSO 7224.(a)]

Q-402. No explosives or blasting agents shall be transported on any locomotive. At least two car lengths shall separate the locomotive from the powder car. [29 CFR 1926.903(j)]

Q-403. Explosives in quantities of 100 pounds or more, when transported on a train, shall be in special powder cars. Such cars shall be constructed of metal and have closed compartments for the explosives. The compartments shall be lined with nonconductive material. [CMSO 7224.(b)]

Q-404. Each side of the special powder car shall bear a sign with the word "EXPLOSIVES" in letters not less than 4 inches high with a 5/8-inch stroke on a background of sharply contrasting color. [CMSO 7224.(d)]

Q-405. Powder cars that are carrying explosives shall be pulled, not pushed, except when switching or traveling at the dead end of a line. [CMSO 7224.(e)]

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Q-406. The primers shall be placed in a primer compartment of the powder car in a suitable box with divisions for each separate delay. If capped fuses are used, they must be in a suitable container in the primer compartment. The primer and powder compartments must be separated by at least 4 inches of hardwood or 25 inches of air space. [CMSO 7224.(f)]

Q-407. Trains which are transporting explosives shall not contain cars carrying rock or other materials except those used in blasting. [CMSO 7224.(g)]

Q-408. Safety chains or other connections shall be used in addition to couplers to connect man cars or powder cars whenever the locomotive is uphill of the cars. [29 CFR 1926.800(r)(13)(l)]

500 - Underground Transportation of Explosives - Special Trackless Vehicles

Q-501. Trackless vehicles used to transport explosives underground shall be truck-type vehicles other than those with dump bodies. [CMSO 7225.(a)]

Q-502. Trackless vehicles used for the transportation of explosives shall be especially equipped for that purpose and shall be carefully maintained. [CMSO 7225.(b)]

Q-503. Truck-type vehicles used for the transportation of explosives shall be equipped with closed compartments for the explosives. The compartments shall be lined with nonconductive materials. [CMSO 7225.(c)]

Q-504. Each side, front, and rear of every truck-type vehicle, when transporting explosives, shall bear a sign with the word "EXPLOSIVES" in letters not less than 4 inches high with a 5/8-inch stroke on a background of sharply contrasting color. [CMSO 7225.(d)]

Q-505. Truck-type vehicles, when transporting explosives underground, shall be equipped with a flashing red light visible from the front and rear. [CMSO 7225.(e)]

Q-506. Trackless vehicles which are transporting explosives shall not contain rock or other materials or equipment, except those used in blasting. [CMSO 7225.(f)]

Q-507. Only the vehicle operator and blaster shall be permitted to ride on any vehicle transporting explosives. [CMSO 7225.(g)]

600 - Manual Transportation of Explosives

Q-601. Explosives that are transported manually from one area to another shall be placed in suitable bags or other containers for such transportation. [CMSO 7226.(a)]

Q-602. Detonators and primers shall be transported in separate bags or containers from other explosives. [CMSO 7226.(b)]

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SECTION R - LOADING AND BLASTING OPERATIONS

100 - Blast Area Preparation

R-101. Only authorized competent persons shall be in immediate charge of blasting.
[CMSO 7230.(a)]

R-102. There shall be no smoking or open flames within 50 feet of any area where explosives are being handled. [CMSO 7230.(b)]

R-103. No energized power cables or sources of ignition, except necessary to the loading and firing operation, shall be permitted in an area containing loaded holes. [CMSO 7230.(c)]

R-104. Explosives containers shall be opened with nonsparking tools, except knives, metallic sitters, or similar tools may be used to open cardboard cartons. [CMSO 7230.(d)]

R-105. Paper cartons, sawdust, and other rubbish from explosives containers shall be removed to a safe place. [CMSO 7230.(e)]

R-106. Explosives shall not be placed or left within 5 feet of an electric light circuit or electric power circuit except during transportation. [CMSO 7230.(f)]

R-107. All detonators, detonating cord, igniter cord, and explosives left over after loading operations are completed, shall be promptly returned to their proper magazines. [CMSO 7230.(g)]

R-108. When blasting in a location where flying rock or material may damage other property, all loaded holes shall be covered with an adequate blasting mat that has been securely anchored.
[CMSO 7230.(h)]

R-109. Precautions shall be taken to prevent unauthorized entry of the blast area including, but not limited to, warning signs, barricades, or flagmen when necessary. [CMSO 7235.(c)]

R-110. In areas where dangerous accumulations of water, gas, mud, or fire atmosphere could be encountered, employees shall be removed to safe places before blasting. [CMSO 7178.(d)]

200 - Tamping Poles And Devices

R-201. Tamping shall be done only with wood rods or plastic tamping poles without exposed metal parts, but nonsparking metal connectors may be used for jointed poles. Violent tamping shall be avoided. The primer shall never be tamped. [29 CFR 1926.905(c)]

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300 - Loading Explosives - General

R-301. Loading shall not commence until all drilling is completed and drill holes are cleaned or blown out, unless this procedure is impracticable under conditions encountered. When conditions justify simultaneous loading and drilling in the same area, such operations shall be separated as widely as practicable and in no case less than the length of the deepest hole in the shot. [CMSO 7232.(a)]

R-302. Machines and all tools not used for loading explosives into bore holes shall be removed from the immediate location of holes before explosives are delivered. Equipment shall not be operated within 50 feet of loaded holes. [29 CFR 1926.905(h)]

R-303. Loading operations shall be carried on with the smallest practical number of persons present and no one but authorized personnel shall be allowed in the loading area. [CMSO 7232.(c)]

R-304. The amount of explosives delivered into a loading area shall not exceed the amount estimated by the blaster as necessary for the blasting. [CMSO 7232.(d)]

R-305. The detonator, if used, shall be properly encased in explosives when inserted into the drill hole. [CMSO 7232.(f)]

R-306. When loading explosives in a bore hole, tamping shall be by pressure or light blows only, and never by excessive ramming. The primer shall be loaded first and not tamped. [CMSO 7232.(g)]

R-307. When required, all blast holes shall be stemmed to a point that will sufficiently confine the charge. [CMSO 7232.(h)]

R-308. Stacks of explosives shall be spaced and distributed in the loading area to prevent propagation of an explosion between any two piles or loaded holes in the event of a premature explosion in any portion of the blast area. [CMSO 7232.(i)]

R-309. Drill holes or any part of such holes which have been charged with explosives shall not be deepened. [CMSO 7232.(k)]

R-310. Holes to be blasted shall be charged as near to blasting time as practical and such holes shall be blasted as soon as possible after charging has been completed. In no case shall the time elapsing between the completion of charging to the time of blasting exceed 72 hours unless prior approval has been obtained. [CMSO 7232.(l)]

R-311. Explosives shall be kept separated from primers until charging is started. [CMSO 7232.(m)]

R-312. Primers shall be made up only as required for each round of blasting.
[29 CFR 1910.109(e)(4)(iii)]

R-313. Only wooden or other nonsparking implements shall be used to punch holes in an explosive cartridge. [CMSO 7232.(o)]

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R-314. Flood lights shall be used as illumination for loading operations. If current for flood lights is supplied by batteries of electric locomotive, these lights shall be placed not closer than 50 feet from the loading operation. Only permissible lights shall be used within 50 feet of the loading area.
[CTSO 8537.(t)]

R-315. Lead wires shall not be connected to the permanent shot firing line until all men have retreated from the face, except the man making the connection, and all men shall retreat with him to the shooting switch. No unnecessary work will be done at the face during or after loading before the shots are fired.
[CTSO 8537.(w)]

R-316. Areas in which charged holes are awaiting firing shall be guarded or barricaded and posted or flagged against unauthorized entry. [CMSO 7232.(p)]

400 - Detonators and Detonating Cord

R-401. Detonators shall not be less strength than No. 6. [CMSO 7232.(e)]

R-402. Electric detonators of different brands shall not be used in the same round. [CMSO 7232.(q)]

R-403. Care shall be taken to select a detonating cord consistent with the type and physical condition of the bore hole and stemming and the type of explosives used. [29 CFR 1926.908(a)]

R-404. Detonating cord shall be handled and used with the same respect and care given other explosives. [29 CFR 1926.908(b)]

R-405. The line of detonating cord extending out of a bore hole or from a charge shall be cut from supply spool before loading the remainder of the bore hole or placing additional charges.
[29 CFR 1926.908(c)]

R-406. Detonating cord shall be handled and used with care to avoid damaging or severing the cord during and after loading and hooking-up. [29 CFR 1926.908(d)]

R-407. Detonating cord connections shall be competent and positive in accordance with approved and recommended methods. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry. [29 CFR 1926.908(e)]

R-408. All detonating cord trunklines and branchlines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation. [29 CFR 1926.908(f)]

R-409. All detonating cord connections shall be inspected before firing the blast.
[29 CFR 1926.908(g)]

R-410. When detonating cord millisecond-delay connectors or short-interval-delay electric blasting caps are used with detonating cord, the practice shall conform strictly to the manufacturer's recommendations. [29 CFR 1926.908(h)]

R-411. When connecting a blasting cap or an electric blasting cap to detonating cord, the cap shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the cap containing the explosive charge pointed in the direction in which the detonation is to proceed.
[29 CFR 1926.908(i)]

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R-412. Detonators for firing the trunkline shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast. [29 CFR 1926.908(j)]

500 - Springing Holes

R-501. Boreholes shall not be sprung within 100 feet of any hole containing explosives for primary blasting. [CMSO 7232.(j)(1)]

R-502. A hole that has been sprung shall not be loaded until sufficient time has elapsed for the hole to cool. Artificial means may be used to cool the hole. [CMSO 7232.(j)(2)]

R-503. Drop fuses or any other method that calls for ignition of the fuse prior to placement of the charge in its final position shall not be used. [CMSO 7232.(j)(3)]

600 - Load and Blasting Near and Under Power Lines

R-601. When surface blasting under or near overhead power lines, the leading wires shall be placed at right angles to such lines and shall be securely anchored to prevent the blasting circuit conductors from being thrown into the overhead lines. [CMSO 7233.(a)]

R-602. When blasting under or near overhead power lines, all loaded holes shall be covered with an adequate nonconductive blasting mat securely anchored to prevent the mat or other material from being blown into the overhead lines. [CMSO 7233.(b)]

700 - Firing of Explosives

R-701. It shall be the duty of the employer or his delegated representative to fix the time of blasting. [CMSO 7235.(a)]

R-702. Blasts are not to be fired without a positive signal and definite assurance that all surplus explosives are in a safe place, and all persons are at a safe distance or under sufficient cover. [CMSO 7235.(b)]

R-703. Employees authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution including, but not limited to, visual and audible warning signals, flags, or barricades, to ensure employee safety. [29 CFR 1926.900(i)]

R-704. Before firing an underground blast, warning shall be given, and all possible entries into the blasting area, and any entrances to any working place where a drift, raise, or other opening is about to hole through, shall be carefully guarded. The blaster shall make sure that all employees are out of the blast area before firing a blast. [29 CFR 1926.909(e)]

R-705. There shall be no activity of any kind that would create a hazard to explosives that have been placed or are being placed for secondary blasting. [CMSO 7236.(a)]

R-706. Where shots are to be fired in such close proximity that one shot may displace another, the firing shall be done by use of detonating cord or instantaneous electric blasting caps. [CMSO 7236.(b)]

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800 - Misfires

THIS IS THE MOST HAZARDOUS OPERATION ASSOCIATED WITH BLASTING OPERATIONS.

R-801. After each shot, the blast area shall be examined for misfires. If any are found or suspected to exist, they shall be reported to the person in charge. Steps shall be taken to eliminate all unexploded charges. [CMSO 7237.(a)]

R-802. Where possible, the number of explosive charges in every blast shall be counted and compared with the total number of explosions heard. [CMSO 7237.(b)]

R-803. In case of detonator misfire, the shot area shall be made safe under competent supervision by one of the following means after a 30-minute wait following electric blasting, except where an electric blasting cap is visible on the surface, or a 60-minute wait following fuse cap blasting:

- (a) Where practical, a new primer shall be inserted into the hole and the hole reblasted, or
- (b) Where the hole cannot be reblasted, the stemming and explosive shall be washed out with water, or
- (c) Where blasting agents are used, try to remove the detonator and cap sensitive explosives. [CMSO 7237.(c)]

R-804. No drilling, digging, or picking shall be permitted until all missed holes have been detonated or the authorized representative has approved that work can proceed. [29 CFR 1926.911(e)]

R-805. If explosives are suspected of burning in a hole, all persons in the endangered area shall move to a safe location and no one shall return to the hole until the danger has passed, but in no case within 1 hour. [CMSO 7237.(e)]

R-806. Explosives recovered from blasting misfires shall be placed in a separate magazine until competent personnel has determined from the manufacturer the method of disposal. Caps recovered from blasting misfires shall not be reused. Such explosives and caps shall then be disposed of in the manner recommended by the manufacturer. [29 CFR 1910.109(c)(5)(ix)]

900 - Safety Fuse - General

R-901. No fuse except safety fuse shall be used for fuse cap blasting. [CMSO 7241.(a)]

R-902. The average burning rate of safety fuse used shall be determined by burning not less than 3-foot lengths of such fuse in open air. No safety fuse which varies more than 10 percent from the average burning rate shall be used. [CMSO 7241.(b)]

R-903. Notice shall be displayed prominently at the work location, stating the burning rate of safety fuse used. [CMSO 7241.(c)]

R-904. It is forbidden to use safety fuse that has been hammered or damaged. [CMSO 7241.(d)]

R-905. In cold weather, the safety fuse shall be warmed slightly before being uncoiled in order to avoid breaking or cracking. [CMSO 7242.(a)]

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R-906. Safety fuse shall not be stored underground unless the storage place is dry and the relative humidity of the air is less than 80 percent. [CMSO 7242.(b)]

R-907. Safety fuse shall not be hung on nails or other projections that could cause a sharp bend to be formed in the fuse. [CMSO 7242.(c)]

R-908. Fuse and igniters shall be stored in a cool, dry place away from oil and grease. [CMSO 7242.(d)]

1000 - Making Capped Fuses and Primers

R-1001. In capping safety fuse, at least one inch shall be cut from the end of each coil of the fuse to be used to prevent damp fuse end from getting into the cap. [CMSO 7243.(a)]

R-1002. Blasting caps shall be kept in original or equivalent container except as they are used for capping safety fuses. [CMSO 7243.(b)]

R-1003. Only a ring-type cap crimper of standard design shall be used for attaching blasting caps to safety fuse. Crimping caps with a knife or teeth shall not be permitted. The employer shall furnish suitable crimper which shall be kept in an accessible place ready for use. [CMSO 7243.(c)]

R-1004. A waterproof ring-type crimp or a compound especially prepared for waterproofing shall be used when necessary. [CMSO 7243.(d)]

R-1005. It is forbidden to use methods of attaching the capped fuse to the primer cartridge which involves half-hitching the capped fuse around the primer cartridge. It is recommended that the string-tied method or other equally effective means be used. [CMSO 7243.(e)]

R-1006. Fuses shall be cut and capped in a safe, dry location posted with "No Smoking" signs. [CMSO 7243.(f)]

1100 - Blasting With Safety Fuse

The chief danger when blasting with safety fuses comes from failure to allow enough time to light all the fuses and retire to a place of safety before the shots start to fire.

Almost all such "premature" blasts are caused by cutting the fuses too short, trying to light too many fuses, loss of time in overcoming unexpected difficulty in lighting fuses, or by underestimating the time needed to reach adequate shelter from the blast.

When using safety fuse, it must be clearly understood that the blaster has lost control of the blast area just as soon as the first fuse is lighted. After that, the time which men may remain safely in the blast area is governed solely by the length and burning rate of the lighted fuse. It is, therefore, very important that the blaster finish lighting his round and leave with as little delay as possible.

A large number of fuses can be connected with igniter cord so that an entire round can be fired by a single ignition. If desired, the igniter cord can be lighted by means of an electric starter. For these reasons, it is strongly recommended that igniter cord be used with fuse blasting. It should do much to reduce the hazards by permitting the blasting crew to leave the blast area immediately after the first ignition, or to even fire the igniter cord by electricity from a remote location safe from the blast.

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R-1101. Safety fuses shall not be ignited before explosive charges are in place. [CMSO 7244.(a)]

R-1102. When blasting with safety fuse, consideration shall be given to the length and burning rate of the fuse, condition of the blaster's escape route and the distance to a place of safety. [CMSO 7244.(b)]

R-1103. All safety fuses must be cut sufficiently long to extend beyond the collar of the hole and in no case shall they be less than 3 feet in length. (NOTE: At the usual rate of burning, a 3-foot length of safety fuse will fire a shot in about 2 minutes.) [CMSO 7244.(c)]

R-1104. Only single shots shall be fired when using 3-foot safety fuses. If more than one fuse is to be lighted at one time, such fuses shall be sufficiently long to comply in full with paragraph R-1105 below. [CMSO 7244.(d)]

R-1105. When lighting safety fuse, the fuses shall be so timed that no charge will explode until at least 2 minutes after the last fuse in the blast area has been ignited. [CMSO 7244.(e)]

R-1106. No one employee shall be permitted to ignite more than 12 safety fuses in succession. When 2 or more safety fuses in a group are lighted as one, by means of igniter cord or other fuse-lighting device, they may be considered as one fuse. [CMSO 7244.(f)]

R-1107. If more than 3 safety fuses are lighted at one time, no person shall enter the blast area until after a period of time equal to 2 minutes for each foot in the length of the longest fuse in the round or 15 minutes, whichever is the longest time. [CMSO 7244.(g)]

R-1108. At least 2 men shall be present when lighting fuses. [CMSO 7244.(h)]

R-1109. Fuse shall be ignited with hot-wire lights, lead spitters, igniter cord, or other such devices designed for this purpose. [CMSO 7244.(i)]

1200 - Firing With Electricity - General

R-1201. Electric blasting caps shall not be used where sources of extraneous electricity make the use of electric blasting caps dangerous. Blasting cap leg wires shall be kept short-circuited (shunted) until they are connected into the circuit for firing. [29 CFR 1926.906(a)]

R-1202. Before adopting any system of electrical firing, the blaster shall conduct a thorough survey for extraneous currents, and all dangerous currents shall be eliminated before any holes are loaded. [29 CFR 1926.906(b)]

R-1203. In any single blast using electric blasting caps, all caps shall be of the same style or function, and of the same manufacturer. [29 CFR 1926.906(c)]

R-1204. Electric blasting shall be carried out by using blasting circuits or power circuits in accordance with the electric blasting cap manufacturer's recommendations, or an approved contractor or his designated representative. [29 CFR 1926.906(d)]

R-1205. When firing a circuit of electric blasting caps, care must be exercised to ensure that an adequate quantity of delivered current is available, in accordance with the manufacturer's recommendations. [29 CFR 1926.906(e)]

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R-1206. Connecting wires and lead wires shall be insulated single solid wires of sufficient current-carrying capacity. [29 CFR 1926.906(f)]

R-1207. Bus wires shall be solid single wires of sufficient current-carrying capacity. [29 CFR 1926.906(g)]

R-1208. When firing electrically, the insulation on all firing lines shall be adequate and in good condition. [29 CFR 1926.906(h)]

R-1209. A power circuit used for firing electric blasting caps shall not be grounded. [29 CFR 1926.906(i)]

R-1210. In underground operations when firing from a power circuit, a safety switch shall be placed in the permanent firing line at intervals. This switch shall be made so it can be locked only in the "Off" position and shall be provided with a short-circuiting arrangement of the firing lines to the cap circuit. [29 CFR 1926.906(j)]

R-1211. In underground operations there shall be a "lightning" gap of at least 5 feet in the firing system ahead of the main firing switch; that is, between this switch and the source of power. This gap shall be bridged by a flexible jumper cord just before firing the blast. [29 CFR 1926.906(k)]

R-1212. When firing from a power circuit, the firing switch shall be locked in the open or "Off" position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short-circuited when the switch is in the "Off" position. Keys to this switch shall be entrusted only to the blaster. [29 CFR 1926.906(l)]

R-1213. Blasting machines shall be in good condition and the efficiency of the machine shall be tested periodically to make certain that it can deliver power at its rated capacity. [29 CFR 1926.906(m)]

R-1214. When firing with blasting machines, the connections shall be made as recommended by the manufacturer of the electric blasting caps used. [29 CFR 1926.906(n)]

R-1215. The number of electric blasting caps connected to a blasting machine shall not be in excess of its rated capacity. Furthermore, in primary blasting, a series circuit shall contain no more caps than the limits recommended by the manufacturer of the electric blasting caps in use. [29 CFR 1926.906(o)]

R-1216. The blaster shall be in charge of the blasting machine, and no other person shall connect the leading wires to the machine. [29 CFR 1926.906(p)]

R-1217. Blasters, when testing circuits to charged holes, shall use only blasting galvanometers equipped with a silver chloride cell especially designed for this purpose. [29 CFR 1926.906(q)]

R-1218. Whenever the possibility exists that a leading line or blasting wire might be thrown over a live powerline by the force of an explosion, care shall be taken to see that the total length of wires are kept too short to hit the lines, or that the wires are securely anchored to the ground. If neither of these requirements can be satisfied, a nonelectric system shall be used. [29 CFR 1926.906(r)]

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R-1219. In electrical firing, only the man making leading wire connections shall fire the shot. All connections shall be made from the bore hole back to the source of firing current, and the leading wires shall remain shorted and not be connected to the blasting machine or other source of current until the charge is to be fired. [29 CFR 1926.906(s)]

R-1220. After firing an electric blast from a blasting machine, the leading wires shall be immediately disconnected from the machine and short-circuited. [29 CFR 1926.906(t)]

R-1221. All blasting wires shall be kept well in the clear of electric lines, pipes, rails, and other conductive materials, except the earth itself. [CTSO 8548.(f)]

R-1222. The shot firing switch should be at the portal, or not less than 1,000 feet from the face of the tunnel if the tunnel length exceeds 1,000 feet. [CTSO 8549.(c)]

1300 - Nonel Blasting

R-1301. Nonel blasting shall be conducted in accordance with instructions incorporated in REECo's Blaster Certification program.

1400 - After the Blast Precautions

R-1401. Sufficient time shall be allowed, not less than 15 minutes in tunnels, for the smoke and fumes to leave the blasted area before returning to the shot. An inspection of the area and the surrounding rubble shall be made by the blaster to determine if all charges have been exploded before employees are allowed to return to the operation, and in tunnels, after the muck pile has been wetted down. [29 CFR 1926.910(b)]

R-1402. After blasting operations in shafts, a competent person shall determine if the walls, ladders, timbers, blocking, or wedges have loosened. If so, necessary repairs shall be made before employees other than those assigned to make the repairs are allowed in or below the affected areas. [29 CFR 1926.800(o)(4)(iii)]

R-1403. Blasting holes shall not be drilled through blasted rock (muck) or water. [29 CFR 1926.800(q)(10)(i)]

R-1404. Employees in a shaft shall be protected either by location or by suitable barrier(s) if powered mechanical loading equipment is used to remove muck containing unfired explosives. [29 CFR 1926.800(q)(10)(ii)]

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SECTION S - CERTIFICATION OF BLASTERS

100 - Competency

S-101. Blasting at underground, construction, demolition, and similar operations or projects shall require certified blasters. [CMSO 7275.(a)]

S-102. An employer shall not permit a blasting operation unless a competent blaster (having a valid Blasters Certificate) is physically present on the site to accomplish the blasting operation and/or direct and supervise others in such operation. Blasting operations shall include but not be limited to the use, on-site transportation, and storage of commercial explosives, blasting agents, and other materials used in blasting. [CMSO 7275.(b)]

S-103. Trainees may work under the direct supervision of a certified blaster for the purpose of obtaining the necessary experience to qualify for a Blaster's Certificate. [CMSO 7275.(c)]

S-104. The employer shall not instruct, order or direct a blaster to load, wire, or fire a charge regardless of size, in violation of safety orders. [CMSO 7280.(e)]

200 - Qualifications

S-201. Every person requesting a Blaster's Certificate shall:

- (a) Be able to understand and give understandable orders;
- (b) Furnish satisfactory proof that he is proficient in the use and handling of explosive materials; the equipment and protective devices necessary for blasting operations; the safety precautions necessary in conducting blasting operations or furnish proof that he has had at least 3 years experience at blasting as an assistant to a person having a valid Blaster's Certificate in various phases of the use and handling of explosives;
- (c) Be of such moral character and physical condition that would not interfere with the proper performance of his duties and have the ability to direct and/or conduct blasting operations. [CMSO 7276.(b) thru (d)]

S-202. The applicant shall pass a written or an oral qualifying examination. Field tests may also be required as deemed necessary to determine the candidate's qualifications to perform the duties of a blaster. [CMSO 7277.(c)]

300 - Certification

S-301. Each Blaster's Certificate issued shall be valid for a period of 2 years. [CMSO 7278.(a)]

S-302. A Blaster's Certificate shall be displayed by the blaster for inspection when requested. [CMSO 7279.(b)]

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S-303. The employer may suspend a Blaster's Certificate when:

- (a) There is a question or doubt of the competency of the blaster, or
- (b) The blaster has not complied with requirements, safety orders, or rules. **[CMSO 7281.(a)]**

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SECTION T - UNDERGROUND CLASSIFICATIONS

100 - Classifications of Underground Worksites

T-101. Underground worksites shall be classified by DOE/NTSO into one of the following classifications:

- (a) Nongassy, which classification shall be applied to underground worksites where there is little likelihood of encountering gas during the construction of the worksite.
- (b) Potentially gassy, which classification shall be applied to underground worksites where there is a possibility flammable gas or hydrocarbons will be encountered.
- (c) Gassy, which classification shall be applied to underground worksites where it is likely gas will be encountered or if a concentration of 0.25 percent by volume (5% of LEL) or more of flammable gas has been detected not less than 12 inches from the roof, face, floor and walls in any open workings with normal ventilation.
- (d) Extrahazardous, which classification shall be applied to underground worksites when there is a serious danger to the safety of employees; and:

Flammable gas or petroleum vapors emanating from the strata has been ignited in the tunnel; or

A concentration of 20 percent of LEL petroleum vapors has been detected not less than three inches from the roof, face, floor and walls in any open workings with normal ventilation.

[CTSO 8422.(a)]

T-102. DOE/NTSO may classify any underground worksite as gassy or extrahazardous if the history or past experience indicates that flammable gas or petroleum vapors in hazardous concentrations is likely to be encountered in such location or if the worksite is connected to a gassy or extrahazardous excavation and subjects the men to reasonable likelihood of danger. [CTSO 8422.(b)]

T-103. A notice of the classification shall be prominently posted at each entrance to the job site. [CTSO 8422.(c) and 29 CFR 1926.800(l)(3)]

T-104. DOE/NTSO shall be notified immediately if flammable gas or petroleum vapor reaches limits requiring reclassification and the work location shall not advance until reclassification has been made. [CTSO 8424.(g)]

200 - Dangerous or Poisonous Gases

T-201. When the air in any part of an underground worksite is known to contain or is suspected of containing dangerous or explosive gas, it shall be tested before men are allowed to work therein. These tests shall be made by a competent person. [CTSO 8424.(a)]

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T-202. A dangerous accumulation of gas is any gas, except flammable gas, in a concentration greater than listed as the maximum allowable concentration for such gas. A dangerous accumulation of flammable gas is any mixture of flammable gas and air which exceeds 20 percent of its lower explosive limit (LEL). [CMSO 7102.(b)]

T-203. If more than 10 percent of the LEL of flammable gas or petroleum vapor is found in the underground worksite, any work therein shall be conducted with extreme care and steps shall be taken to improve ventilation. The tests shall then be made continuously during the working shift and DOE/NTSO notified immediately of the condition and underground workers shall be informed of the readings. DOE/NTSO may permit the underground worksite to operate up to, but not exceeding, 20 percent of LEL without notification if the required precautionary measures are in effect and permission is given in writing. [CTSO 8424.(d)]

T-204. Whenever any of the following conditions have been encountered, all underground work shall cease, employees shall be removed, and re-entry except for rescue purposes shall be prohibited until DOE/NTSO has been notified and has authorized re-entry in writing.

- (a) An underground ignition of gas or vapor occurs.
- (b) 20 percent of LEL of flammable gas or vapor occurs.
- (c) A poisonous or suffocating gas in concentrations dangerous to life is encountered.
[CTSO 8424.(e)]

T-205. If an accumulation of gas is sufficient to endanger persons away from its immediate vicinity, such persons shall be promptly taken out of the danger area until the gas is removed.
[CMSO 7102.(c)]

T-206. When it is necessary to move an accumulation of gas, provision shall be made for the safety of employees in the area through which the gas is to be moved. Accumulations of gas shall be moved under the direction of a competent man. [CMSO 7102.(d)]

T-207. No one shall be permitted to work or be in a dangerous accumulation of gas unless he is wearing permissible respiratory equipment adequate for his protection. [CMSO 7102.(e)]

300 - Tests for Gases

T-301. Tests for flammable gases shall be made with a permissible methane detector or by chemical analysis. [CMSO 7104.(a)]

T-302. Tests for flammable gases shall be conducted not less than 12 inches from the roof, face, floor, and walls in any open workings. [CTSO 8424.(b)]

T-303. Tests for flammable petroleum vapors shall be conducted not less than 3 inches from the roof, face, floor, and walls in any open workings. [CTSO 8424.(c)]

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T-304. Tests for any gas other than flammable gas shall be made by chemical analysis or by use of a testing device designed to detect the particular gas for which the test is being made, and to measure its concentration. [CMSO 7104.(b)]

T-305. Tests for gas shall be made by competent persons prior to the start of each work shift and at least every 4 work hours in underground locations classified as potentially gassy. Records shall be kept of such tests. [CTSO 8424.(f)]

400 - Operation of Gassy and Extrahazardous Operations

T-401. Smoking shall be prohibited in all gassy operations and the employer shall be responsible for collecting all personal sources of ignition, such as matches and lighters, from all persons entering a gassy operation. [29 CFR 1926.800(l)(4)]

T-402. Welding, cutting, or other spark producing operations shall only be done in atmospheres containing less than 20 percent LEL and under the direct supervision of qualified persons. Tests for gas and vapors shall be made before such operations start and continuously during such operations. [CTSO 8425.(c)]

T-403. A fire watch as described in 29 CFR 1926.352(e) shall be maintained when hot work is performed. [29 CFR 1926.800(l)(5)]

T-404. Automatic and manual gas monitoring equipment shall be provided for the heading and return air of underground worksites using mechanical excavators. The monitor shall signal the heading and shut down electric power underground, except for ventilation equipment, when 20 percent or more of the LEL is encountered. In addition, a manual shut down control shall be provided near the heading. [CTSO 8425.(d)]

T-405. In underground operations driven by drill-and-blast methods, the air in the affected area shall be tested for flammable gas prior to re-entry after blasting, and continuously when employees are working underground. [29 CFR 1926.800(j)(2)(v)]

T-406. Records of gas tests and air flow measurements shall be maintained on the surface by the employer. [CTSO 8425.(f)]

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SECTION U - MATERIALS STORAGE AND HANDLING

100 - Storage of Materials

U-101. Supplies shall not be stacked, or stored, in a manner which creates tripping or fall-of-material hazards. [30 CFR 57.16001.]

U-102. Bins, hoppers, silos, tanks and surge piles, where loose unconsolidated materials are stored, handled or transferred shall be:

- (a) Equipped with mechanical devices or other effective means of handling materials so that during normal operations persons are not required to enter or work where they are exposed to entrapment by the caving or sliding of materials; and
- (b) Equipped with supply and discharge operating controls. The controls shall be located so that spills or overruns will not endanger persons. [30 CFR 57.16002(a)]

U-103. Where persons are required to move around or over any facility listed in this standard, suitable walkways or passageways shall be provided. [30 CFR 57.16002(b)]

U-104. Where persons are required to enter any facility listed in this Section for maintenance or inspection purposes, ladders, platforms, or staging shall be provided. No person shall enter the facility until the supply and discharge of materials have ceased and the supply and discharge equipment is locked out. Persons entering the facility shall wear a safety belt or harness equipped with a lifeline suitably fastened. A second person, similarly equipped, shall be stationed near where the lifeline is fastened and shall constantly adjust it or keep it tight as needed, with minimum slack.
[30 CFR 57.16002(c)]

U-105. Materials that can create hazards if accidentally liberated from their containers shall be stored in a manner that minimizes the dangers. [30 CFR 57.16003]

U-106. Hazardous materials shall be stored in containers of a type approved for such use by recognized agencies; such containers shall be labeled appropriately. [30 CFR 57.16004]

U-107. Compressed and liquid gas cylinders shall be secured in a safe manner. [30 CFR 57.16005]

U-108. 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 57.16006]

U-109. Chemical substances, including concentrated acids and alkalies, shall be stored to prevent inadvertent contact with each other or with other substances where such contact could cause a violent reaction or the liberation of harmful fumes or gases. [30 CFR 57.16012]

200 - Handling of Materials

U-201. Taglines shall be attached to loads that may require steadying or guidance while suspended.
[30 CFR 57.16007(a)]

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U-202. Hitches and slings used to hoist materials shall be suitable for the particular material handled. **[30 CFR 57.16007(b)]**

U-203. Persons shall stay clear of suspended loads. **[30 CFR 57.16009]**

U-204. To protect personnel, material shall not be dropped from an overhead elevation until the drop area is first cleared of personnel and the area is then either guarded or a suitable warning is given. **[30 CFR 57.16010]**

U-205. Persons shall not ride on loads being moved by cranes or derricks, nor shall they ride the hoisting hooks unless such method eliminates a greater hazard. **[30 CFR 57.16011]**

U-206. Operator-carrying overhead cranes shall be provided with:

- (a) Bumpers at each end of each rail;
- (b) Automatic switches to half uptravel of the blocks before they strike the hoist;
- (c) Effective audible warning signals within each reach of the operator; and
- (d) A means to lockout the disconnect switch. **[30 CFR 57.16014]**

U-207. No person shall work from or travel on the bridge of an overhead crane unless the bridge is provided with substantial footwalks with toeboards and railings the length of the bridge. **[30 CFR 57.16015]**

U-208. Fork and other similar types of lift trucks shall be operated with the:

- (a) Upright tilted back to steady and secure the load;
- (b) Load in the upgrade position when ascending or descending grades in excess of 10 percent;
- (c) Load not raised or lowered enroute except for minor adjustments; and
- (d) Load-engaging device downgrade when travelling unloaded on all grades. **[30 CFR 57.16016]**

U-209. Where the stretching or contraction of a hoist rope could create a hazard, chairs or other suitable blocking shall be used to support conveyances at shaft landings before heavy equipment or material is loaded or unloaded. **[30 CFR 57.16017]**

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COMMITTEE MEMO FOR ADDENDUM 'A'

Department of Energy

Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518

JUL 15 1992

J. K. Magruder, Assistant Manager for Operations, DOE/NV,
Las Vegas, NV
THRU: Lester P. Skousen, Director, Safety & Health
Division, DOE/NV, Las Vegas, NV

COMMITTEE TO PREPARE ADDENDUM TO DOE NEVADA FIELD OFFICE,
NEVADA TEST SITE UNDERGROUND SAFETY AND HEALTH STANDARDS,
DOE/NV 353, DATED MAY 5, 1992

The committee selected on June 2, 1992, to address the
subject, has prepared the enclosed addendum to the Nevada
Test Site Underground Safety and Health Standards (NTS
US&HS) for your review and approval.

Committee Members

Donald Schlick, DOE/NV, SHD
Stewart Thomas, DOE/NV, NTSO
Clayton Barrow, DOE/NV, NTSO
Sheldon Murphy, RSN
Sam Williams, REECO
Al Frazier, REECO
Steve Goodin, DNA

It is recommended that a sentence be added at the end of
Standards D-103, D-104, and J-1503 of DOE/NV 353. That
sentence would read "SEE ADDENDUM A FOR SITUATIONS WHERE
AIR QUANTITY AND VELOCITY CAN NOT BE MET AND EQUAL OR
BETTER SAFETY AND HEALTH WILL BE PROVIDED BY AIR QUALITY
MONITORING.

All members of the committee concur with the addendum and
the changes to the three standards. Upon your concurrence
with the addendum, it can be incorporated into NV 353 at
the next committee meeting. In the past, Stewart Thomas
has acted as chairman of this committee.

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COMMITTEE MEMO FOR ADDENDUM 'A' (Continued)

J. K. Magruder

-2-

Approved
J. K. Magruder, AMO

____ Disapproved
J. K. Magruder, AMO

Donald P. Schlick, Chief
Facilities & Occupational
Safety Branch
Safety & Health Division

SHD/FOSB:DPS-2136

Enclosure:
As stated

cc:
S. W. Goodin, DNA, Mercury, NV
S. D. Murphy, RSN, Mercury, NV
S. M. Williams, REECO, Mercury, NV
A. R. Frazier, REECO, Mercury, NV
S. A. Thomas, NTSO, DOE/NV,
Mercury, NV
C. W. Barrow, NTSO, DOE/NV,
Mercury, NV

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ADDENDUM A

VENTILATION AND AIR QUALITY MONITORING PLANS

A. INTRODUCTION

The purpose of this addendum is to develop a general ventilation/air quality monitoring plan which will serve as the basis for an "event specific" ventilation/air quality monitoring plan to be submitted by the construction contractor and approved by the DOE/Nevada Test Site Office (DOE/NTSO). At no time will compliance with the proposed modified Nevada Test Site Underground Safety and Health Standards (NTS US&HS) outlined in this addendum compromise underground worker safety and health or subject the underground personnel to an unsafe quality of ventilation air.

This trade-off of air quality for quantity/velocity can be accomplished through the use of Mine Safety Appliances (MSA), Data Acquisition Network (DAN) system, and Industrial Hygiene (IH) personnel monitoring of underground air quality in the work place. The intent is to substitute the NTS US&HS air quality Standards (D-101, D-105, D-301, D-302, D-303, D-306, D-311, D-401, and D-403) in lieu of the air quantity and velocity Standards (D-103, D-104, and J-1503) during the activities noted in Section D of this addendum. Actions necessary to satisfactorily accomplish this include the future development of detailed ventilation/air quality monitoring plans for event specific areas. The event specific plans to be submitted by the construction contractor will be submitted for approval at least 60 days prior to the proposed implementation.

B. STANDARDS ADDRESSED BY THIS ADDENDUM

The NTS US&HS D-103, D-104, and J-1503 dictate that there be a specified velocity and quantities of ventilating air provided to each underground working place. Due to tunnel configurations, unique to underground testing, it is not practical for a ventilation system to be in compliance at all times during the preparation of an event under the requirements of the above standards. The underground activities or areas to which this addendum is directed are identified in Section D of this addendum.

C. ALTERNATE STANDARDS

In the designing of ventilation systems, the velocities and volumes of ventilation air, specified in D-103, D-104, and J-1503, will be attempted. However, if the velocities and volumes cannot be met, the final determination of a safe working atmosphere and ventilation requirements will be based on compliance with the air quality standards identified in Section A above. These portions of the NTS US&HS do not require specific velocity and volume quantities, but rather require ventilation air flow sufficient for the removal of contaminants and ventilation air flow monitoring to assure that the quality of air in the underground facilities is within the threshold limit values established by the American Conference of Governmental Industrial Hygienists (ACGIH), Occupational Safety and Health Administration (OSHA) permissible exposure limits (PEL), or California Tunnel Safety Orders (CTSO), as applicable based on the most stringent standard.

These alternate standards will apply to those activities identified in Section D.

D. CIRCUMSTANCES TO WHICH THE ADDENDUM APPLIES

The NTS tunnel facilities have complex ventilation requirements unique to the operations conducted.

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Conditions exist within and around each test bed during some mining and construction activities and during user occupancy activities where supplying the volumes and velocity of ventilation air required in standards identified in Section B, is not practical.

MINING ACTIVITIES

1. Mining large excavations.
2. Mining in areas which split a peripheral secondary ventilation circuit.
3. Short-term excursions from ventilation air quantity requirements as a result of the infrequent use of additional diesel equipment entering a minimal cross-section drift.

CONSTRUCTION AND OTHER ACTIVITIES

1. User and craft alcove occupancy.
2. The area within plugs under construction.
3. Activities within the LOS pipe.
4. Activities around the LOS pipe.
5. Activities within experimental work stations.
6. Pre-stemming of some drift areas.
7. During the stemming bulkhead construction phase.
8. Activities during the event button-up phase.
9. Activities within large excavations.
10. Short-term excursions from ventilation air quantity requirements as a result of the infrequent use of additional diesel equipment entering a minimal cross-section drift.
11. Activities within inactive/limited-access areas.

The above activities can be associated with confined areas or locations where an exchange of air that meets all NTS US&HS requirements is not practical due to the unique type of operations. It is only to the mining and construction activities outlined above that this addendum is directed. Each of the above activities are discussed in more detail below. Items of like characteristics have been grouped under common headings.

User and craft alcoves--Item 1

These work and office locations are generally enclosed and have small access openings causing reduced air flow.

In these areas the volumes and velocities of exchange air required by the NTS US&HS (30 feet per minute) are not needed to assure a healthful environment and may be detrimental to event-related instrumentation. The user alcove environment is conditioned to support operating instrumentation. High volumes of exchange air would introduce additional dust, other particles, and humidity destructive to sensitive instrumentation and destroy the experimental integrity of the above.

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Confined areas or areas where the drift cross-section is reduced--Items 2 through 8

These work locations are usually associated with a reduction to the drift cross-section due to an obstruction. Containment considerations often necessitate the smallest drift size possible, which in turn dictates the larger ventilation duct that may be installed, and results in reduced ventilation quantity and velocity. This ventilation quantity limitation does not indicate air quality deficiency. The air quality requirements, identified in Section A, are achieved by the ventilation supplied.

Access opening through bulkheads provide the only location for ventilation ducting and make-up air flow. Openings through each bulkhead must be minimized in size and number to accommodate stemming loads and bulkhead design, but still provide a reasonable factor of safety. There is insufficient space available for the installation of ventilation tubing of a size to provide the quantity of air required in the NTS US&HS. Stemming pours in series, such as the length of bypass drift within the stemming areas, multiply the effect of minimized bulkhead openings. Each bulkhead creates additional resistance to the ventilation system both in the ventline and the drift.

In areas where containment or construction reasons dictate a limited ventilation air flow, other engineering measures are utilized, such as small booster fans and air movers to provide additional air flow. Emphasis of activities which fall under the realm of Items 3, 4, and 5 are:

- Item 3: Experiment installations within the LOS pipe.
- Item 4: Experiment and port installations outside the LOS pipe.
- Item 5: Stub pipe and experiment installation between shield walls.

Activities within large excavations--Item 9

Large excavations impose demands on the ventilation system beyond system capacities. Because of their shapes and sizes, achieving the air quantities and velocities required is not practical.

After the completion of mining, typical equipment utilization includes sporadic mucker activity during invert cleanup, accomplished with the electric load/haul dump; drill-hole completion with the diesel/electric drill jumbo, and invert preparations which usually involve limited equipment usage. Diesel equipment utilization within large chambers is minimized.

Short-term excursions from ventilation air quantity requirements as a result of the infrequent use of additional diesel equipment entering a minimal cross-section drift--Item 10

The delivery of material and supplies often necessitate additional temporary pieces of diesel equipment in operation above the number originally planned. These additional pieces of operating diesel equipment are only in the working area for brief periods of time, but their presence technically causes non-compliance with NTS US&HS J-1503. The quality of ventilation air as determined by the threshold limit value time-weighted average (TLV-TWA) concentrates of diesel emission gases for a normal 8-hour work day and a 40-hour work week, are not exceeded as a result of these short-term excursions.

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Activities within inactive/limited-access areas--Item 11

Inactive and limited areas are commonly controlled by limiting access. Examples of inactive areas are completed reentry drifts, areas behind closed plugs and barricaded areas. Entries into an area previously unventilated are performed with an escort from REECO IH and health physics personnel. Inactive areas are thoroughly surveyed for air quantity prior to any work commencing.

REECO Safety Codes U-14, "Sealing/Barricading of Unused or Abandoned Underground Areas"; U-25, "Unusual Entry"; IH-5, "Mandatory Respiratory Protective Equipment Program"; and REECO Industrial Hygiene procedure AACAA.D.13.00, "Confined Space Entry," are complied with in every situation. Monitoring of air quality ensures a safe work environment for the duration of activity within the inactive or limited access area.

Although the volume and velocity of ventilation air as required by the existing standards may not be available at the above referenced locations and situations, the air quality is determined by continuous and spot sampling within the level required by the most stringent of the ACGIH TLV's, OSHA PEL's, or CTSO. In the event excursions from the maximum permissible exposure levels are noted, those excursions are remedied by implementing administrative control measures such as moving or shutting down equipment or shutting down a work place until the air quality is restored.

E. MINIMUM REQUIREMENTS FOR EACH EVENT SPECIFIC PLAN

Specific operational plans for ventilation and air quality monitoring must be developed for each tunnel event. These plans will be submitted to DOE/NTSO for review at least 60 days prior to proposed implementation. Comments from DOE/NTSO will be furnished within 15 days of receipt of the plan. These comments will be resolved and the plan resubmitted to DOE/NTSO. Implementation of the plan will not take place until approval is granted by DOE/NTSO.

The plan shall address, but not be limited to, the following:

I. VENTILATION DESIGN

A. Event Ventilation Drawings

1. Fan characteristics and locations.
2. Air flow direction.
3. Damper location and settings.
4. Ventilation tube size.
5. Places where ventilation tube sizes change.
6. Areas where air quality standards will be in effect.

B. Quality and Velocity Values

1. Measured values.
2. Calculated values.

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II. TUNNEL AIR QUALITY MONITORING

A. MSA DAN

1. Sensor locations.
2. Justification for sensor locations.
3. Contaminants monitored.
4. Excursion action plan.

B. IH Area Monitoring

1. Monitoring strategy.
2. Contaminants monitored.
3. Operations potentially adverse to air quality.
4. Excursion action plan.

C. IH Personnel Monitoring

1. Monitoring strategy.
2. Contaminants monitored.
3. Operations potentially adverse to air quality.
4. Excursion action plan.

D. Monthly Summary Report

1. Map of sensor locations.
2. Summary of data from A, B, and C above with explanation of excursions.
3. Trend analysis.
4. Interpretation of data results.

III. EQUIPMENT USAGE STRATEGY

- A. Diesel equipment numbers and type.
- B. Electric equipment numbers and type.
- C. Administrative controls.

F. MODIFICATIONS TO EVENT SPECIFIC PLAN

Subsequent modifications to each event which result in air quantity deficiencies shall require modification to the event specific plan. These modifications shall address the minimum requirements of Section F, above impacted by the change. The modifications shall be submitted by the construction contractor to DOE/NTSO for review and approval. DOE/NTSO shall provide approval within 72 hours.

G. EFFECTIVE DATE OF IMPLEMENTATION

This addendum is in effect 90 days after approval.

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APPENDICES

APPENDIX I

November 5, 1990

John D. Stewart, Director, NTSO

MEETING OF THE NTS UNDERGROUND SAFETY AND HEALTH STANDARDS WORKING GROUP

The Working Group reviewed and/or discussed the following items:

1. The general nature of the various reports and assessments recently completed by various organizations (Tiger Team Report, Accident Investigation Report, etc.).
2. The requirements of DOE Order 5480.4, NV Order 5480.4, and the letter from DOE/HQ specifying the safety and health codes applicable to NTS underground (U/G) operations (other than the future Yucca Mountain high level waste facility).

The working group concluded that the following plan of action and schedule meets the requirements of Items 1 and 2 above.

This plan of action also fulfills the directive given to the Working Group by the Director, NTSO.

The plan of action is summarized:

1. A matrix was completed comparing California Tunnel Safety Orders (CTSO), and Occupational Safety & Health Administration (OSHA) code elements.
2. The matrix was evaluated and the appropriate standard for each code element was adopted.
3. The adopted standards were formalized by the Working Group and called the "NTS U/G Safety and Health Standards." Concurrence by Safety & Health Division (SHD) (a representative of SHD is a member of the working group) will ensure that this standard does not conflict with either DOE Order 5480.4 or NV Order 5480.4.

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John D. Stewart

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4. The standard has been signed by all ten members of the Working Group and addressed to the Director, NTSO, for DOE approval.

MEMBERS OF THE NTS UNDERGROUND STANDARDS WORKING GROUP

<u>MEMBERS</u>	<u>PHONE</u>	<u>ORGANIZATION</u>
1. Gaylene M. Parmenter	5-7404	REECo OS&FP
2. Paul F. Porter	5-6893	REECo HPD
3. Samuel M. Williams	5-4694	REECo FOD/DOD
4. Sheldon D. Murphy	5-6984	RSN
5. Eric E. Shanholtz	5-7069	DNA
6. Donald P. Schlick	5-2263	DOE/SD
7. Darrel M. McPherson	5-4015	DOE/TOD
8. Clayton W. Barrow	5-7960	DOE/NTSO
9. Stewart A. Thomas	5-3361	DOE/NTSO
10. Ramon F. Martinez	5-3361	EG&G/EM

NTSO-ONA-144

Stewart A. Thomas
Test Construction Branch, NTSO

cc:

J. A. Blodgett, NTSO
Members of Working Group

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APPENDIX II

NEVADA FIELD OFFICE
NEVADA TEST SITE UNDERGROUND SAFETY AND HEALTH STANDARDS
WORKING GROUP

This document has been approved by the undersigned members of the Working Group:

Gaylene M. Parmenter
Occupational Safety & Fire
Protection
Reynolds Electrical &
Engineering Co., Inc.

6/9/93
Date

Donald P. Schlick
Safety Division
Nevada Operations Office

6-10-93
Date

Paul F. Porter
Industrial Hygiene
Reynolds Electrical &
Engineering Co., Inc.

6/9/93
Date

Darrel M. McPherson
Test Operations Division
Nevada Operations Office

6/9/93
Date

Samuel M. Williams
Field Operations Department/
Department of Defense
Reynolds Electrical &
Engineering Co., Inc.

6-10-93
Date

Clayton W. Barrow
Nevada Test Site Office
Nevada Operations Office

6/9/93
Date

Sheldon D. Murphy
DOD/DNA/SNL Operations
Raytheon Services Nevada

6/9/93
Date

Stewart A. Thomas
Nevada Test Site Office
Nevada Operations Office

6/9/93
Date

Eric E. Shanholz
Construction, Engineering &
Technical Services
Defense Nuclear Agency

6/15/93
Date

Ramon F. Martinez
EG&G/EM

6-23-93
Date

END

DATE
FILMED
10 / 7 / 93