

MICHIGAN TECHNOLOGICAL UNIVERSITY

Mine Safety and Health Training Program - Mining Engineering Department

Surface Mine Instructor Reference and Trainee Review Manual

for Mine Safety and Health Training

For Surface Metal/Nonmetal Mining

INSTRUCTOR REFERENCE AND TRAINEE REVIEW MANUAL

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INTRODUCTION

Purpose of this Manual

This Manual is primarily for surface mining operations. Its purpose is to provide instructors with both information and sources of information that will help them prepare for and present mine specific safety training. This manual is presently (and probably always will be) under construction.

IC ON KEY		How to use this Manual
	Important Information	Although this manual is intended primarily for instructors, some of the material in this manual can be used for making a student handbook.
	Tests & Questions	Each topic area will include information and referral sources. These resources will be updated on a regular basis. The Icons at left will appear at the beginning of a paragraph to indicate the purpose of the information in that paragraph. “Important Information” is just that. It needs to be understood to get maximum benefit from that paragraph or section. “Tests & Questions” are questions that have been specifically written for that topic area. “Computer Materials” will refer you to sources of this material. “Handbook Materials” are those materials that can be used directly from this manual to make trainee handouts.
	Computer Materials	
	Handout Materials	
	Suggested Videos	
	Suggested Pictures	
	MSHA Fatalgrams	

“Suggested Videos” are MSHA videos that are pertinent to the topic area. To get more information on MSHA videos and other MSHA training materials, write to: National Mine Health and Safety Academy - Department of Instructional Materials, P.O. Box 1166, Beaver, West Virginia 25802-1166. You can call them at 304-256-3257 (Fax: 304-256-3368) or send e-mail to: mlord@msha.gov. “Suggested Pictures” refer to pictures available from our web site that apply to the topic. Michigan Mine Safety’s web site address is <http://www.mine-safety.mtu.edu>. “MSHA Fatalgrams” will list those fatalities between 1995 and 1999 that are pertinent to the topic. Some blank space has been left in the manual for instructor notes and updates.

Disclaimer

While we have attempted to be accurate, we make no claims as to the accuracy of these materials, to their suitability for a specific purpose or to their compliance with current standards. These materials are for training purposes only and need to be checked for accuracy, suitability and compliance with current standards. If you do discover inaccuracies or out of date references and want to help us, please forward these corrections to the address on the second page of this manual or e-mail to peggerdi@mtu.edu or dcarlson@mtu.edu. Thank you for your time.

Some Suggested uses for Materials in this Manual

Using Questions

Questions can be used before, during or after instruction and for trainee review.

Before Instruction

Pre-Testing as introduction to topic: Use the questions of a Pre-test to let trainees know what is being covered in the lesson.

Pre-Testing for comparison to after-instruction test results: A pre-test can be compared to a test given after instruction to show the improvements trainees made as a result of the instruction.

Pre-Testing to assess Class Knowledge level: A pre-test can determine the trainee's present level of knowledge and the instructor can adjust class content accordingly.

Introduction Questioning: Use a question as an introduction to the training session. For example, an instructor may start a class on powered haulage with the question "What is the leading cause of fatalities in surface mining?"

During Instruction

Games: Most classroom games are used to review material in a manner that encourages trainee participation. Most of these games are "Question & Answer" based contests between trainees. The competition makes dull material, interesting.

After Instruction

Testing Trainee Knowledge: A Post-Instructional test is used to determine whether a trainee has met the class objective of retaining certain information.

Testing Instructor Proficiency: Post-Instructional testing of trainees can also indicate how well the instructor did in giving the class.

Trainee Review

Because most of the answers to the questions in this manual include detailed explanations, trainees can use these tests, and the answers presented, for topic review.

Using Videos

Videos should never be considered just a "Plug 'n' Play" substitute for good instruction. The "Video Lesson Plan Generator" (for Microsoft Word), available from Michigan Mine Safety's web site (www.mine-safety.mtu.edu), is a tool that helps turn a simple video into a complete lesson that includes overhead slides and discussion topics.

Games

Although Safety itself is not a "game", games are an interesting way of presenting information that might otherwise be too dry or repetitious to hold the trainee's interest. Games may be topic specific or they may cover a wide range of subjects. "Regulation Football" is an example of a topic specific game as it deals primarily with 30 CFR's regulations. A copy of the "Regulation Football" rules is included in appendix 1. "Mine Safety Jopardy" is an example of a multi-topic computer based game that is used for general safety review. A copy of Mine Safety Jopardy may be obtained from our web site at: <http://www.mine-safety.mtu.edu> .

Instruction Guide - Suggestions for Training

1. Training site and time should be selected for the convenience of the worker.
2. Familiarize yourself with the training & lesson plan and any audio visual aids prior to training.
3. After the whole training group has assembled, pass around any documentation roster that is required and distribute any handouts needed for the lesson.
4. Inform the group that this lesson is part of their MSHA required training. Tell the trainees the topic that the lesson will be covering.
5. Tell the trainees what the outline of the class will be. An example is:
 - a) Introduction to topic & Method of Instruction.
 - b) Main Lesson Body
 - c) Material review and class discussion on relevant areas of material.
 - d) Q & A and Program Retention Evaluation (Quiz)
6. Present the sections in order, as shown in your presentation outline.
7. Program Retention Evaluation or “Quiz”. Explain to the class that there are several reasons for having a test.
 - a) First, it is a teaching tool that restates the essential points of the lesson.
 - b) Second, it helps the instructor discover those areas of the lesson plan that were not explained well enough. The instructor can then review these points.
 - c) Third, it gives the trainee an idea of how well they retained the material.
8. The “Quiz” can be administered in several ways.
 - a) For classes that may have reading impaired trainees it is best to read the questions out loud while displaying the question on the overhead projector. The trainees can then mark the best answer on a prepared paper answer sheet. Using the Overhead Version of the questions allows non-reading impaired trainees to read the questions themselves as well. If you do not have an overhead projector, read the question and potential answers at least twice and ask if the trainees understand the question and answers.
 - b) For classes that do not contain reading impaired individuals, the paper version of the quiz can be given.
 - c) After completion of the quiz, give the correct answers to the questions. Have the trainees correct their own answer sheets. Quickly review the answer sheets to determine any question that had a large number of incorrect answers. This indicates that the point covered by that question needs review, or the question was poorly written and needs revision.
9. Take note of problems the group sees concerning complying with the information contained in the training session. In other words, how hard will it be to actually put this training into practice at work? Submit these notes to the company’s safety department with other required documentation.
10. If a question is asked that you do not know the answer to - DO NOT GUESS at the answer. Find the answer from an appropriate source and get that answer back to the person who asked it.



Safety and Health Training Requirements Surface Miners and Contractors

This chapter will describe the different types of MSHA-required training for workers at surface metal and nonmetal mines.

Who needs Mine Safety Training?

All mining operations, regardless of size, must provide safety training for workers, and most supervisors. Contractors working on the mining property, customers, and visitors to the mine property may need the same training as miners if certain criteria are met. Regulations covering training requirements for surface mining operations can be found in 30 CFR Parts 46 and 48.

The definition of a 'miner' for training purposes includes: **any person who is engaged in the extraction and production process; or who is regularly exposed to mine hazards; or who is a maintenance or service worker contracted by the operator to work at the mine for frequent or extended periods.** MSHA policy statement categorizes 'regular exposure' to a mine hazard as either a "pattern of recurring exposure" or extended exposure of five consecutive workdays. Such workers are required to receive training as outlined in 30 CFR Parts 46 or 48 depending upon which type of mine they are serving. Short-term workers, such as drillers and blasters have special training circumstances. Since the work they perform is similar from mine site to mine site, these types of workers only need site specific hazard training at each new mine site, as long as they have fulfilled their comprehensive training requirement (New Miner, Newly Employed Experienced Miner, or Annual Refresher) under Part 46 or Part 48. Supervisory personnel who meet any of the above definitions for a miner must also receive training.

Mine Safety training - Part 46 or Part 48?

Surface metal and nonmetal mining operations in Michigan that are subject to 30 CFR Part 48 training regulations include metal mines and gypsum mines. Surface coal mines, which are not found in Michigan, also come under Part 48. Workers at these mines must be trained by an MSHA certified instructor. Virtually all other mining operations in the state of Michigan are required to follow the training guidelines set forth in 30 CFR Part 46. A competent person designated in the mine's training plan must do safety instruction for workers at Part 46 mines. (If you have a question about which part your mine fall under, contact your local MSHA field office.)

Training Plans

Every mine, no matter how small, (and contractors considered to be miners under the standard) must have a training plan detailing how the five types of training (discussed below) are to be accomplished. Miners which fall under Part 48 may follow the training plan of the MSHA certified instructor. Mines under Part 46 must follow a training plan they, themselves create.

Instructor guides and other useful information for creating Part 46 training plans can be found on the Internet at MSHA's web site: www.msha.gov . But, upon request, the Michigan Mine Safety and Health Training Program (phone 906/487-2453) will assist Part 46 mines and contractors in Michigan in making up their training plans. At your request, the Michigan Mine Safety and Health Training Program will e-mail you a generic training plan (with instructions) that makes it easy to create your own mine specific training plan. To request a plan, contact us at 906/487-2453 or e-mail dcarlson@mtu.edu .

Part 48 training plans used by MSHA-certified instructors must be approved and signed by MSHA. Part 46 training plans meeting the standard's requirements need not be sent to MSHA for approval, but must be made available for review to all miners two weeks prior to implementation of the plan.

Training Requirements for Parts 46 & 48 Mines

Table 2.1 - "Parts 46 And 48 Surface Mine Training Requirement Chart", lists the training requirements for surface mines that come under Part 48 and 46 of the Standard. Five types of training are required by each of these parts of the standard including:

- **New miner:** This training is for newly-hired miners who have not received new miner training; or for newly-hired miners who have received new miner training, but have not accumulated 12 months of experience in the 36 months after completing the new miner training. Twenty-four hours of training is needed for new miners and specific topics outlined in the regulations must be included. Under Part 46, four hours of this training covering the seven topics listed in the standard must be completed prior to the miner beginning work. A first aid review must be covered within 60 days of starting work along with respirator training, where applicable. The remaining hours may be spent in practice of the assigned task under the supervision of a competent person designated in the training plan. There are exceptions to this rule for Part 46 miners. Miners employed on April 14, 1999 and miners hired after April 14, 1999 who have had new miner training or have gotten 12 months of experience prior to Oct 2, 2000 are automatically considered to be experienced miners.
- **Newly hired experienced miner:** No training-time requirement is listed in either Part 48 or 46 of the Standard. However, miners who fall under Part 48 and have not been in mining for the previous 5 years, must have 8 hours of training prior to work. Specific topics for Newly Hired Experienced Miners are very similar to those under New *In*experienced Miner Training. (See Table 2.1)
- **New Task Training:** New Task Training is required whenever a miner is assigned to a new task. Training times will vary and times should be included in the mine's training

plan for each task. Part 46 requires that this training be conducted by the competent person designated in the mine's training plan. Required subjects are listed in Table 2.1.

- **Annual Refresher:** 8 hours of Annual Refresher Training is required once each year and this training must be completed by the end of the same month in which the miner had completed training the previous year. The only subject specified in the Part 46 standard is “Changes in the Work Environment That Could Adversely Affect Health and Safety” although the Standard does state, “Refresher training must also address other health and safety subjects that are relevant to mining operations at the mine”. A large number of subjects are recommended in the Part 46 Standard. The Part 48 Standard gives a list of required subjects as well. (See Table 2.1)
- **Site Specific Hazard Awareness Training:** This training is required for most all others visiting or working at a mine. Under Part 46, miners such as drillers or blasters, who move from one mine to another, while remaining employed by the same production-operator or independent contractor, must be provided with site-specific hazard awareness training for each mine I.D. number. A training record meeting the Standard's requirement must be on file for these miners. Part 46 does not require written records for the hazard training of non-miners. However, upon the request of MSHA, a mine must be able to show evidence that this training was provided. Part 48 does not require written records for hazard training that is not a part of one of the other types of training where records are required. Training times will vary depending on the worker or visitor's exposure to hazards.

Written records must be on file for New Miner, Newly-Employed Experienced Miner, Task and Annual Refresher training. For Part 48 Training, a Form 5000-23 must be completed for each miner trained. For Part 46 training, either a Form 5000-23 or other certificate containing the minimum information required by the Part 46 Standard must be used. The person designated in the mine's training plan, as the person responsible for Safety and Health Training, must sign all Part 46 training records.

Length of Training Record Retention for Part 48 Mines.

Copies of Part 48 training certificates for currently employed miners shall be kept at the mine site for 2 years, or for 60 days after termination of employment

Length of Training Record Retention for Part 46 Mines.

Each mine must maintain copies of training certificates and training records for each currently employed miner during his or her employment, except records and certificates of annual refresher training under Part 46.8, which must be maintained for only two years. Each mine must maintain copies of training certificates and training records for at least 60 calendar days after a miner terminates employment.

Independent Contractors.

For training purposes, independent contractors working on mining properties that are subject to either Part 48 or Part 46 training requirements may be considered to be miners. Contract miners working at mines subject to Part 48, would be trained under the mine's training plan or the MSHA-Certified trainer's plan. Contract miners working on mining properties subject to Part 46 need their own training plans. Contractors should contact the

MSHA field office supervisor or MSHA's Educational Field Services to determine whether or not they need full comprehensive training (such as new miner training), and whether they will need a training plan for the work they will be doing on mine property. A Contractor I.D. number is required on any Part 46 contractor training plan. Contractor I.D. numbers can be obtained by contacting the local MSHA field office.

The mining operation, not the contractor, is responsible for providing contractors with site-specific hazard-awareness training covering conditions at the mine. Conversely, if work done by the contractor creates hazards for mine employees, the contractor must provide hazard specific training to those mine employees exposed. All site-specific hazard training must be given before work starts at each mine site. Although no certificate of site-specific hazard training is required, MSHA will want evidence that it is, in fact, being done.

For Your Information

MSHA field offices in Michigan are located in Marquette (Phone number 906/228-6805) and Lansing (Phone number 517/377-1751).

For assistance with these two regulations, contact the Mine Safety & Health Training Program at Michigan Tech University (906) 487-2453 or contact Educational Field Services (EFS) at the following locations.

Eastern U.S.

Call Toll Free: 1-800-678-6746

E-mail: part46east@msha.gov

Western U.S.

Call Toll Free: 1-800-579-2647

E-mail: part46west@msha.gov

On the Internet, the Part 46 Training Assistance Page is available on the MSHA home page. Available items include a 30 CFR Part 46 Starter Kit with Sample Training Plan (IG 36), Instructor's Guide with Lesson Plans (IG 37), the part 46 rule, and Compliance Guideline for MSHA's Part 46 Training Regulations. All items can be ordered from:

The National Mine Health & Safety Academy

1301 Airport Road

Beaver, WV 25813-9426

Call (304) 256-3257

FAX (304) 256-3368

E-mail: mlord@msha.gov

Also find the Compliance Guide for MSHA's 1999 Modified Regulations on Training & Retraining of Miners at: <http://www.msha.gov/regs/complian/guides/train/cover.htm> .

First Aid Training

30 CFR 56.18010 First Aid - An individual capable of providing first aid shall be available on all shifts. The individual shall be currently trained and have the skills to: perform patient

assessment and artificial respiration; control bleeding; and treat shock, wounds, burns, and musculoskeletal injuries. First aid training shall be made available to all interested miners.

The Michigan Mine Safety & Health Training Program (906-487-2453) has a 4-hour course that meets the above requirements. The standard doesn't require CPR, and this is not covered in this 4-hour course. Courses meeting the Standard's requirements are also taught by other organizations. MSHA requires that the trainees meet the standards set by the certifying organization.

Respirator Training and Fit-testing

Where respirators are required, the miner must be trained in the proper use and care of the respirator. They must also be fit tested to ensure that the respirator is being worn properly and functions properly.

MSHA requires that a miner's exposure to airborne contaminants shall not exceed the limit for any substance as specified in the 1973 ACGIH TLV list. When this exposure limit is exceeded a citation is issued and Part 56.5005 mandates that operators install feasible engineering controls to reduce a miner's exposure. Respiratory protection is required when controls are not feasible, as well as while establishing controls, and during occasional entry into hazardous atmospheres to perform short-term maintenance or investigations. If respirators are used, operators must have a respirator program containing all of the elements of the standard, which incorporates ANSI Z88.2-1969.

The Michigan Mine Safety and Health training program can do respirator fit testing upon request. Call (906-487-2453).



Statutory and regulatory information can be obtained from MSHA's Internet site at: www.msha.gov/REGSINFO.HTM.

MTU - MINE SAFETY AND HEALTH TRAINING

PARTS 46 AND 48 SURFACE MINE TRAINING REQUIREMENT CHART

This is a best effort to summarize information. Accuracy is not guaranteed.

TRAINING AREAS		24 HOUR NEW MINER TRAINING		NEWLY EMPLOYED EXPERIENCED MINER TRAINING		TASK TRAINING (NEW or CHANGES)****		8 HOUR ANN. REFRESHER TRAINING		HAZARD TRAINING	
		PART 48	PART 46	PART 48	PART 46	PART 48	PART 46	PART 48	PART 46	PART 48	PART 46
1	Introduction to the Work Environment	X	X	X	X						
2	Hazard Recognition and Avoidance	X	X	X	X		X**			X	X
3	Emergency Medical Procedures	X	X	X	X						
4	Health and Safety Aspects of the Task	X	X	X	X	X	X				
	or task-specific hazard recognition training + practice under close supervision of competent person.		X		X						
5	Statutory Rights of Miners	X	X		X						
6	Auth. and Resp. of Supervisors/Miner's Reps.	X	X	X	X						
7	Introduction to Rules for Reporting Hazards		X		X						
8	Self-Rescue and Respiratory Devices	X	X	X	X			X	rec.	X	
9	First Aid Review	X	X					X	rec.		
10	Changes that could adversely affect health & safety			X	X*				X		
11	Safety Rules and Safe Working Procedures		X		X		X			X	
12	Supervised Practice (non-production)					X ¹	X***				
13	Other relevant health and safety subjects -- see recommended (rec.) ones								X		
14	Mandatory Health and Safety Standards	X	X	X	X			X	rec.	X	
15	Transportation Systems and Controls	X						X	rec.		
16	Communication Systems	X		X					rec.		
17	Escape and Emergency Evacuation Plans	X		X				X	rec.	X	X
18	Firewarning and Firefighting	X	X	X	X			X	rec.		
19	Ground Conditions and Control								rec.		
20	Traffic Patterns and Control		X		X				rec.		X
21	Working in Areas of highwalls								rec.		
22	Water Hazards, Pits and Spoil Banks	X		X				X	rec.		
23	Illumination and Night Work	X							rec.		
24	Electrical Hazards	X	X		X			X	rec.		X
25	Prevention of Accidents			X				X	rec.		
26	Health	X		X				X	rec.		
27	Explosives	X						X	rec.		
28	Mobile Equipment hazards		X		X				rec.		
29	Conveyor System Hazards								rec.		
30	Crane Hazards								rec.		
31	Crusher Hazards								rec.		
32	Excavator Hazards								rec.		

Chart continued next page.

MTU - MINE SAFETY AND HEALTH TRAINING

PARTS 46 AND 48 SURFACE MINE TRAINING REQUIREMENT CHART

This is a best effort to summarize information. Accuracy is not guaranteed.

TRAINING AREAS	24 HOUR NEW MINER TRAINING		NEWLY EMPLOYED EXPERIENCED MINER TRAINING		TASK TRAINING (NEW or CHANGES)****		8 HOUR ANN. REFRESHER TRAINING		HAZARD TRAINING	
	PART 48	PART 46	PART 48	PART 46	PART 48	PART 46	PART 48	PART 46	PART 48	PART 46
33 Dredge Hazards								rec.		
34 Maintenance and Repair (Hand tools and Welding Equipment.								rec.		
35 Material Handling								rec.		
36 Fall Prevention and Protection								rec.		
37 Machine Guarding								rec.		
38 Information or Instructions on hazards person exposed to at the mine and applicable emergency procedures.										X
39 Powered Haulage Hazards										X
40 Other special safety procedures										X
41 Unique Geologic and Environmental Cond.										X
42 Restricted Areas										X
43 Warning and Evacuation Signals										X
44 Ground Control (highwalls)	X		X				X	rec.		
45 Supervised Operation During Production					X ¹					
46 New or Modified Machines and Equip. Training					X ¹					
47 Other training Required by District	X		X		X ¹		X		X	

* Only for miner who returns to same mine within 12 months and the only course he/she must take other than missed parts of annual refresher training.

** Hazard recognition training required if practice under supervision of a competent person used to fulfill task training requirement.

*** Competent person required (non-production not specified under Part 46).

**** Credit task training under Part 46 to New Miner Training

x¹ Required for miners assigned to new work tasks as mobile equipment operators, drilling machine operators, haulage and conveyor systems operators, ground control machine operators, and those in blasting operations.

Chapter
3

Training Materials by Topic

To have a complete training program, the instructor needs to address topic areas to the degree outlined in their company's training plan. Training plans will vary depending on the nature of mining activities. Please refer to Chapter two of this manual to see what topics are required for the type of training that must be presented.

The following chart Takes the topic areas listed in Table 2.1 and indicates which sections in this chapter have materials that may relate to those topics. Use this manual's table of contents (page ii) to locate the page numbers corresponding to the section number.

Table 3.1 - SURFACE MINE TRAINING TOPIC CHART

TRAINING AREAS	MATERIAL TOPIC SECTION(S)	TRAINING AREAS	MATERIAL TOPIC SECTION(S)
1 Introduction to the Work Environment		24 Electrical Hazards	12
2 Hazard Recognition and Avoidance	1	25 Prevention of Accidents	1
3 Emergency Medical Procedures	7 & 13	26 Health	11
4 Health and Safety Aspects of the Task -	2	27 Explosives	15
or specific hazard recognition training/practice under close supervision of competent person.	2	28 Mobile Equipment hazards	1
5 Statutory Rights of Miners	3	29 Conveyor System Hazards	1
6 Auth. and Resp. of Supervisors/Miner's Reps.	10	30 Crane Hazards	1
7 Introduction to Rules for Reporting Hazards	7	31 Crusher Hazards	1
8 Self-Rescue and Respiratory Devices	11 & 14	32 Excavator Hazards	
9 First Aid Review	13	33 Dredge Hazards	
10 Changes that could adversely affect health & safety		34 Maintenance and Repair (Hand tools and Welding Equipment.	2
11 Safety Rules and Safe Working Procedures		35 Material Handling	2 & 11
12 Supervised Practice (non-production)		36 Fall Prevention and Protection	2
13 Other relevant health and safety subjects -- see recommended (rec.) ones		37 Machine Guarding	1
14 Mandatory Health and Safety Standards	9	38 Info/Instructions on hazards person exposed to at the mine & emergency procedures.	
15 Transportation Systems and Controls	5	39 Powered Haulage Hazards	1
16 Communication Systems	5	40 Other special safety procedures	16
17 Escape and Emergency Evacuation Plans	7	41 Unique Geologic and Environmental Cond.	6
18 Firewarning and Firefighting	7	42 Restricted Areas	
19 Ground Conditions and Control	6	43 Warning and Evacuation Signals	5
20 Traffic Patterns and Control	5	44 Ground Control (highwalls)	6
21 Working in Areas of highwalls	6	45 Supervised Operation During Production	6
22 Water Hazards, Pits and Spoil Banks	6	46 New or Modified Machines and Equip. Training	
23 Illumination and Night Work		47 Other training Required by District	

1. Hazard Recognition/Accident Prevention

The course shall include the recognition and avoidance of hazards present at the mine. The course shall also include a review of accidents and causes of accidents, and instruction in accident

prevention in the work environment. Common areas of concern under the Hazard Recognition/Accident Prevention category are addressed on the following pages, but they are by no means the only safety concerns that could fall into this category. Many additional mine-specific or job-specific safety topics could be included in Hazard Recognition/Accident Prevention, depending on the site-specific needs of the miners.

Powered Haulage

This is the mining activity that is associated with the largest number of fatalities. Training on this topic should always be included.

MOBILE EQUIPMENT



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

- VC 887 - Air Brake System Safety -MSHA 1990 - 44 min
- VC 846 - Automatic Emergency Parking Brakes - MSHA 1992 - 17 min
- VC 821 - Blind Spots Can Kill - MSHA 1996 - 7 min
- VC 873 - Brakes, Grades, and Runaways - Highway Trucks - MSHA 1995 - 18 min
- VC 872 - Brakes, Grades, and Runaways - Off Road Trucks - MSHA 1995 - 18 min
- VC 862 - Front End Loader Safety - MSHA 1994 - 14 min
- VC 935 - Mobile Equipment Safety - MSHA 1987 - 19 min
- VC 894 - Protective Canopy (A Survivor's Story) - MSHA 1995 - 6 min
- VC 833 - Seat Belt Success Part 1, The Terry Sanders Story - MSHA 1996 - 5 min
- VC 834 - Seat Belt Success-Part 2, The Roger Newman Story - MSHA 1996 - 7 min
- VC 828 - Safety on the Move: Truck Haulage Safety - MSHA 1995 - 13 min
- VC 869 - Visibility and Communications: Off Road & Highway Trucks - MSHA '96 - 18 min



Haulage materials are available at MSHA's Internet Site at www.msha.gov

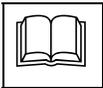
Analysis of Surface Powered Haulage accidents:

www.msha.gov/S&HINFO/SAFETY.HTM

Powered Haulage Safety (125 slides): www.msha.gov/training/surfhaul/index.htm

Tire & Rim Safety Awareness Program: www.msha.gov/S&HINFO/SAFETY.HTM

“Traffic Control Guidelines” is also available on the Michigan Mine Safety & Health Program's web site at: www.mine-safety.mtu.edu



The following Powered Haulage materials are available from the Mine Safety and Health Academy at Beaver, WV.

Guidelines for Traffic Control at Surface Mines and Installations - 1997 - OT-26

Powered Haulage “Best Practice” Series - BP Cards 1 to 12



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Mobile Haulage Equipment. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

MTU - MINE SAFETY AND HEALTH TRAINING

2. 01/10/1995 - Powered Haulage - Surface - Clay - GA - A truck spotter is run over by a truck.
4. 01/18/1995 - Powered Haulage - Surface - Copper - AZ - Truck goes through berm of waste rock dump.
5. 02/02/1995 - Powered Haulage - Surface - Sand & Gravel - AZ - Loader goes over edge of 30-ft slope.
11. 03/14/1995 - Powered Haulage - Surface - Granite - AL - Fast moving water truck rolls over in turn.
12. 03/17/1995 - Powered Haulage - Surface - Limestone - MO - Truck driver struck by another truck backing up.
13. 03/27/1995 - Powered Haulage - Surface - Boron Minerals - CA - Mechanic's vehicle is run over by haul truck.
16. 05/12/1995 - Powered Haulage - Surface - Gold - NV - Water truck driver rolls truck.
19. 05/22/1995 - Powered Haulage - Mill/Prep Plant - Cement - NV - Mechanic under vehicle when it moves.
23. 08/03/1995 - Powered Haulage - Surface - Sand & Gravel - CT - Loader tips into pit when pitwall sloughs.
33. 09/19/1995 - Powered Haulage - Surface - Gold - AK - Apprentice truck driver overturns truck into trench.
36. 10/03/1995 - Powered Haulage - Surface - Granite - SC - Truck drives through berm and over 50-ft highwall.
39. 10/09/1995 - Powered Haulage - Mill/Prep Plant - Uranium - UT - Unattended truck tractor rolls over truck driver.
41. 10/31/1995 - Powered Haulage - Underground - Salt - LA - Worker struck by loader backing through vent curtain.
47. 12/09/1995 - Powered Haulage - Surface - Gold - NV - Haul truck goes over berm on elevated waste dump.
48. 12/11/1995 - Powered Haulage - Surface - Sand & Gravel - MO - Employee crushed by descending dump truck bed.
52. 12/24/1995 - Powered Haulage - Underground - Copper - AZ - Truck operator run over by truck.

1996

1. 01/11/1996 - Powered Haulage - Surface - Traprock - OR - Worker riding as passenger falls from loader.
2. 01/25/1996 - Powered Haulage - Surface - Copper - AZ - Haul truck backs through berm at dumpsite.
3. 02/06/1996 - Powered Haulage - Surface - Granite - PA - Worker caught between skid-steer loader lift arm & ROPS.
7. 02/15/1996 - Powered Haulage - Surface - Limestone - OK - Loader backs over plant operator
9. 03/19/1996 - Powered Haulage - Surface - Copper - AZ - Electrician in pickup truck run over by haul truck.
11. 04/03/1996 - Powered Haulage - Underground - Zinc - TN - Operator run over by his own loader.
23. 05/18/1996 - Powered Haulage - Underground - Gold - CA - Supervisor's truck rolls over embankment.
25. 06/19/1996 - Powered Haulage - Surface - Sand and Gravel - IL - Customer truck driver run over by haul truck.
27. 06/29/1996 - Powered Haulage - Surface - Limestone - OK - Worker crushed while working from loader bucket.
28. 07/08/1996 - Powered Haulage - Surface - Limestone - IL - Mechanic crushed when haul truck starts unexpectedly.
40. 10/09/1996 - Powered Haulage - Surface - Sand and Gravel - MT - Loader runs off road into trench.
42. 11/05/1996 - Powered Haulage - Surface - Limestone (CB) - FL - Truck goes off road into a water-filled quarry.
43. 11/18/1996 - Powered Haulage - Surface - Gold - NV - Worker backing truck down access road runs off edge.
44. 12/02/1996 - Powered Haulage - Surface - Limestone - MI - Mechanic pinned between lift arm and loader body.
45. 12/12/1996 - Powered Haulage - Surface - Limestone (CB) - Forklift overturns.

1997

3. 01/15/1997 - Powered Haulage - Underground - Gold - NV - Employee walking along rib crushed by loader.
7. 02/03/1997 - Powered Haulage - Surface - Stone (CB) - OR - Haul truck slips off elevated road into pond.
9. 02/14/1997 - Powered Haulage - Surface - Stone (CB) - TX - Loader drives over edge of highwall.
11. 02/17/1997 - Powered Haulage - Surface - Sand and Gravel - KS - Driver exits his truck; is run over by other truck.
12. 02/20/1997 - Powered Haulage - Surface - Gold - SC - Worker doing pre-shift is run over when truck is started.
13. 02/24/1997 - Powered Haulage - Surface - Sand and Gravel - KS - Driver drove his truck into a pond.
16. 03/13/1997 - Powered Haulage - Surface - Gold - CA - Foreman's pickup goes off roadway and rolls down slope.
25. 04/26/1997 - Powered Haulage - Surface - Granite (CB) - AZ - Welder jumps from loader and is run over.
33. 06/06/1997 - Powered Haulage - Surface - Limestone (CB) - IL - Bump causes driver to strike head on cab frame.
37. 07/08/1997 - Powered Haulage - Surface - Granite (CB) - NC - Over-the-road truck is struck by a freight train.
38. 07/09/1997 - Powered Haulage - Surface - Limestone (CB) - Over-the-road truck struck by a freight train.
41. 07/19/1997 - Powered Haulage - Surface - Sand and Gravel - CO - Operator pinned between machine parts
43. 07/25/1997 - Powered Haulage - Surface - Traprock (CB) - MA - Driver loses control, goes up over a berm.
48. 08/28/1997 - Powered Haulage - Underground - Boron Mineral - CA - Worker run over by load-haul-dump unit.
51. 09/16/1997 - Powered Haulage - Surface - Gold - NV - Contract truck driver run over as he tried to stop roll-away.
54. 09/30/1997 - Powered Haulage - Surface - Sand and Gravel - NH - Scraper runs over stockpile and rolls over.
56. 10/20/1997 - Powered Haulage - Surface - Granite (CB) - GA Worker in front of train run over when train moves.

1998

3. 01/19/1998 - Powered Haulage - Surface - Limestone (CB) - TX - Truck driver loses control and strikes berm.
8. 02/13/1998 - Powered Haulage - Surface - Molybdenum - ID - Driver loses control of truck and goes over berm.
13. 03/13/1998 - Powered Haulage - Surface - Limestone (CB) - MI - Driver pinned between trailers as truck moves.
22. 05/04/1998 - Powered Haulage - Surface - Granite (CB) - AR - Mechanic repairing rail car struck by car.
24. 05/14/1998 - Powered Haulage - Surface - Limestone (CB) - IA - Haul truck backs over edge of waste dump pile.
26. 05/28/1998 - Powered Haulage - Surface - Sand & Gravel - TX - Truck driver struck by following truck.
28. 07/01/1998 - Powered Haulage - Open Pit- Cement - MD - Serviceman in sweeper struck by rail car.
30. 07/23/1998 - Powered Haulage - Surface - Clay - IA - Water truck jack-knives.

34. 08/15/1998 - Powered Haulage - Surface - Crushed Granite - Security guard run over by his own truck.
41. 09/18/1998 - Powered Haulage - Surface - S& G - Loader operator backs over pitwall.
43. 09/28/1998 - Powered Haulage - Surface - Gold - Contract mechanic struck by a 190-ton haul truck.
46. 11/05/1998 - Powered Haulage - UG - Salt - Operator of rear-steer loader struck head while it was outside of cab.
47. 11/09/1998 - Powered Haulage - Surface - Granite - Haul truck goes over loaded out stockpile wall; wall collapses.

1999

1. 01/10/1999 - Powered Haulage - Underground - Gold Haul truck backed into victim's truck.
2. 01/13/1999 - Powered Haulage - Surface - S& G - Contract truck driver crushed by defective doors on asphalt truck.
7. 02/15/1999 - Powered Haulage - Surface - Copper - Contract technician pickup truck run over by 320-ton haul-truck.
11. 03/15/1999 - Powered Haulage - Surface - Limestone - Truck driver backs truck off 100-ft highwall.
18. 05/10/1999 - Powered Haulage - Surface - Granite - Laborer struck by slab of rock from working face.
28. 07/25/1999 - Powered Haulage - Surface - Iron Ore - Plant repairman run over by skid-loader during cleanup.
30. 07/30/1999 - Powered Haulage - Surface - Limestone - Haul truck overturns. Operator not wearing seat belt.
31. 08/06/1999 - Powered Haulage - Surface - S& G - Loader slips over elevated embankment. No seat belt worn.
35. 09/16/1999 - Powered Haulage - Surface - Uranium - Truck operator's water truck goes out of control.
37. 09/29/1999 - Powered Haulage - Underground - Limestone - Laborer/operator crushed by loader boom.
40. 10/14/1999 - Powered Haulage - Surface - Limestone - Man servicing haul truck struck when driver drives away.
46. 11/11/1999 - Powered Haulage - Surface - Trap Rock - Driver run over by his own truck. Park brake not used.
48. 11/18/1999 - Powered Haulage - Surface - Limestone - Scraper lost power and went over edge of highwall.



Suggested Pictures: Use the “Surface Mobile Equipment” pictures from the download section at: <http://www.mine-safety.mtu.edu> . These pictures involve different types of haulage equipment. Mine Specific suggestion: Digital cameras are getting less expensive and taking pictures of the specific mine’s work-site is always better than using generic pictures.



Haulage Road Test (Answers follow test.)

1. Single lane roads should be a) as wide, b) twice as wide as the truck.
2. A two lane roadway should be at least: 1 ½, 2 ½, 3 ½, 4 ½ times as wide as the truck.
3. Wider roads (are/are not) needed on curves.
4. Which of the following is the least dangerous place to have a sharp curve in the road? a) A bridge, b) The crest of a hill, c) At the bottom of long sustained downgrade
5. Intersections positioned near hill crests or sharp curves are generally safe. True/False
6. Wetting down roads can create dangerous driving conditions. True/False
7. Road dust is what type of concern? a) Safety concern, b) Health concern, c) both a & b.
8. Berms: a) act as a wall to stop trucks that are going off the road. b) are good for helping the driver know where the edge of the road is, c) are required where drop-offs are of sufficient grade or depth to endanger persons in equipment.
9. Berms may be made of a) concrete, b) large boulders, c) loose material between lanes.
10. A berm's height must be equal to the wheel height of the largest vehicle using the road. True/False
11. To be most effective, the tire should initially sink into the berm. True/False
12. The side of the berm facing the road must not be too steep. True/False
13. Berms are a big maintenance item. True/False
14. Boulders are not recommended as berm materials. True/False
15. A well-constructed guardrail is better than a berm. True/False
16. Center (or straddle) berms and escape lanes can be used instead of berms. True/False
17. Some important considerations in road construction are the _____ and _____ distances over grades and around curves, the ability to carry the _____, the ability to shed _____, and location away from pit walls to prevent danger from _____.
18. A road designer should try either to cut the angle or length of grades. True/False
19. Curves should be banked ____ to ____ %
20. Drainage should be on the a) inside or b) outside of the curve.
21. Traffic signs are needed on mine roads. True/False
22. Haul road maintenance is costly. True/False
23. Operator training is required to use runaway berms. True/False
24. A good maximum grade would be 20 %, 15 %, 10%, 7.5%, 5 %, 2.5%.
25. If the grade is over 10 %, escape facilities are needed. True/False
26. Berms made of boulders are easy for a truck to push over the edge. True/False
27. Tarping of trucks is not a dangerous operation. True/False
28. In order to minimize surface haulage accidents, drivers of trucks that are being loaded should be told which of the following. a) Stay in the truck, or the truck will not be loaded. b) When they can leave the truck and where to stay if they must leave the trucks while being loaded or waiting to be loaded. c) Clean the windows and perform other needed safety checks while the truck is waiting to be loaded or is being loaded.
29. Backup alarms are a good way to make sure no one gets run over. True/False
30. Properly working parking brakes are needed on mine vehicles. True/False
31. MSHA requires mine operators to establish workable rules and warning signs to indicate unusually or potentially dangerous road conditions. True/False
32. Road signs should be non-uniform in appearance so drivers can see them better. True/False

Haulage Road Test (Continued)

33. Training in traffic patterns and their changes are unimportant in small operations. True/False
34. Drivers should anticipate changes in road conditions whenever the weather changes. True/False
35. Dry loose gravel provides a stable, skid-resistant road surface. True/False
36. Road bumps damage equipment, but are not a safety concern. True/False
37. Muddy or slushy (snow mixed with water) roads are even more dangerous than either snow or ice alone. True/False
38. The width of a tire has little to do with its skid resistance. True/False
39. An overloaded vehicle has which of the following performance characteristics? a) Tendency to sway on corners. b) Poor response to steering. c) Increased potential for tipping. d) Increased instability during sudden stops. e) Increased stopping distances. f) Increased potential for brake failure on slopes. g) Increased potential for overheating of engine. g) Increased potential for overheating and blowout of tires. h) Increased road maintenance requirements. i) Increased potential for damage to axles and wheels when driving over holes or bumps.
40. Communication between vehicles on mine roads is discouraged because it distracts the driver. True/False
41. Mine operators should establish adequate and appropriate _____ indicating any unusual or potentially dangerous road conditions.
42. Signs should be _____ in appearance and location and must be clearly posted, that is, placed at locations where they can be observed.
43. Mine operators should provide _____ to truck drivers to become familiar with traffic patterns and any changes in these patterns.
44. Equipment operators should be alert to and anticipate changes in road conditions, especially with changes in _____ conditions.
45. Equipment operators should obey traffic rules and take the necessary precautions to respond to _____ signs.

Answers to Haul Road Test

1. (b)
2. (3 ½)
3. They are needed on curves, especially where there is 2-way traffic.
4. (a) a bridge
5. False – They have sight distances that are too short.
6. True - Excessive amounts of water can cause the road to become muddy and very slippery.
7. (c) Both a & b. - Road dust restricts visibility, a safety hazard, and it can be high in crystalline silica that could cause silicosis, a lung disease.
8. (b) & (c) – They give a driver a tactile method of feeling the edge of the road (like the “rumble strips” on highways. They limit or restrain a vehicle’s passage off the roadway.
9. All correct, but “a” and “b” are not preferred materials. Gravel is best.
10. False – Berms must be mid-axle height of largest vehicle traveling the road.
11. True - The berm then raises the tire tending to return it to the roadway.
12. False - The side facing the road must be steep to minimize any ramping effect.
13. True - Berms require continual attention to maintain adequate width and height.
14. True - Large boulders can injure the driver and small ones may slide over the edge.
15. True- Properly constructed guardrails should be used in place of berms where the installation is permanent.
16. False - center or straddle berms and escape lanes do not replace edge berms.
17. Some important considerations in road construction are the stopping and sight distances over grades and around curves, the ability to carry the weight, the ability to shed water, and location away from pitwalls to prevent danger from rock falls.
18. True
19. 1 to 2 %
20. Inside
21. True - Stop signs, right-of-way signs, grade signs, slippery surface, and upcoming ramp signs are among those that should be used to help prevent accidents.
22. False - Good maintenance on haul roads saves money on equipment and tire wear and also eliminates costs associated with accidents that result from poorly maintained roads.
23. True
24. 7.5 %
25. True
26. True - Because of this danger, it is a good idea to set them in 27 feet or more.
27. False - The fall danger is significant and automatic tarpers should be considered to reduce the likelihood of fall fatalities.
28. (a) and (b). While leaving the truck can be extremely dangerous, clearly designated times to leave the truck and locations to stand can reduce danger.
29. False - While the law requires them, people become immune to them. There are new alarms coming out that warn the driver of the pedestrian rather than warning the pedestrian of the truck. These have great potential to reduce vehicle/pedestrian accidents.
30. True - Parked vehicles rolling over drivers or other pedestrians is an important cause of mine injuries and fatalities.
31. True - See 56/57.9100

Answers to Haul Road Test (Continued)

32. False - Signs should be uniform in appearance and clearly posted at locations where they can be observed.
33. False - To avoid accidents, people that drive on mine property must know where and what to expect.
34. True - Slippery muddy conditions and washouts among other hazards are much more likely to occur on unimproved roads such as those used by many of the mines to transport ore, materials and personnel.
35. False - Gravel moves under a vehicle's tires and often results in failure of the steering to respond or in sideways skidding of the vehicle's rear-end. Avoid high speeds when driving on gravel roads, especially on turns. Be prepared for continually changing road conditions. Material spills on paved roads also cause vehicles to lose steering and skid sideways and should be cleaned up immediately.
36. False - Bumpy roads destroy equipment, and even small bumps in series can result in the vehicle's steering failing to respond or in causing the vehicle's rear-end to skid sideways. Roads must be graded regularly to maintain smooth, safe driving and drivers must continually be on the lookout for such hazards.
37. True - Mud and slush not only cause the vehicle to hydroplane (float) where the wheels lose traction and the steering becomes unresponsive, but tend to pull the vehicle into the oncoming traffic lane or off the edge of the road.
38. False - When the road is water covered, cars and pickup trucks with wide low-tread tires tend to hydroplane making the vehicle's steering unresponsive even at relatively low speeds. This condition is magnified when the road is covered with a mixture of snow and water (slush). In general the narrower the vehicle's tires (within limits set by the vehicle's weight) and the deeper the tire's tread, the less tendency there is for the vehicle to hydroplane. Other factors in tread design also contribute to the ability of a tire to shed water and remain in contact with the road.
39. All true
40. False - Communication and rules about when to let other drivers know your position are very important to safe travel through the mine site, especially where heavy loads are carried by haulage trucks and loaders. However, drivers must use extreme caution so that the distractions from using communication devices do not result in increased accident potential.
41. Signs
42. Uniform
43. Training
44. Weather
45. Warning



Truck Haulage - Best Practices Test

1. Off-road haulage trucks usually have three braking systems. True/False
2. A truck in which any of the three braking systems doesn't work properly should be immediately removed from service. True/False
3. Using the parking brake to stop a truck, which doesn't have an emergency brake, may render the parking brake unusable. True/False
4. A retarder is an acceptable substitute for the service brake. True/False.
5. The primary source of information for safe operation of a mine haulage truck is: a) annual refresher training, b) task training, c) the operator's manual.
6. An unusual noise is usually the best means of knowing that something is wrong with mechanical equipment and a mechanic should be consulted immediately. True/False
7. Any unusual feel in the operation of a vehicle should be checked out immediately. True/False
8. Increased resistance to steering control may indicate that the primary steering system has failed and the vehicle should be immediately removed from service, checked, and maintained if necessary. True/False

Truck Haulage Best Practices Test Answers

1. True - powered haulage trucks usually have 1) a service brake, 2) a secondary or emergency brake, and 3) a parking brake.
2. True - MSHA requires that all braking systems be functional when a truck is in service. Each system should be inspected prior to putting the truck into use.
3. True - therefore, if such use is required the parking brake should be immediately tested (full load on bottom of maximum grade - should not exceed 15 %) to determine if it is still functional.
4. False - the retarder system is a dynamic (usually non-friction) brake used to control the machine's speed while operating on down grades. It is also used to assist normal braking and to reduce wear on the service brake.
5. (c) - the operator's manual is the primary source of information for safe operation of any machine. Task training in proper operating procedures is next in importance and annual refresher safety training is important to point out hazards of a more general nature at the mine site.
6. True
7. True
8. True

CONVEYORS



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC934 - Conveyor Safety - MSHA 1987 - 7 min



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Conveyors. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm.

1995

- 20. 05/31/1995 - Slip/Fall of Person - Surface - Limestone - FL - Contract worker falls 42 feet off of conveyor.
- 26. 08/19/1995 - Slip/Fall of Person - Surface - Granite - SC - Contract project manager falls from conveyor.
- 29. 09/01/1995 - Slip/Fall of Person - Surface - Sand & Gravel - VA - Equipment operator falls washing conveyor.
- 51. 12/22/1995 - Machinery - Surface - Sand & Gravel - MI - Truck driver crushed as conveyor slips off crane hook.

1996

- 22. 05/16/1996 - Powered Haulage - Surface - Sand and Gravel - IA - Worker on conveyor caught when it's started.
- 30. 07/21/1996 - Electrical - Surface - Limestone - VA - Boy electrocuted in water energized by faulty conveyor.

1997

- 2. 01/14/1997 - Powered Haulage - Surface - Gold - NV - Crusher helper caught in conveyor tail pulley when it starts.
- 18. 03/24/1997 - Powered Haulage - Surface - Sand and Gravel - TX - Operator caught in the tail-pulley.
- 20. 04/09/1997 - Powered Haulage - Surface - Limestone (CB) - MO - Material slides, engulfs worker taking sample.
- 29. 05/02/1997 - Powered Haulage - Surface - Sand and Gravel - MI - Foreman wedged between conveyor and idler.
- 59. 11/12/1997 - Powered Haulage - Surface - Sand and Gravel - NY - Crusher operator is entangled in the tail pulley.

1998

- 14. 03/14/1998 - Powered Haulage - Surface - Sand and Gravel - TX - Welder drawn into stockpile chute.
- 15. 04/11/1998 - Powered Haulage - Surface - Sandstone - PA - Plant manager caught between tail and snubber pulley.
- 18. 04/28/1998 - Powered Haulage - Surface - Limestone (CB) - TN - Worker is caught in conveyor.
- 19. 04/29/1998 - Powered Haulage - Surface - Traprock (CB) - PA - Mechanic caught in conveyor while adjusting it.

1999

- 12. 03/18/1999 - Powered Haulage - Surface - Sand & Gravel - Superintendent caught in conveyor idler while cleaning it.
- 32. 08/09/1999 - Powered Haulage - Surface - S&G - Laborer cleaning under conveyor is drawn into pinch point.
- 51. 12/23/1999 - Powered Haulage - UG - Crushed Limestone - Worker caught in conveyor's self cleaning tail pulley.



Suggested Pictures: Use the "Conveyors" pictures from the download section at <http://www.mine-safety.mtu.edu>. Mine Specific suggestion: Digital cameras are getting less expensive, and using pictures of the specific mine is always better than using generic pictures.



Conveyor Test (Answers follow test.)

Objective - The trainee will be able to answer questions correctly about the hazards of working around conveyors.

1. Falling material is a hazard around elevated conveyors. True/False
2. Fire is a concern with conveyors. True/False
3. Electrocution is not a danger around conveyors. True/False
4. Guards should not be removable without the use of hand tools. True/False.
5. Guards should be readily removable with the use of common hand tools. True/False
6. Guards should be light so workers can handle them without special lifting equipment. True/False
7. Expanded metal with steel angle bracing is a preferred material for making guards. True/False
8. Emergency stop switches of the "Pull Cord" type are not likely to fail. True/False
9. Proper lighting is a major consideration around conveyors. True/False
10. Walkways and work platforms with guardrails are necessary on elevated conveyors. True/False
11. Adequate crossovers are a matter of convenience. They are not a safety concern. True/False
12. Workers should never lubricate a conveyor when it is operating. True/False
13. Proper skirtboards and wipers do not effect conveyor safety. True/False
14. A conveyor needs brakes that work well. True/False
15. Communications along the length of a conveyor are necessary. True/False
16. Under-belt crossings do not need guarding if they are more than 7 feet below the moving conveyor equipment. True/False
17. A company must clearly label conveyor crossover points. True/False
18. Points along conveyors where workers might want to cross should have warning signs. True/False
19. Qualified workers should regularly check control systems, interlock systems, monitoring systems and warning devices on conveyors. True/False

Answers to Conveyor Test

1. True -- Materials can roll and fall from a belt causing serious injury or death to workers below.
2. True -- Among other causes, conveyors can catch fire when the belt rubs against fixed objects or stuck rollers.
3. False -- Like any electrically operated equipment, conveyors can present an electrocution hazard. The best form of protection is a visual inspection and continuity test to make sure that the frame has a continuous, low-resistance ground back to the power source.
4. True -- It should require a conscious effort to remove a guard; otherwise, removing them while the machine is operating becomes too easy.
5. True -- This is necessary so authorized personnel can carry out their duties.
6. True -- Wherever possible, design them to be installed and removed in sections.
7. True -- Expanded metal guards, braced and supported by lightweight steel angle, provide good protection and allow inspection of the machinery.
8. False -- They will fail in time. Check them frequently to make sure they provide the protection intended.
9. True -- Direct light where it is beneficial. It should not shine into workers' eyes. Light walkways adequately. Mobile equipment operators must be able to see the various components.
10. True -- Provide a work platform next to belt drives, discharge points, take-ups, turnovers and tailpieces because bearings, pulleys and shafts need occasional repair.
11. False -- "A worker attempting to cross an operating conveyor" is one of the leading causes of conveyor-related fatalities and injuries. Employees might be tempted to save time by crossing operating conveyors if there are no crossovers.
12. False -- If workers cannot shut down a conveyor for lubrication, then a means must be provided to lubricate components from a safe location.
13. False -- Proper skirtboards prevent material from spilling off a conveyor transfer point. Adequate wipers can stop carry-back of material, eliminating deposits at unwanted locations.
14. True -- A conveyor needs both brakes and backstops. Brakes keep a declined conveyor from rolling forward too fast or rolling forward when turned off. Backstops keep an inclined conveyor from rolling backward and spilling its load from the tail end.
15. True -- Communications are vital during emergencies, as well as during normal operations.
16. False - Back guards over under-belt crossings should be strong enough to prevent a person from being struck by a broken belt. They should also prevent a person from coming into contact with the belt or being hit by falling material.
17. True
18. True
19. True

Machinery



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 933 - Ball Mill Safety - MSHA 1988 - 17 min

VC 916 -Think: "Quicksand" Safety around Bins & Hoppers - MSHA 1987 - 10 min

STATIONARY EQUIPMENT



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Stationary Machinery. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

3. 01/12/1995 - Falling/Sliding Material - Surface - Gold - NV - Powderman struck by falling prill tank.
8. 02/17/1995 - Machinery - Surface - Limestone - MO - Driller's clothing caught on moving drill stem.
10. 03/10/1995 - Machinery - Surface - Copper - NV - Wood chipper yoke moves crushing contractor employee.
45. 12/05/1995 - Machinery - Surface - Limestone - TN - Welder killed in crusher when it unexpectedly started.

1996

4. 02/09/1996 - Handling Material - Surface - Limestone - TX - Refractory worker struck by kiln liner.
5. 02/09/1996 - Handling Material - Surface - Limestone - TX - Refractory supervisor struck by kiln liner.
17. 05/07/1996 - Powered Haulage - Surface - Stone (CB) - OR - Worker caught between two crushers during setup.
21. 05/10/1996 - Slip/Fall of Person - Surface - Limestone (CB) - WI - Plant foreman falls off crusher.
26. 06/26/1996 - Slip/Fall of Person - Surface - Sand and Gravel - PA - Worker falls through floor into bin.
34. 09/10/1996 - Slip of Fall of Person - Surface - Sand and Gravel - MS - Worker slips off pipe from dredge to shore.
36. 09/16/1996 - Falling/Sliding Material - Surface - Cement - PR - Worker burned when kiln material breaks loose.
37. 09/16/1996 - Falling/Sliding Material - Surface - Cement - PR - Worker burned when kiln material breaks loose.

1997

1. 01/08/1997 - Machinery - Surface - Sand and Gravel - WA - Mechanic caught in blade mill when it starts.
42. 07/24/1997 - Machinery - Surface - Limestone (CB) - TX - Rail wheels fall off blocking, landing on mechanic.
49. 09/03/1997 - Machinery - Surface - Limestone (CB) - IL - Hammer feed chain broke causing driller to fall.
53. 09/29/1997 - Machinery - Surface - Limestone (CB) - Service technician has suspended loader tire fall on him.
55. 10/07/1997 - Fall/Slide Material - Surface - Sand and Gravel - Supervisor struck as barrier plate falls off crusher.
57. 10/20/1997 - Slip/Fall of Person - Surface - Stone(CB) - ID - Owner/operator falls into operating jaw crusher.

1998

1. 01/19/1998 - Slip/Fall of Person - Surface - Limestone - OH - Welder falls 50 feet from the top of a hopper.
9. 02/25/1998 - Machinery - Surface at Underground - Copper - MI - Salvage worker struck by falling material.
16. 04/16/1998 - Fall of Material - Surface - Sand & Gravel - CA - Plant superintendent struck by falling screen cloth.
21. 04/30/1998 - Machinery - Surface - Stone (CB) - OR - Crusher operator struck by hammer dropped into crusher.
25. 05/26/1998 - Machinery - Surface - Sand & Gravel - UT - Crusher operator tangled in unguarded shaft coupling.
29. 07/14/1998 - Machinery - Surface - Sand and Gravel - IA - Dredge operator drawn into crusher drive belts.

1999

4. 01/27/1999 - Fall/Slide Material - Surface - Cement - Contractor was engulfed by sliding material in silo.
6. 02/03/1999 - Machinery - Surface - Zircon - Shipping operator crushed my mechanical sampler arm.
15. 04/07/1999 - Machinery - Surface - Stone - Driller struck in head when compressed air pipe connection fails.
29. 07/27/1999 - Powered Haulage - Surface - S& G - Plant operator engulfed while cleaning in feed hopper.

MOBILE EQUIPMENT - OTHER



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Mobile Machinery. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

- 25. 08/16/1995 - Machinery - Surface - Limestone - NY - Contract dozer operator falls under his moving dozer.
- 27. 08/20/1995 - Machinery - Surface - Nonmetal - PA - Truck driver struck when suspended steel plates fall.
- 32. 09/18/1995 - Machinery - Surface - Sand & Gravel - CA - Dozer goes through berm and falls into water filled pit.
- 37. 10/04/1995 - Machinery - Mill/Prep Plant - Sand & Gravel - MD - Foreman falls off weight being lifted by crane.
- 50. 12/14/1995 - Machinery - Surface - Limestone - OH - Dozer runs over operator.
- 51. 12/22/1995 - Machinery - Surface - Sand & Gravel - MI - Truck driver crushed as conveyor slips off crane hook.
- 53. 12/27/1995 - Machinery - Mill/Prep Plant - Borate - NV - Cable breaks holding crane basket with 2 men.

1996

- 6. 02/14/1996 - Machinery - Surface - Sand and Gravel - CA - Mechanic run over by tracked drill rig.
- 15. 04/23/1996 - Machinery - Surface - Stone (CB) - NV - Worker driving mobile crane hits bump and tips over.
- 41. 10/29/1996 - Machinery - Surface - Limestone - SC - Backhoe slips into water-filled pit.

1997

- 17. 03/15/1997 - Machinery - Surface - Sand and Gravel - CA - Loader tire slips off hook on truck mounted boom.
- 26. 04/26/1997 - Machinery - Surface - Limestone (CB) - FL - Tram chain slips causing dredge to slip into water.(1)
- 27. 04/26/1997 - Machinery - Surface - Limestone (CB) - FL - Tram chain slips causing dredge to slip into water.(2)
- 50. 09/08/1997 - Machinery - Surface - Cement - TX - Machinist caught when crane hoist drum he was on, moved.

1998

- 20. 04/29/1998 - Machinery - Surface - Sand & Gravel - MI - Dozer operator is struck when towing chain breaks.
- 27. 06/22/1998 - Machinery - Surface - Limestone (CB)- KS- Superintendent caught between track and frame of dozer.
- 35. 08/21/1998 - Slip/Fall of Person - Surface - Clay - Laborer engulfed in rail hopper car material.
- 39. 09/02/1998 - Machinery - Surface - Crushed Stone - Dozer rolls into pit after narrow bench collapses.
- 42. 09/22/1998 - Powered Haulage - Surface - S& G - Dozer operator on surge pile is pulled into draw point.

1999

- 5. 02/01/1999 - Machinery - Surface - Limestone - Maintenance worker struck by boom while dismantling crane.
- 22. 06/28/1999 - Machinery - Surface - Sand & Gravel - Production manager drowns when backhoe slips into pond.
- 25. 07/09/1999 - Machinery - Surface - Limestone - Contractor crushed when his grader goes over bank of road
- 50. 12/08/1999 - Machinery - Surface - Crushed Limestone - Dozer overtravels embankment and falls into water.

GUARDING



No specific videos on guarding as of this writing, but all conveyor and stationary machinery videos will discuss guarding to some degree. For the most up-to-date listing of available videos, visit MSHA on the Internet at <http://www.msha.gov/TRAINING/prodintr.htm>



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1998 involving Guarding. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

8. 02/17/1995 - Machinery - Surface - Limestone - MO - Driller's clothing caught on moving drill stem.

1996

32. 07/28/1996 - Other - Surface - Boron Mineral - CA - Contractor heating lug nuts stuck when loader tire explodes.

1997

60. 12/03/1997 - Powered Haulage -Surface -Sand and Gravel-NY -Laborer caught in machinery & drawn into washer.

1998

15. 04/11/1998 - Powered Haulage - Surface - Sandstone - PA - Plant manager caught between tail and snubber pulley.

25. 05/26/1998 - Machinery - Surface - Sand & Gravel - UT - Crusher operator tangled in unguarded shaft coupling.

29. 07/14/1998 - Machinery - Surface - Sand and Gravel - IA - Dredge operator drawn into crusher drive belts.



“Guarding” is a short MS PowerPoint program that can be downloaded from our web site at www.mine-safety.mtu.edu . It uses illustrations from the MSHA pamphlet on guarding to illustrate good vs. bad guards and the concept of guarding by location. Warning: There are some pictures of severely injured hands in this presentation.

MHSA's Guide to Equipment Guarding is available at MSHA's Internet Site at: www.msha.gov/S&HINFO/equipguard/equipguard.htm www.msha.gov



Suggested Pictures: Use the “Guarding” pictures from the download section at: <http://www.mine-safety.mtu.edu> . Most of these pictures involve guards on conveyors. Mine Specific suggestion: Digital cameras are getting less expensive and taking pictures of the specific mine's work-site is always better than using generic pictures.



Guarding Test (Answers follow test.)

This test is based on MSHA’s guide to Equipment Guarding for Metal and Nonmetal Mining, 1994 reprinting.

1. A guard must make pinch points inaccessible during operation. True/False
2. The flywheel in Figure 1 doesn’t need guarding. True/False
3. Return idlers on conveyors need to be guarded. True/False.
4. Conveyor stop cords must be loose and accessible to a person falling against the belt. True/False.
5. Unguarded conveyors next to travelways must be equipped with railings or have emergency stop devices located so that a person falling on or against the conveyor can de-energize the conveyor. True/False
6. The worker in Figure 2 is applying belt dressing to a moving conveyor. He is doing it in an acceptable manner. True/False.
7. Conveyor take-up pulleys require guarding in all circumstances. True/False.
8. Belts and pulleys require guarding only on the side that is most readily accessible. True/False.
9. Guards are needed to keep a breaking belt from injuring people working or traveling nearby. True/False.
10. Keyed protruding shafts (Figure 3) need guarding. True/False.
11. Unkeyed protruding shafts need to be guarded. True/False
12. Fan inlets require guarding. True/False.
13. Fan outlets require guarding. True/False.
14. An operator cannot be cited if material buildup occurs below a conveyor guarded by location. True/False.
15. Exposed trunions do not require guarding if a rail limits access to the underside of a rotary kiln (Figure 4). True/False
16. The use of expanded metal or screens has the following advantages:
 - a) easy to inspect
 - b) grease and/or oil without removal
 - c) readily available scrap and minimal particle buildup
 - d) ease of cleaning
 - e) all of the above

Figure 1

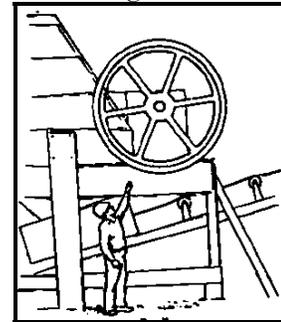


Figure 2

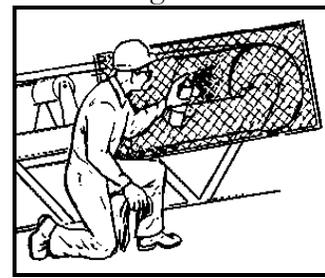


Figure 3

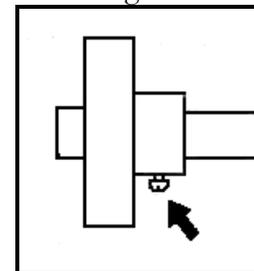
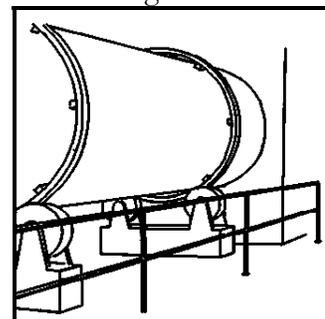


Figure 4



Answers to Guarding Test

1. True
2. True, however, where work is to be done they must be de-energized and locked out and a temporary safe means of access (ladder) provided before work is started.
3. True if less than 7 feet above walking surface.
4. False - They must be accessible, but taut enough to de-energize the conveyor when pulled.
5. True - Unguarded conveyors next to travelways which don't have properly-located emergency stop devices must have railings which a) are positioned to prevent persons from falling on or against the conveyor, b) will be able to withstand the vibration, shock, and wear to which they will be subjected during normal use; c) are constructed and maintained so that they will not create a hazard.
6. True – Moving conveyors should not have belt dressing applied except when an aerosol-type dressing is used.
7. False - if the pinch points are out of reach, they needn't be guarded. However, they may need to be guarded from access due to the danger of a suspended load falling if the belt breaks. Cables can be used to provide an additional means of suspending the load in the event of belt failure.
8. False - If accessible from both sides, both must be guarded.
9. True
10. True
11. True - if they protrude farther than $\frac{1}{2}$ the shaft diameter.
12. True - Fan inlets require guarding regardless of location.
13. True - However, fan outlets may be guarded by location.
14. False - if the buildup causes the distance from the top of the pile to the parts requiring guarding to become less than 7 feet, a citation will be issued.
15. False, these areas require guarding because personnel servicing the kiln use them.
16. e) - all are correct

Welding



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 878 - Compressed Gasses: Correct way to Use Oxy/Fuel for cutting - MSHA 1989 – 42 Min.



Below are listed (in order of occurrence) the MNM Fatalgrams from 1996 to 1998 involving Welding. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1996

- 12. 04/10/1996 - Ignition or Explosion of Gas - Surface - Sand and Gravel - UT - Welding causes fuel tank to explode.
- 32. 07/28/1996 - Other - Surface - Boron Mineral - CA - Contractor heating lug nuts stuck when loader tire explodes.

1997

- 15. 03/06/1997 - Exploding Vessels Under Pressure - Surface - Limestone (CB) - FL - Welding on tank = explosion.

1998

- 17. 04/22/1998 - Exploding Vessels Under Pressure -Surface -Limestone -TX - Tire explodes as torch cuts brake drum.



Welding Test (Answers follow test.)

Objective: The trainee should be able to demonstrate knowledge of the hazards involved in oxyacetylene and arc welding, and various ways to control them.

1. A Type 'A' fire extinguisher is needed for arc welding. True/False
2. Oxygen cylinders must be stored with inert materials such as grease. True/False
3. Oxygen, which makes up 21 % of the air we breathe, is not dangerous to work with. True/False
4. Acetylene is a very explosive gas. True/False
5. Oxygen and acetylene cylinder valves must be closed when the torch and hoses are not in use. True/False
6. Using an oxy-acetylene torch to cut a hole through a tank or drum is a quick and safe way to get at its insides. True/False
7. There is no danger in welding a gasoline tank as long as it is full of gasoline. True/False
8. Concrete blocks or a concrete floor should be used to support the material being heated, because these are not combustible and will absorb the heat. True/False
9. Electric shock is a serious danger when arc welding on wet surfaces. True/False
10. Storing and transporting acetylene cylinders horizontally is acceptable. True/False
11. Every type of gas must have a regulator, which is only used on that type of gas. True/False
12. It is important to open cylinder valves slowly. True/False
13. A cylinder's steel protective cap is only for shipping. True/False
14. Oxygen cylinders should be stored at least 20 feet from acetylene or other combustibles or be separated by a 5-foot high, fire resistant barrier. True/False
15. Welding metals produces toxic emissions. True/False
16. Eye and face protection is valuable for arc welders. True/False
17. To avoid inhaling hazardous fumes and gases, welders should use: a) Respirators b) Gloves, c) Fans
18. One reason welding is popular is because it is safe to use around combustible materials without causing fires. True/ False
19. Clothes with open pockets are an important part of a welder's clothing. True/False
20. A permit is needed to safely use welding machines and gas cylinders in a confined space. True/False
21. You needn't be concerned about the regulator exploding when you open the valve on an oxygen cylinder. True/False
22. On the acetylene cylinder, the valve is opened two full turns. True/False
23. Use compressed acetylene in a free state only at pressures below 15 psig. True/False
24. Open both the acetylene and oxygen when you light the torch to avoid soot. True/False
25. A flashback is not a dangerous condition. True/False
26. Check valve problems can cause a fire or regulator to blow up. True/False
27. Extra ventilation during arc welding isn't necessary. True/False
28. The only PPE a welder needs is a face shield. True/False

Answers to Welding Test

1. False - When welding, cutting, soldering, thawing, or bending with an electric arc or with an open flame where an electrically conductive extinguishing agent could create an electrical hazard, a multipurpose dry-chemical fire extinguisher or other extinguisher with at least a 2-A:10-B:C rating shall be at the work site. With an open flame in an area where no electrical hazard exists, a multipurpose dry-chemical fire extinguisher or equivalent fire extinguishing equipment for the class of fire hazard present must be at the work site. Use of halogenated fire extinguishing agents to meet the requirements of this standard are limited to Halon 1211 (CBrClF₂) and Halon 1301 (CBrF₃). When these agents are used in confined or unventilated areas, precautions based on the manufacturer's use instructions must be taken so that the gases produced by thermal decomposition of the agents are not inhaled.
2. False - Oxygen cylinders must not be stored in rooms or areas used or designated for storage of flammable or combustible liquids. Grease is not inert, but is a combustible liquid.
3. False - oxygen is one of the most dangerous of the gases people work with. Even metals will burn in the high oxygen concentrations used in welding and cutting. Fires and explosions involving oxygen cylinders and pressure regulators, piping etc. are much too common. Combustion of this nature and explosions usually take place when oxygen flows through regulators and other parts that are not kept absolutely free of oil and grease. This may occur if parts from one regulator are used on another. Oxygen regulators should not be tampered with and should be stored in a clean and dry location. Gauges and regulators used with oxygen or acetylene cylinders must be kept clean and free of oil and grease. Compressed oxygen is not compressed air and must never be used as such.
4. True - acetylene, because of its extremely explosive nature is stored in a cylinder in combination with acetone and a filler. Otherwise it would explode. It is important that all instructions be followed precisely in the handling, storage, and use of acetylene.
5. True - To prevent accidental release of gases from hoses and torches, cylinder (or manifold system) valves must be closed when (a) The cylinders are moved; (b) The torch and hoses are left unattended; or (c) The task or series of tasks is completed.
6. False - Immense pressures can build up almost immediately from heating the air or vapors inside any enclosed space, causing an explosion. Even if the container has been used in the past to store material such as grease or other flammable or explosive materials, these materials may ignite and explode causing serious injury and death. Shops, which weld automobile gasoline tanks for example, usually steam clean the insides for more than an hour to ensure that no residual gasoline or oil is emitted from pores in the metal during heating. Even this is dangerous since there is no way to ensure that all of the volatile material has been driven from the pores. Others take additional precautions such as blowing the exhaust from a vehicle into the tank being welded. This has the associated dangers of carbon monoxide asphyxiation or ignition and explosion of gasoline or other volatile organics that are contained in the exhaust. According to Part 57.4604, before welding, cutting, or applying heat with an open flame to pipelines or containers that have contained flammable or combustible liquids, flammable gases, or explosive solids, the pipelines or containers must be (a) Drained, ventilated, and thoroughly cleaned of any residue; (b) Vented to prevent pressure build-up during the

application of heat; and (c)(1) Filled with an inert gas or water, where compatible (venting and other precautions are necessary such as, for example, complete purging of the air and maintaining a steady stream of nitrogen flowing freely into and out of the container with the flow-rate large enough and outlet hose long enough and of small enough diameter to eliminate return of air through it); or (2) Determined to be free of flammable gases by a flammable gas detection device prior to and at frequent intervals during the application of heat.

7. False - This is a dangerous belief. Fumes or leaking fuel are likely to ignite and such leaks, if they don't already exist, can result from the welding operation itself. Furthermore, gasoline and other fuels and lubricants are very volatile and will generate high pressures when heated in enclosed containers. The explosion which results will spew the contained fuel or lubricant onto anyone or anything in its path causing rapid ignition virtually ensuring that persons involved will die a fiery death even if they live through the explosion itself.
8. False - the welding torch should be aimed away from cement or stone surfaces; because contained moisture may be turned to steam causing very high pressures and dangerous explosions of the concrete.
9. True - The 80-volt maximum voltage used will kill. To avoid electric shock: Work on dry surfaces. Ground the case of the power supply. Use good cables, good earth ground, good electrode holders, and make sure cable insulation is intact. Use welding gloves without holes that are dry, and contain no oil. Use a dry insulating material to sit/stand on. Never use a common ground when two welders of opposing polarities are used on the same job. AC and DC are not to be used together. Voltage could increase to 160 volts with 80 volts per machine. Persons should never loop cables around their bodies. Using in-line GFCIs or using machines where circuit breakers contain ground fault circuit interrupters (GFCIs) are usually the best form of worker protection.
10. False - Don't accept delivered acetylene cylinders that have not arrived upright, because they can explode.
11. True - switching ends on a single regulator and using it for more than one type of gas could mix two reactive gases and result in a deadly explosion.
12. True - the shock resulting from rapidly increasing pressure in the regulator may damage the regulator or cause an explosion.
13. False - This cap should be left on when the cylinder isn't in use to ensure that the valve isn't inadvertently opened by being bumped. Also, it is said that the valves will break upon falling, causing rocketing of the cylinder. A cylinder that is in use must be securely supported (for example, securely chained to a wall, but not to electrical conduit) or falling may damage lines, open valves, or cause other damage which endangers personnel in the area.
14. True - This minimizes the fire or explosion danger from simultaneous leaks of fuel gases and oxygen.
15. True - many coatings, metals etc. emit toxic contaminants when heated and ventilation to remove these from the workers breathing zone is essential.
16. True - it is important that this protection be properly selected for the type of welding etc.
17. a & c.
18. False - Keep heat, sparks and flames away from combustibles. Either remove combustibles before welding or provide protective barriers.
19. False - Sparks can fly into open pockets and cause serious burns.
20. True

21. False - You should stand to one side of regulator before opening the cylinder valve. The weakest point of the regulator is the bonnet. If it explodes, the adjusting screw may be blown out with a force equal to or greater than that of a 30-06 rifle cartridge.
22. False - On the acetylene cylinder, open the valve only $\frac{1}{4}$ to 1 turn. Otherwise it will take too much time to close the valve in case of a flashback. Never exceed 15 psi on acetylene cylinders.
23. True - Never use compressed acetylene in a free state at pressures greater than 15 psig where it can explode without a flame. Seven pounds of pressure is suitable to cut 14-inch thick steel.
24. False - Light the acetylene before opening the oxygen valve regardless of soot. Use a friction lighter to avoid serious burns. Open the acetylene valve until the flame stands out from the tip. Then open the oxygen valve and adjust to a neutral flame (little inner flame surrounded by outer flame).
25. False - a flashback is dangerous and may occur when the flame burns inside the torch. Turn the torch off immediately and allow it to cool, purge the torch with oxygen and restart it. If more than one flashback occurs, discard the tip.
26. True - an improperly working check-valve is truly dangerous in that it can allow one of the gases to back up into the hose and contact the other gas. This makes it possible for flame to back up in the line to the point of contact and the lines could burn, creating even more serious hazards.
27. False - Particulate emitted during welding contains: metal oxides, metal powders, substances from electrode coatings, stainless steels, cadmium (do not weld cadmium-containing metals without specific instructions), manganese, copper, beryllium, vanadium and a host of other metals -ventilate away from the welder's breathing zone. The larger the diameter of the electrode beam, the more ventilation is required. Gaseous fumes produced by welding include nitric oxide (NO) (which is also generated from oxyacetylene welding) and ozone (O₃), which is dangerous, even in extremely small quantities.
28. False - Among other items, eye protection must be shaded properly, non-reflective screening should protect co-workers eyes and the eyes of the welder, safety glasses should be used under the helmet, ear protection may be needed, shirt pockets etc. should be closed to keep sparks out of clothing, wool, cotton or leather clothing should be used - avoid flammable clothing. Arc rays present an infrared, visible and ultraviolet wavelength light hazard with ultraviolet being the most dangerous. Ultraviolet light produces sunburn and is very hazardous to the eyes. Hazards are drastically increased when using argon gas, while carbon dioxide gas tends to reduce ultraviolet rays. Be sure a sufficiently dark shade is used - standards are available. Lenses must be good - gold coated with gold intact or others - no visible cracks. Wearing white fabric is dangerous when welding in that it reflects the light up under the hood and causes serious sunburn. Screens should be used in that rays are dangerous to bystanders up to 50 feet away.

OXY/FUEL



Oxy/Fuel Welding/Cutting Test (Answers for follow test.)

1. Acetylene is extremely unstable and should never be used at pressures over 15 psig. True/False
2. Acetylene at 7 psig will cut: a) 1/2 inch of steel b) 1 inch of steel, c) 7 inches of steel, d) 14 inches of steel.
3. The acetylene cylinder valve should be: a) fully opened, b) opened 1 turn, c) opened 1/4 turn.
4. Acetylene will collect in the air similar to gasoline and cause an explosion. True/False
5. It is dangerous to use an acetylene cylinder that has been laid on its side. True/False
6. Acetylene stored in the pure form has been known to decompose and explode from a shock when under as little as 5.9 psi. True/False
7. Sputtering of your torch is not a dangerous condition. True/False
8. Oxygen from a cylinder causes things to burn that will not burn in air. True/False
9. Oxygen from a cylinder accelerates combustion of combustible materials. True/False
10. Oxygen flowing through a regulator that has lubricating oil or other hydrocarbons in it, is likely to start on fire or cause an explosion. True/False
11. Oxygen bottles should only be opened 1/2 turn. True/False
12. It is safe to always stand directly in front of the pressure adjusting screw on the regulator when opening the oxygen cylinder valve. True/False
13. Cylinder valves should be blown out before attaching regulators. True/False
14. The regulator pressure-adjusting screw should be opened before opening the cylinder valve. True/False
15. The cylinder valves should be opened as rapidly as possible to avoid leakage. True/False
16. It is wise to purge oxygen and acetylene lines before starting to weld. True/False
17. Both the oxygen and acetylene lines should be opened before lighting the torch because opening the acetylene alone causes soot. True/False

Welding Test - Answers

1. True - acetylene should never be used at gage pressures over 15 psi and will explode at 30 psi.
2. d) acetylene at 7 psig will cut 14 inches of steel.
3. c) ¼ turn is recommended so it can be shut off quickly in case of a problem.
4. True - acetylene has a wide explosive range from 2 % to 87 % when mixed with air.
5. True - an acetylene cylinder has a filler material and acetone to lower the likelihood of an explosion. Acetylene cylinders should always be transported upright. If an acetylene cylinder has laid on its side, it should be returned. It is said that allowing it to stand up for as long as it was laid down can restore the cylinder. However, this requires extreme caution in timing and making sure no one uses the cylinder before it is ready to use.
6. True.
7. False - sputtering is a very dangerous condition as well as damaging to the torch.
8. True - thus oxy-acetylene cutting is actually burning heated metal with oxygen.
9. True - combustion is greatly accelerated at higher levels of oxygen in air.
10. True
11. False - while acetylene cylinder valves should only be opened ¼ turn, oxygen cylinder valves should be opened all the way to minimize the potential for leakage.
12. False - if an explosion occurs, the regulator valve can shoot out with the force of a bullet from a high-powered rifle.
13. True - this keeps any loose dust or dirt from entering the regulator and welding systems.
14. False - the regulator pressure adjusting screw should be fully closed before opening the cylinder valve.
15. False - under the right conditions, the shock from rapidly opening the cylinder valve can cause an explosion.
16. True - this removes any mixture of the two gases that may have leaked into either line, thereby reducing the likelihood of an explosion.
17. False - the torch should be lit with only the acetylene valve open in spite of the soot. This reduces the likelihood of an explosion that would otherwise occur under certain fault conditions in the equipment.

2. H&S Aspects of Tasks Assigned

Hand tools



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Welding. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

- 34. 09/21/1995 - Hand tools - Surface - Clay - GA - Worker struck by falling sledge hammer.
- 35. 09/23/1995 - Electrical Surface - Potash - NM - Electrician's tool contacts energized line & ground in electric box.

1996

- 8. 03/09/1996 - Hand Tools - Underground - Gold - NV - Contract core driller struck in head by wrench.

1997

- 23. 04/21/1997 - Hand Tools - Surface - Limestone (CB) - TN - Mech struck by loader arm when hydraulics released.
- 35. 06/20/1997 - Hand Tools - Surface - Limestone (CB) - MO - Worker struck as come-along holding fender fails.
- 44. 08/06/1997 - Hand Tools - Surface - Clay (Comm) - GA - PVC pipe from flatbed trailer falls on truck driver.

1998

- 4. 01/21/1998 - Hand Tools - Surface - Sand and Gravel - UT - Laborer struck by hammer thrown from crusher.

1999

- 8. 02/15/1999 - Hand Tools - Underground - Gold - Miner struck by violently whipping high-pressure air hose.

Personal Protective Equipment



While there are no videos available from the Mine Safety and Health Academy at Beaver, WV specifically dealing with PPE in general, they do have many on respiratory protection. (See Dust Hazards under the Industrial Health section.) For the most up-to-date listing of available videos, visit the MSHA Internet site at <http://www.msha.gov/TRAINING/prodintr.htm>



Personal Protection and PPE Test (Answers follow test.)

1. A safe means of access, such as properly-constructed ladders and stairways, are required for people who must reach elevated positions. True/False
2. Valves on compressed and liquid gas cylinders must be protected by covers when transported or stored and by a safe location when the cylinders are in use for the following reasons: a) to keep the valve from being broken, b) to ensure that the valve position is not changed either opening or closing it or changing the required settings.
3. The concentrations of contaminants in the air are not covered by MSHA regulations. True/False.
4. MSHA standards require stretchers and blankets at places convenient to all working areas as well as water where corrosive chemicals or other harmful substances are stored, handled, or used. True/False
5. MSHA standards require that fall protection (including safety belts and lines) be worn when persons work where there is a danger of falling. True/False
6. MSHA standards require that a second person tend the lifeline when bins, tanks, or other dangerous areas are entered. True/False
7. Protective footwear is required in all areas of the mine or plant. True/False
8. The MSHA standards require all persons to wear appropriate safety glasses, goggles, or face shields or other eye protection devices when on mine property. True/False
9. There is no standard that requires keeping workplaces clean and orderly. True/False
10. Railings, barriers, or covers are required on openings through which persons or materials could fall. True/False
11. There are no scaffold requirements for a mine. True/False
12. Seat belt maintenance is an MSHA requirement. True/False
13. Sanding, salting and snow removal make good sense, but are not MSHA requirements. True/False
14. It is OK to walk under a suspended load as long as it is secured properly. True/False
15. MSHA requires that mine employees have separate readily-accessible, clean and sanitary toilet facilities for both men and women. True/False
16. Toe-boards make good sense to keep tools from falling, but are not an MSHA requirement. True/False

Answers to Personal Protection and PPE Test

1. True - MSHA standard 56.11001 requires that safe means of access be provided and maintained to all working places.
2. a and b
3. False - MSHA standards incorporate limits as listed in the 1973 edition of the ACGIH "TLV's (Threshold Limit values for Chemical Substances in Workroom Air) pages 1 through 54 etc.
4. True
5. True
6. True
7. False - The standard requires protective footwear in all areas of the mine or plant where hazards exist. Many mines require protective footwear at all times on their mine property, but this is not an MSHA requirement. It is usually a requirement of the company's worker's compensation insurance carrier.
8. False - Appropriate eye protection is only required when in or around an area of a mine or plant where a hazard exists that could cause injury to unprotected eyes. Examples of this type of hazard include grinding, use of any striking hand tool, use of corrosive chemicals, etc. However, as in #7, many mines require PPE at all times.
9. False - Standard 56.2003 requires that workplaces, passageways, storerooms, and service rooms are kept clean and orderly. (b) The floor of every workplace is maintained in a clean and, so far as possible, dry condition and where wet processes are used, that drainage be maintained and false floors, platforms, mats, or other dry standing places are provided where practicable. (c) That every floor, working place, and passageway be kept free from protruding nails, splinters, holes, or loose boards, as practicable.
10. True - 56.11012 requires that railings, barriers, or covers must protect openings above, below, or near travelways through which persons or materials may fall. Where it is impractical to install such protective devices, adequate warning signals must be installed.
11. False - Scaffolds must be safe to work on and maintained in a safe condition.
12. True - Seat belts must be maintained in a functional condition or replaced to assure proper performance.
13. False - Regularly used walkways and travelways must be sanded, salted, or cleared of snow and ice as soon as practicable.
14. False - 56.9317 says, "persons must stay clear of suspended loads".
15. True - except separate facilities for men and women aren't required if the toilet will be occupied by only one person and can be locked from the inside.
16. False - 56.11002 requires that crossovers, elevated walkways, elevated ramps, and stairways be of substantial construction provided with handrails, and maintained in good condition and, where necessary, that toeboards be provided

Slips & Falls / Fall Protection



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 851 - Slips, Trips and Falls - MSHA 1994 – 9 Min.



The following information on Slips & Falls is available at MSHA's Internet site at: www.msha.gov

Fall Protection on Highwalls - www.msha.gov/S&HINFO/SAFETY.HTM



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Falls. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm.

1995

20. 05/31/1995 - Slip/Fall of Person - Surface - Limestone - FL - Contract worker falls 42 feet off of conveyor.
21. 06/09/1995 - Slip/Fall of Person - Surface - Copper - MT - Mechanic falls while changing hinge pin on haul truck.
26. 08/19/1995 - Slip/Fall of Person - Surface - Granite - SC - Contract project manager falls from conveyor.
29. 09/01/1995 - Slip/Fall of Person - Surface - Sand & Gravel - VA - Equipment operator falls washing conveyor.

1996

21. 05/10/1996 - Slip/Fall of Person - Surface - Limestone (CB) - WI - Plant foreman falls off crusher.
26. 06/26/1996 - Slip or Fall of Person - Surface - Sand and Gravel - PA - Worker falls through floor into bin.
33. 08/07/1996 - Slip of Fall of Person - Surface - Limestone (CB) - MO - Contractor cement driver falls from truck.
34. 09/10/1996 - Slip of Fall of Person - Surface - Sand and Gravel - MS - Worker slips off pipe from dredge to shore.
35. 09/12/1996 - Slip of Fall of Person - Underground - Silver - ID - Timber repairman falls into raise.

1997

4. 01/17/1997 - Slip/Fall of Person - Surface - Cement - FL - Contractor employee fell through opening in handrail.
24. 04/22/1997 - Slip/Fall of Person - Underground - Copper - AZ - Trapper/car loader falls from ladder.
28. 04/27/1997 - Slip/Fall of Person - Surface - Lime - IA - Truck driver falls off trailer.
36. 06/25/1997 - Fall of Person - Surface - Cement - UT - Maintenance specialist falls 13 ft down mill elevator shaft.
47. 08/19/1997 - Fall of Person - Surface - Sand and Gravel - CA - Contract electrician/welder falls 10-12 feet.
52. 09/28/1997 - Slip/Fall of Person - Surface (Dredge) - Sand and Gravel - Superintendent falls off stone barge.
57. 10/20/1997 - Slip/Fall of Person - Surface - Stone(CB) - ID - Owner/operator falls into operating jaw crusher.

1998

1. 01/19/1998 - Slip/Fall of Person - Surface - Limestone - OH - Welder falls 50 feet from the top of a hopper.
5. 01/27/1998 - Slip/Fall of Person - Underground - Silver - ID - Shaft repairman falls into shaft trying to free skip.
12. 03/12/1998 - Slip/Fall of Person - Surface - Crushed Stone - CA - Truck driver, climbing back of truck, falls.
23. 05/06/1998 - Fall of Person - Surface - Limestone (CB) - WI - Co-owner falls over highwall while burning trash.
31. 07/17/1998 - Slip/Fall of Person - Surface - Limestone - Service contractor replacing glass, slips off loader.
33. 08/18/1998 - Slip/Fall of Person - Surface - Boron - Contract driller drowns after slipping into sump.
35. 08/21/1998 - Slip/Fall of Person - Surface - Clay - Laborer engulfed in rail hopper car material.
48. 11/13/1998 - Fall of Person - Surface - Limestone - Ironworker falls 40 feet from beam.

1999

14. 04/01/1999 - Fall of Person - UG - Gold - Contract supervisor fell down ore pass trying to catch fellow worker.
27. 07/22/1999 - Slip and Fall of Person - Surface - S&G - Maintenance worker falls off on dragline shovel.
36. 09/20/1999 - Fall of Person - Surface - Gold - Welder installing catwalk grating falls. Not tied off.
38. 10/12/1999 - Fall of Person - Surface - Mill/Prep Plant Laborer falls from scaffolding that collapses.



Fall Protection and Scaffolding Test (OSHA) (Answers follow test.)

OSHA fall-protection laws, for the most part, are more specific than MSHA laws and also provide protection that is usually acceptable to MSHA. Because of MSHA regulations are less specific and lack detail, mining companies may want to follow OSHA's guidelines.

The objective is to provide the trainee with the information needed to correctly answer questions about OSHA scaffolding and fall protection requirements. All of the following questions pertain to OSHA Standards.

1. Above what height is fall protection required by OSHA? a) 4 feet, b) 6 feet, c) 8 feet, d) 10 feet.
2. The primary purpose of toe-boards is to prevent workers who have slipped from sliding off of an elevated platform. True/False
3. Which of the following are fall arrest devices? a) handrails, b) safety nets, c) safety belts and lines, d) full body harness with shock absorbing lanyard.
4. After January 1, 1998, the use of body belts in personal fall arrest systems was no longer allowed in workplaces regulated by OSHA. The reason for this is: a) they are too uncomfortable, b) they don't actually help, c) there are better systems that injure you less when you fall, d) it is too difficult to rescue you when you fall.
5. The top rail of a fall protection guardrail should be: a) 27 to 33 inches high, b) 33 to 39 inches high, or c) 39 to 45 inches high.
6. Guardrails have specific construction and inspection requirements: True/False
7. Safety nets should not allow you to drop more than: a) 5 feet, b) 10 feet, c) 15 feet, d) 30 feet.
8. Safety nets must extend out from the outer edge of your work area at least a) 8 feet, b) 10 feet, c) 13 feet d) any one of the above.
9. Safety nets must be drop tested or certified before use. True/False
10. Safety nets must be inspected for wear, damage, and other deterioration at least: a) each day, b) once per week, c) once per month, d) once every 6 months.
11. Materials and tools that fall into a safety net must be removed at least: a) every hour, b) every 4 hours, c) before the next work shift, d) once each week.
12. Which of the following is not correct? Requirements for a personal fall arrest system include: a) a horizontal lifeline that is designed, installed, and used under the supervision of a qualified person b) lanyards and vertical lifelines that have minimum breaking strengths of 2000 pounds, c) only one worker per vertical lifeline, d) inspections for cuts or abrasions, e) ropes and straps used in body belts and harnesses made from synthetic fibers, f) attachment horizontally in the center of your back, g) an available rescue plan and capability for prompt rescue or self-rescue, h) system inspection before each use.
13. You cannot attach your personal fall arrest equipment to: a) an anchorage used to support or suspend platforms, b) guardrails or c) hoists
14. Training in specific areas related to fall protection must be done anytime workers could be exposed to a fall hazard. True/False
15. Which of the following is true? a) a stairway or ladder is required at all access points with a difference in elevation of 19 inches, b) access points from one level to the next must be kept clear to permit free passage of employees, c) alternate access points must be provided when one is restricted because of work or equipment.

16. Which of the following is not always true? a) Ladder rungs must be treated to make them skid resistant, b) any grease, oil, or other slippery materials must be immediately removed from ladders, c) all ladders must have nonconductive side rails, d) defective ladders must be tagged “do not use” and repaired before use, e) ladders must be inspected periodically.
17. Which of the following is false? a) Ladder rungs, cleats, and steps must be parallel, level and uniformly-spaced when the ladder is in position for use, b) ladders placed on unstable and sloping surfaces must be “tied off” to prevent accidental movement, c) ladders on slippery surfaces must be secured, d) ladders must be tied or fastened together to make them stronger if the load is too heavy for one, e) the area around the top and bottom of ladders must be kept clear, f) workers must face away from the ladder when climbing down with materials, g) at least one hand must be holding onto the ladder at all times when climbing.
18. In setting up an extension ladder against a wall, the distance from the bottom of the wall to the bottom of the ladder should be: a) one-half b) one-fourth c) one-eighth, or d) one-sixteenth the working length of the ladder.
19. The top of an extension ladder must extend the following distance above the upper landing surface or be “tied off” at the top: a) 1 foot, b) 2 feet, c) 3 feet, d) 4 feet.
20. It is necessary to have something to grab onto when leaving the top of a ladder. True/False
21. If the top of a fixed ladder is 24 feet high or higher it is required to have cages, wells, ladder safety devices or self-retracting lifelines. True/False
22. Which of the following are not correct fixed-ladder requirements: a) where self-retracting lifelines are used, rest platforms cannot be spaced farther apart than 50 feet, b) when a cage or well is used on fixed ladders, the ladder sections must be offset from adjacent sections every 50 feet and landing sections are required every 50 feet, c) ladder safety devices must be activated within six feet after a fall occurs.
23. Is either of the following false? a) Job-made ladders must have cleats spaced uniformly at between 10 and 14 inches apart. b) Wooden job-made ladders with spliced side rails should be set up so that the space between the bottom of the ladder and the wall is one-eighth rather than one-quarter the working length of the ladder.
24. Landings on non-permanent stairways must be every 12 feet and should be at least 30 inches in the direction of travel and 22 inches in width. True/False
25. Correctly sized landing platforms are required when doors or gates open directly on a stairway. True/False
26. Stair rails (rails that protect you from falling off an unprotected stairway) measured from the tread to the top of the rail must be at least: a) 29 inches, b) 36 inches, or c) 43 inches.
27. Stairways must have at least one handrail and one stair-rail system along each unprotected side or edge when the stairway has two or more risers or rises more than 2 feet. True/False
28. The two basic types of scaffolds are supported scaffolds and suspended scaffolds. A supported scaffold must be at least one foot wide for every ___ feet of height or it must be protected from tipping by tying, bracing or guying.
29. Blocks of wood or buckets must be placed under the uprights to provide support for supported scaffolds. True/False
30. Poles, legs, posts, frames and uprights must be plumb. True/False

31. Poles, legs, posts, frames and uprights must be braced to prevent swaying and movement. True/False
32. Which of the following are untrue for suspension scaffolds: a) The inboard ends of outriggers must be stabilized by bolts or other direct connections to the floor or roof deck or stabilized by counterweights and a competent person must check the connections before use. b) Counterweights must be secured by mechanical means to the outrigger beams. c) Counterweights can be made of flowable material. d) Counterweights can be made of construction materials. e) Suspension ropes must be inspected at least once each week.
33. Which of the following are incorrect for supported scaffolds? a) Cross-braces are acceptable as a replacement for ladders to reach a scaffold's working platform. b) Access to and between scaffold platforms more than 2 foot above or below the point of access must be made by acceptable ladders, stairways, ramps, walkways, integral prefabricated scaffold access, or equivalent means or by direct access from another scaffold, structure, personnel hoist, or similar surface.
34. Which of the following are correct? Portable, hookup or attachable ladders: a) have the associated danger that if improperly positioned they can tip the scaffold, b) must be positioned such that the bottom rung is not more than 24 inches above your starting point, c) must be equipped with a rest platform at 20-foot maximum vertical intervals.
35. The maximum space between rungs that are integral parts of the scaffold frame is a) 13 ½ inches, b) 16 ¾ inches, c) 20 inches, d) 24 inches.
36. Scaffolds must be inspected by the company competent person a) every 4 hours, b) every eight hours, c) every week, d) before each work shift.
37. Which of the following are true statements? a) The worker must know the scaffolds maximum intended load or rated capacity and the approximate overall weight of people, materials and equipment on the scaffold. b) Some scaffolds can be moved horizontally with personnel on them. c) If the voltage of an insulated power line located nearby is greater than 100 volts, the scaffold must be at least 10 feet away.
38. You cannot work on a scaffold during a storm. True/False
39. You cannot work on a scaffold covered with snow or ice under any circumstances. True/False.
40. The use of a ladder to increase your height requires a special scaffold. True/False.
41. When you are on a scaffold platform that is more than ___ feet above a lower level, you must be protected from falling by some sort of fall protection.
42. Only self-contained adjustable scaffolds with the platform supported by the frame do not require a personal fall arrest system when the distance above the lower level exceeds 10 feet. True/False
43. Personal fall arrest systems used on scaffolds must meet OSHA requirements in 1926.502(d). They must also be attached by a _____ to a vertical or horizontal lifeline or scaffold structural member meeting the requirements of 1926.452(g)(3).
44. Lifelines longer than 6 feet may be used where more freedom of movement is desirable. True/False
45. A travel restraint device that restrains a worker from getting too close to an unrestricted edge consists of a safety belt, lanyard, rope grabs and lifeline securely fastened to an anchoring point. True/False
46. A fall arrest system consists of a safety belt or full body harness, a lanyard, a shock absorber, a lifeline, a secure anchoring point and in some cases a rope grab. True/False

47. Which of the following are not true? a) Falling with a safety belt threatens serious injury to the liver and spleen, b) a safety belt usually maintains the person in the upright position, c) a full body harness reduces the risk of injury by distributing the shock of the fall more evenly throughout the body, d) a safety belt can slide up the person's body and restrict breathing, e) proper fit is not critical to effectiveness of a full-body harness, f) it is not safe to use the fall protection system twice.
48. Which of the following is not a true statement: a) Platforms on all working levels must be fully decked between the front uprights and the guardrail supports. b) The space between planks, and between the platform and uprights can be no more than 3 inches wide. c) Platforms and walkways must be at least 18 inches wide or as wide as possible for the space and protected by guardrails and/or personal fall arrest systems. d) Guardrails and/or personal fall arrest systems are required if the front of the platform is less than 14 inches from the face of your work (18 inches for plaster and lathing work). e) The ends of the platform must either be cleated or restrained or extend over the center line of its support at least six inches (not more than 12 inches for platforms 10 feet long or less and not more than 18 inches for platforms greater than 10 feet long unless designed to support workers without tipping or has guardrails to block employee access to the platform ends).

Answers to Fall Protection Test

1. OSHA requires fall protection at heights above 4 feet for general industry and 6 feet for construction (10 feet when on a scaffold platform), but MSHA requires safety belts and lines when persons work where there is danger of falling (height left to inspector judgment). MSHA also requires that a second person tend the lifeline when bins, tanks, or other dangerous areas are entered.
2. False - While a toe-board would help keep you from sliding off an elevated platform if you slipped, the purpose of a toe-board is to keep supplies from being knocked off. Other falling object protection methods include screen, debris nets, and catch platforms or canopy structures.
3. b & d - Safety nets and full body harnesses with shock absorbing lanyards are considered to be fall arrest systems. The other two are fall prevention systems.
4. c and d - Full body harness systems cause less injury than body belts and were required by OSHA after January 1, 1998. Full body harness systems also make rescue easier in that a person's body tends to be held in a more natural straight, rather than a jackknifed, position that can result from falls with a safety belt.
5. c - the top rail must be 39 to 45 inches high.
6. True - they must withstand a 200 lb. force outward or downward, a 150 lb. force inward or downward, the top edge must not bend to less than 39 inches from the floor, steel or plastic banding can't be used for mid or top rails, wire rope for top rails must have high-visibility flagging at 6 foot intervals, rope (if used) must be inspected frequently for strength.
7. d - OSHA requires that safety nets not allow you to drop more than 30 feet.
8. d - All are correct, depending on the vertical drop. OSHA requires that safety nets extend out from the outer edge of your work area 8 feet for a 5 foot vertical drop, 10 feet for from 5 to 10 foot vertical drop, and 13 feet for more than 10 foot vertical drop.
9. True - OSHA requires that safety nets be drop tested or certified before use whenever relocated, repaired and every 6 months if they remain at one location.
10. b - OSHA requires that safety nets be inspected for wear, damage, and other deterioration once per week and defective nets or components be replaced before use.
11. c - OSHA requires that materials and tools that fall into a safety net be removed as soon as possible and at least before the next work shift.
12. b and f are incorrect. OSHA requirements for a personal fall arrest system include that lanyards and vertical lifelines have minimum breaking strength of 5000 pounds - not 2000 lbs. as in the above statement. f - The attachment point for a body belt must be in the center of your back. For a full body harness the attachment point must be located in the center of your back near your shoulder or above your head.
13. a, b, and c are correct -- according to OSHA, you cannot attach your personal fall arrest equipment to: a) anchorages used to support or suspend platforms, b) guardrails, or c) hoists.
14. True - Training records must be prepared and retraining is required if the employee doesn't understand something, when moved to a different workplace, or when new equipment is used. - The training must include a) recognition and minimization of work-site specific fall hazards, b) correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection equipment and systems you will use, c) proper use and operation of the various fall protection systems, d) the role of each employee in a safety monitoring system if used, e) limitations of the use of mechanical

equipment when working on low-sloped roofs, and f) An understanding of the OSHA fall protection rules.

15. a, b, and c
16. All, but c are true statements and c is true when the worker or ladder could contact energized electrical conductors or equipment. Since such contact is very likely in many work situations, it is wise to purchase all ladders with nonconductive side rails.
17. d and f. d) Ladders cannot be tied or fastened together to make them stronger unless they are specially designed to be used that way and f) you must always face the ladder when climbing and you are not allowed to carry any object or load that could cause you to lose your balance.
18. b) The ladder should be sloped so that the distance from the bottom of the wall to the bottom of the ladder is one-fourth the working length of the ladder.
19. c - the top of the ladder must extend 3 feet above the upper landing surface or be tied off at the top.
20. True - a grab rail at the top is required to help employees get on and off.
21. True - OSHA requires cages, wells, ladder safety devices or self-retracting lifelines if the top of a fixed ladder is 24 feet high or more.
22. a and c. a - where self-retracting lifelines are used, rest platforms cannot be spaced farther apart than 150 feet, and c - ladder safety devices must be activated within two feet after a fall occurs.
23. Neither is false, but b appears to be a dangerous compromise in that it makes little sense to change the required angle of the ladder to an unsafe one (from one-quarter to one-eighth the working length) just because the ladder with spliced side rails is not sufficiently strong to be set up properly. Obviously wood ladders with spliced side rails should be avoided.
24. True - Non-permanent stairways must have landings every 12 feet that are 30 inches or more in the direction of travel and 22 inches or more in width.
25. True - Where doors or gates open on a stairway, a landing platform must be provided. Door swing must not reduce the effective standing area on the landing to less than 18 inches (45.7 cm) in depth.
26. b - the shortest distance from the top of the tread to the top of the handrail must be at least 36 inches.
27. False - stairways must have at least one handrail and one stair rail system along each unprotected side or edge when the stairway has 4 or more risers or rises more than 30 inches.
28. OSHA requires that a scaffold be at least one foot wide for every four feet of height or it must be protected from tipping by tying, bracing or guying.
29. False - supported scaffolds must be properly supported by base plates, mudsills or other steady foundations and not by blocks of wood or buckets.
- 30 and 31. Poles, legs, posts, frames and uprights must be plumb and braced to prevent swaying and movement.
32. c, d, and e are untrue – neither flowable materials such as sand or gravel nor construction materials are suitable for counterweights, and suspension ropes must be inspected by a competent person each work shift and after every occurrence that could affect the rope's integrity, not once per week.
33. a is incorrect - cross-braces are not acceptable as a replacement for ladders to reach a scaffold working platform.

34. a and b are correct. c is incorrect because the rest platform minimum vertical distance is 35 feet, not 20 feet.
35. b - The maximum spacing between rungs that are integral parts of the scaffold frame is 16 $\frac{3}{4}$ inches. The rungs must also be uniformly spaced within each frame section.
36. d - scaffolds must be inspected by the company competent person before each workshift and after any incident which could affect a scaffold's structural integrity.
37. a and b are true statements. c is incorrect -- if the voltage in a nearby insulated power line is greater than 300 volts, the scaffold must either be at least 10 feet away with 0.4 inches additional distance for each 1 kV over 50 kV or 2 times the length of the line insulator, but never less than 10 feet. For uninsulated lines, the minimum distance must never be less than 10 feet for any voltage below 50 kV and the same formulas applies for voltages over 50 kV. For safety sake, an absolute minimum 10-foot separation is a good rule to follow.
38. False - if your competent person says it is safe to do so and a personal fall arrest system or windscreen protects you; you can work during a "storm".
39. False - you can remove the snow/ice, but that's all.
40. True - You cannot increase your working height with a ladder unless you are on large area scaffolds and you must also meet a list of requirements found in the standards (1926.452(f)(15)).
41. When you are on a scaffold platform that is more than 10 feet above a lower level, you must be protected from falling by some sort of fall protection.
42. True - Self-contained adjustable scaffolds with the platform supported by the frame and walkways within a scaffold may use guardrails. Most of the other types require both guardrails and personal fall arrest systems.
43. Personal fall arrest systems used on scaffolds must meet OSHA requirements in 1926.502(d) and a lanyard must also attach them to a vertical or horizontal lifeline or scaffold structural member. Lanyards and lifelines must meet the requirements of 1926.452(g)(3).
44. False - the longer the lifeline, the farther you fall and the faster you are falling when the line becomes tight. To minimize personal injury, keep the lifeline as short as possible.
45. True - a travel restraint device meant to keep a person from falling at all, consists of a safety belt, lanyard, rope grabs and lifeline securely fastened to an anchoring point and restrains a worker from getting too close to an unrestricted edge.
46. True - A fall arrest system consists of a safety belt or preferably a full body harness, a lanyard, a shock absorber, lifeline, a secure anchor point and in some cases a rope grab.
47. b and e are not true. A full body harness – not a safety belt – maintains the falling worker in an upright position while a belt usually leaves the worker in a jackknifed position, making retrieval more difficult. Proper fit is also critical for a full-body harness.
48. b - the correct maximum space between planks, and between the platform and uprights is 1-inch. All of these requirements are to avoid stepping or dropping tools between planks or over the edge of the platform and to keep the planks themselves from teetering up when an employee steps on or near the joint where the ends overlap.

Some MSHA Fall Protection Laws are As Follows:

30 CFR § 77.204 - Openings in surface installations; safeguards.

Railings, barriers, covers or other protective devices shall protect openings in surface installations through which men or material may fall.

30 CFR § 57.20021 - Abandoned mine openings.

Upon abandonment of a mine, the owner or operator shall effectively close or fence off all surface openings down which persons could fall or through which persons could enter. Upon or near all such safeguards, trespass warnings and appropriate danger notices shall be posted.

30 CFR § 56.19038 - Platforms around elevated head sheaves.

Platforms with toe-boards and handrails shall be provided around elevated head sheaves.

30 CFR § 56.11002 - Handrails and toe-boards.

Crossovers, elevated walkways, elevated ramps, and stairways shall be of substantial construction provided with handrails, and maintained in good condition. Where necessary, toeboards shall be provided.

30 CFR § 56.11009 - Walkways along conveyors.

Walkways with outboard railings shall be provided wherever persons are required to walk alongside elevated conveyor belts. Inclined and railed walkways shall be nonskid or provided with cleats.

30 CFR § 77.405 & 75.1726 - Performing work from a raised position; safeguards.

(a) Men shall not work on or from a piece of mobile equipment in a raised position until it has been blocked in place securely. This does not preclude the use of equipment specifically designed as elevated mobile work platforms.

(b) No work shall be performed under machinery or equipment that has been raised until such machinery or equipment has been securely blocked in position.

30 CFR § 77.205 - Travelways at surface installations.

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

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

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

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

(e) Crossovers, elevated walkways, elevated ramps, and stairways shall be of substantial construction, provided with handrails, and maintained in good condition. Where necessary toeboards shall be provided.

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

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

30 CFR § 56.15005 - Safety belts and lines.

Safety belts and lines shall be worn when persons work where there is danger of falling; a second person shall tend the lifeline when bins, tanks, or other dangerous areas are entered. (NOTE: Full Body Harnesses are now recommended and safety belts are considered to be unsafe for fall arrest applications by OSHA and other safety professionals.)

Equipment Maintenance



Below are listed (in order of occurrence) the MNM Fatalgrams from 1998 to 1999 involving Equipment Maintenance or other non-routine tasks. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm.

1998

31. 07/17/1998 - Slip/Fall of Person - Surface - Limestone - Service contractor replacing glass, slips off loader.
32. 08/01/1998 - Powered Haulage - Surface - Alumina - Contractor crushed by improperly blocked bucket.
36. 08/23/1998 - Exploding Vessel - Surface - Iron Ore - Shift manager over-inflates a waterline patch.
37. 08/28/1998 - Exploding Vessel - Surface - S&G - Maintenance man over-inflates deteriorated tire.
40. 09/18/1998 - Powered Haulage - Surface - Sandstone - Defective loader attachment actuated.
49. 12/07/1998 - Drowning - Surface - Limestone - Construction worker drowned when floating pump tipped.

1999

3. 01/20/1999 - Fall/Slide Material - Surface - Limestone - Contract welder pinned by feeder being hoisted by crane.
5. 02/01/1999 - Machinery - Surface - Limestone - Maintenance worker struck by boom while dismantling crane.
9. 02/17/1999 - Exploding Vessels - Surface - S&G - Tire ruptures when contract technician heats wheel with torch.
16. 04/08/1999 - Machinery - Surface - Gypsum - Maintenance supervisor struck by suspension rod he was heating.
17. 05/07/1999 - Other - Surface - Sand & Gravel - Crane operator drowns clearing logs from dredge anchor line.
20. 05/26/1999 - Ignition/Explosion of Gas - Surface - S&G - Man struck by impeller hub after heating it to remove it.
21. 06/27/1999 - Handling Material - Surface - Limestone - Quarry owner struck by loader wheel when removing it.
24. 07/07/1999 - Slip/Fall of Person - Surface - S&G - Contractor struck by falling hood of loader engine compartment.
26. 07/21/1999 - Powered Haulage - UG - Gold - Mechanic repairing loader struck by unblocked bucket.
27. 07/22/1999 - Slip and Fall of Person - Surface - S&G - Maintenance worker falls off on dragline shovel.
33. 08/12/1999 - Powered Haulage - Surface - S&G - Owner operator struck by grizzly being lifted by loader bucket.
40. 10/14/1999 - Powered Haulage - Surface - Limestone - Man servicing haul truck struck when driver drives away.
45. 10/30/1999 - Exploding Vessels - Surface - S&G - Mechanic mounting loader wheel struck when wheel exploded.



Maintenance Test (Answers follow test.)

Objective: The trainee will be able to correctly answer questions which demonstrate the ability to recognize common hazards involved in the maintenance of mining equipment.

1. Maintenance persons should leave rings and jewelry at home. True/False
2. Athletic or tennis shoes are adequate for a person working in maintenance. True/False
3. Chemicals of concern in the workplace include all of the following and a person who uses them should be familiar with directions printed on the labels: aerosols, solvents, paints, cleaners, oil, and soaps. True/False
4. A material safety data sheet contains data about how well a product works. True/False
5. Normal prescription glasses are adequate safety glasses. True/False
6. The main danger with grinding wheels is that they can abrade your skin. True/False
7. There is a difference between hard hats and bump caps. True/False
8. It is good practice to wear gloves near moving parts of a machine. True/False
9. Lock out means to turn the equipment off before working on it. True/False
10. Once equipment is locked out, it is safe to begin working on it. True/False.
11. It is safe practice to repair electrical cords. True/False
12. All electrical tools should be either grounded or have double-insulated clearly labeled on them. True/False
13. All extension cords should be checked regularly to ensure that there is continuity between the ground prong and the ground plug on the opposite end. True/False
14. If you are going to be working on wet surfaces, it is safe to have a double-insulated tool. True/False
15. If you see a plug that only has two prongs you should: a) throw the tool away, b) put a new three prong plug on, c) check to see if the tool is double insulated and, if it is not, replace the plug with a 3-prong one before using the tool.
16. Electrical panels should have all circuit breakers labeled. True/False
17. Changing fuses is not dangerous. True/False

Answers to Maintenance Test

1. True - These items conduct electricity and can get caught in moving or stationary equipment. A ring can pull a finger off when climbing down from mining equipment for example.
2. False - A maintenance person should wear a good leather top shoe. Athletic shoes do not offer adequate protection against chemical spills or minor cuts and scrapes.
3. True
4. False - The material safety data sheet gives information on the properties of concern to safe transportation and use of the material, proper disposal etc.
5. False - Industrial safety glasses, goggles or shields are needed depending upon the danger involved.
6. False - While too wide a gap between the tool rest and wheel can cause serious abrasion and loss of fingers, it is even more serious if the wheel explodes and flying pieces cause serious eye injury. Wear a face shield when grinding. Make sure the tool rest is very close to the wheel and guards are in place.
7. True - Hard hats provide protection against impact from falling tools etc., while bump hats provide protection only against bumping your head when walking under things. Excessive reliance on a bump hat may also be dangerous in that it will not protect your neck from being broken if an object is struck too hard or from protruding objects (pipes, valves etc.) causing severe eye injury.
8. False (usually) - The moving parts can catch the glove and pull your hand in resulting in severe damage. It is better to get a cut or abrasion than to lose the whole hand.
9. False - Correct lock out procedure involves several steps including actually locking the switch in the off position, testing the machine to see if it is working, and placing a warning tag on the switch. Properly set-up lockout systems have room for several locks at the same time in case more than one employee is working on the equipment at the same time.
10. False - The person doing the work must be absolutely certain there is no other way the locked out equipment can be turned on and be willing to consult others on this if he/she is not 100 % certain. Furthermore, the person must disable any part of the equipment that could fall, crush, or injure him/her, should a non-electrical movement occur. Blocks, safety bolts or other equipment are used for this purpose. Examples include trucks rolling, loader buckets dropping, conveyor belts settling and turning head and tail pulleys, etc.
11. False - In general, it is safer to replace than repair damaged extension cords to avoid dangers associated with incorrect splicing procedures, insufficient insulation, disconnected ground wires, etc. on cords which are often worn enough to be dangerous before the damage occurred which caused them to fail.
12. True - The two methods provide about the same protection, but neither protects from the dangers of working in wet locations.
13. True - All extension cords should be checked regularly to ensure that there is continuity between the ground prong and the ground plug on the opposite end. A continuous ground wire connects to ground the part of the tool you touch, which then causes the circuit breaker to trip should the body of the tool become energized. If the ground wire is broken or disconnected, the circuit breaker will not trip, and the person holding the tool becomes the conductor to ground. Because the amount of current needed to kill

will not trip the circuit breaker, electrocution results. A simple continuity testing device costing about \$3 can be purchased at most hardware stores.

14. False - Water and electricity are a very dangerous mix. The safest method is to use a battery-powered tool under such conditions. Battery voltages are usually low enough (18 volts or less) to make the chance of being electrocuted virtually nonexistent. Under wet working conditions, a person can reduce the chance of a fatal injury from an electrified hand tool by using a ground fault circuit interrupter. This device will shut the power off if more than 5 milliamps of current leaves the circuit (such as passing through your body to ground). Other less-effective methods of reducing danger include: 1) wearing good non-leaky rubber boots, 2) wearing good electrical insulating gloves, and 3) using a 3 prong plug which connects the exposed parts of the tool to ground, or a double-insulated tool.
15. C - If you see a plug that only has 2 prongs you should check to see if the tool is double insulated. If it is not, replace the plug with a 3-prong plug making sure the third (ground) prong is connected to the part of the tool you touch before using the tool. If in doubt, only use the tool when connected to a GFCI.
16. True - Proper labeling eliminates errors in turning the wrong equipment off and on, which can be critical when the equipment is locked out to work on it.
17. False - Fuse pullers should be used and the main should be locked and tagged out before starting.

Material Handling



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at: <http://www.msha.gov/TRAINING/prodintr.htm>

VC 810 - Oh! My Aching Back! - MSHA 1965 – 21 min.



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1998 involving Material Handling. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

22. 07/19/1995 - Powered Haulage - Surface - Molybdenum - CO - Delivery truck driver struck by falling beam.

1996

39. 10/09/1996 - Falling/Sliding Material - Surface - Granite (CB) - NC - Worker pinned between when block slips.

1998

9. 02/25/1998 - Machinery - Surface at Underground - Copper - MI - Salvage worker struck by falling material.

3. Statutory Rights of Miners

MSHA pamphlet available called "A Guide To Miner's Rights and Responsibilities Under the Federal Mine Safety and Health Act of 1977"



Information on Miner's Rights can be located on MSHA's Internet Site at: www.msha.gov
NEW Miner's Rights Booklet (63p): www.msha.gov/S&HINFO/minersrights/minersrights2000.htm



Miner's Rights Test (Answers follow test.)

Objective: Trainees will be able to correctly answer questions about their rights, responsibilities and limitations under the act.

1. A miner who exercises any of his rights under the Mine Safety Act:
 - a) Cannot be discriminated against for doing so.
 - b) Can be penalized by his employer under certain circumstances.
2. Any discrimination claim filed by a miner must be filed within
 - a) 1 day.
 - b) 1 week.
 - c) 30 days.
 - d) 60 day.
3. Under the MSHA Act, who is given the opportunity to accompany Federal Inspectors during an inspection of the mine?
 - a) Person who notices the violation.
 - b) Supervisor.
 - c) Miner's representative.
 - d) Union president.
4. Any person is encouraged to notify MSHA of any of the following except:
 - a) Imminent danger.
 - b) Mining contract violation.
 - c) Violation of the MSHA Act.
 - d) Violation of a safety or health standard.
5. Under the MSHA act, miners are entitled to pay for time lost, but only for the balance of the shift when they are idled because of:
 - a) A withdrawal order.
 - b) A strike.
 - c) Equipment breakdown.
6. Any miner who desires to challenge any order issued, modified, or terminated by a Federal inspector must do so within
 - a) 1 day.
 - b) 10 days.
 - c) 30 days.
 - d) 60 days.

7. Which persons on a mine property don't need some form of safety, health or hazard recognition training?
 - a) Miners hired as temporary summer help.
 - b) Contractors who don't go underground on mine property.
 - c) Vendors who are on the property less than 15 minutes.
 - d) Vendors on the property who won't be in areas with hazards.

8. Miners rights do not include:
 - a) Right to a safe and healthy work environment.
 - b) Right to use equipment with safety defects during the remainder of the shift.
 - c) Right to safe and properly maintained equipment.

9. A supervisor's responsibilities include:
 - a) Providing a safe work place and safe equipment.
 - b) The correction of reported safety deficiencies or tagging the equipment and relocation to the repair area.
 - c) Providing training as specified in Title 30 CFR, part 48.
 - d) All of the above

Miners Rights True/False Questions

10. Tricky question! Think about this carefully. A person being considered for employment at a mine is asked to attend mine safety training for newly hired inexperienced miners. He must be paid a normal wage by the mine operator while attending this training. True/False

11. Any person, including a miner, who knowingly makes a false statement (to an MSHA inspector) either orally or in writing or who makes a false certification in an application, record, report, plan, training certificate, or any other document required to be kept or filed with MSHA shall be subject to a fine of up to \$10,000, or imprisoned for up to five years, or both. True/False.

12. A miner has worked for 2 years as a front-end loader operator. He is being reassigned temporarily to a portable crusher. Because he had 8 hours Annual Refresher training 3 months ago, he doesn't need any further training. True/False.

13. After an inspection that generated 20 citations, a mine operator decides to contest two of them. These two citations need not be posted or made accessible to the miners until after the Federal Mine Safety & Health Review Commission has rendered a decision on them. True/False.

14. A screen plant operator notices that the pit highwall next to the crusher has developed large cracks on the top edge and rain is predicted today after a long dry spell. Can he call MSHA for an inspection if the mine owner and his representatives refuse to do anything about this? Yes/No

How would you change the words underlined in the following statements of miner's rights so that they read correctly?

MTU - MINE SAFETY AND HEALTH TRAINING

1. The right to have all miners accompany Federal inspectors during inspections at a mine.
2. The right to obtain a withdrawal order in a mine where there are reasonable grounds to believe that an imminent danger, or a violation of the Act or a safety or health standard, exists
3. The right to unemployment benefits during certain periods of time when a mine or a part of a mine has been closed because of a withdrawal order.
4. The right to be protected from discrimination based on the exercise of rights given by the U.S. Constitution.
5. The right to give safety and health training.
6. The right to be informed of, and to participate in enforcement and legal proceedings in all legal situations concerning the mine.

Answers for “RIGHTS OF MINERS” Test

1. a) cannot be discriminated against for doing so
2. d) 60 days
3. c) miner’s representative
4. b) mining contract violation
5. a) withdrawal orders
6. c) 30 days
7. d) vendors who won’t be encountering hazards
8. b)
9. d)
10. True - If for any reason a mining company asks a person to get the mine safety & health training required for miners, they must pay them for their time. In essence, the mine has hired the person, at least for the time spent on the training.
11. True - for example, if you sign a form 5000 that says you’ve had 8 hours training when you were only in the class for 2 hours of the day, you have falsified that document.
12. False - Any miner who is assigned to do a new job and has no work experience doing that job within the previous year must receive training in the safety and health aspects of that job as well as the safe operating procedures required to do that job.
13. False - Any order, citation, notice, or decision required by the Act to be given to the operator shall be delivered to the mine office and the operator or his/her agent must immediately post a copy on the mine bulletin board.
14. Yes - At any time any person may, and is encouraged to, notify MSHA of any violation of the Act or safety or health standard, or of an imminent danger.

Word Change Answers

1. A representative of the miners
2. An inspection
3. Pay
4. Federal Mine Safety & Health Act of 1977
5. Receive
6. Proceedings under the Federal Mine Safety & Health Act of 1977

4. Self-Rescue & Respiratory Devices



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC912 - Efficient Method of Donning SCSR: Draeger - MSHA 1987 - 9 min

VC914 - Efficient Method of Donning SCSR: Ocenco - MSHA 1987 - 12 min

VC946 - Respiratory Protection Programs - MSHA 1990 - 47 min

There are also several MSHA Tapes on Silicosis listed under the Industrial Health section of this manual. While they do discuss respiratory protection, their emphasis is on prevention.



Dust & Respirators - Power Point Program for download from www.mine-safety.mtu.edu . This is a brief program describing the hazards of dust and the respirators used for protection.

Respirator Fit Testing



Dust & Respirators - PowerPoint Program for download from www.mine-safety.mtu.edu . This is a short Microsoft PowerPoint program that describes the harmful effects of dust and describes the use of respirators.

5. Transport & Communication Systems

Traffic Control, Communication & Signs



MSHA Pamphlet “Guidelines for Traffic Control at Surface Mines & Installations.” This Pamphlet is available from the Mine Health and Safety Academy. It is also be available as a web page at our web site: www.mine-safety.mtu.edu .



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm> .

VC 869 - Visibility and Communications: Off Road & Highway Trucks - MSHA '96 - 18 min



Below are listed (in order of occurrence) the MNM Fatalgrams involving Transport and Communication Systems. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1998

43. 09/28/1998 - Powered Haulage - Surface - Gold - Contract mechanic struck by a 190-ton haul truck.

1999

7. 02/15/1999 - Powered Haulage - Surface - Copper - Contract technician pickup truck run over by 320-ton haul truck.

6. Roof/Ground Control & Ventilation



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 858 - Dump Point Safety - MSHA 1997 – 14 Min

VC 890 - Ground Control in Surface Mining - MSHA 1980 – 8 Min



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving ground hazards and fall of roof/highwall/material. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm.

1995

1. 01/05/1995 - Fall of Highwall - Surface - Gold - SD - A large fall of material onto a shovel loading a haul truck.
9. 02/24/1995 - Falling/Sliding Material - Surface - Stone - CA - Stockpile sloughs and covers customer truck driver.
17. 05/19/1995 - Fall of Highwall - Surface - Sand & Gravel - WA - Crusher operator covered when highwall collapses.
18. 05/19/1995 - Fall of Highwall - Surface - Sand & Gravel - WA - 5 year old boy engulfed when highwall collapses.
28. 08/21/1995 - Falling/Sliding Material - Underground - Platinum - MT- Rock in chute breaks free & miner covered.
40. 10/20/1995 - Fall of Roof - Underground - Lead/Zinc - TN - Worker outside his scaler is stuck by roof fall.

1996

19. 05/10/1996 - Fall of Roof/Back - Underground - Limestone (CB) - MO - Fall of roof crushes pickup (1).
20. 05/10/1996 - Fall of Roof/Back - Underground - Limestone (CB) - MO - Fall of roof crushes pickup (2).
24. 05/28/1996 - Fall of Face/Highwall - Surface - Sandstone (DM) - NC - Company VP struck by falling rock.
29. 07/17/1996 - Falling/Sliding Material - Surface - Limestone - KY - Welder engulfed when surge pile sloughs.
31. 07/24/1996 - Fall of Rib - Underground - Gold - NV - Driller engulfed by roof fall.
46. 12/17/1996 - Fall of Highwall - Surface - Limestone (CB) - Contract blaster falls when ledge gives way.

1997

5. 02/03/1997 - Fall of Roof - Underground - Zinc - TN - Underground driller crushed in massive roof fall.
8. 02/05/1997 - Fall of Roof - Underground - Gold -NN - Miner, who had been scaling, found under roof fall.
10. 02/15/1997 - Fall of Face/Highwall - Surface - Limestone (CB) - MO - Rock breaks free and falls on excavator.
14. 02/26/1997 - Fall of Face/Highwall - Surface - Iron Ore - CA - Drilling over abandoned mine; ground caves.
19. 04/01/1997 - Fall of Face - Underground - Limestone (CB) - TN - Ground fall from a pillar crushes driller.
47. 08/18/1997 - Falling/Sliding Material - Surface - Limestone (CB) - IL - Driver buried when stockpile sloughs.
61. 12/18/1997 - Falling/Sliding Material - Surface - Granite (DM) - GA - Ledge man has slab of granite fall on him.

1998

6. 02/06/1998 - Handling Material- Surface -Sand and Gravel -MA -Customer engulfed when loading from stockpile.
10. 03/04/1998 - Fall of Roof - Underground - Copper - AZ - Miner installing pony sets struck by fall of ground.
39. 09/02/1998 - Machinery - Surface - Crushed Stone - Dozer rolls into pit after narrow bench collapses.
42. 09/22/1998 - Powered Haulage - Surface - S& G - Dozer operator on surge pile is pulled into draw point.
45. 11/04/1998 - Fall of Rib - UG - Uranium - Material falls from the rib, crushing driller.
47. 11/09/1998 - Powered Haulage - Surface - Granite - Haul truck goes over loaded out stockpile wall; wall collapses.

1999

10. 02/27/1999 - Fall of Highwall - Surface - Limestone - Contract driller struck by rock falling from highwall.
13. 03/29/1999 - Machinery - Surface - Limestone - Equipment operator struck by rock falling from highwall.
18. 05/10/1999 - Powered Haulage - Surface - Granite - Laborer struck by slab of rock from working face.
39. 10/12/1999 - Fall of Roof/Back - Underground - Gold - Roof fell while workers (2) were installing roof bolts.
43. 10/23/1999 - Fall of Roof/Back - UG - Gold - Driller struck by rock from back while inspecting drill holes.
44. 10/26/1999 - Fall of Rib/Pillar - UG - Limestone - Worker struck by rock from rib while scaling.



Suggested Pictures: Use the “Ground Hazards” pictures from the download section at: <http://www.mine-safety.mtu.edu> . Mine Specific suggestion: Digital cameras are getting less

expensive and taking pictures of the specific mine's work-site is always better than using generic pictures.

Ground Control

Ground Control Test (Answers follow Test)



Note: Letters indicate which questions are for which type of mining operation. LQ = Large Quarry (Multiple bench), SQ = Small Quarry (Single Bench), LP = Large Pit (Multiple bench), SP = Small Pit (Single Bench). Ground control requirements can vary greatly depending on the nature of the mining operation.

1. (LQ, SQ, LP, SP) Persons must never work or travel between machinery or equipment and a highwall or bank. True/False
2. (LQ, SQ, LP, SP) A "Ground Control Plan" is a plan for connecting electrically-powered equipment to the transformer? True/False
3. (LQ, LP) The law requires that only the bench located immediately above the area where miners work or travel must be maintained in a condition adequate to prevent material sliding, raveling, or sloughing onto the bench below. True/False
4. (LQ, LP) A bench located immediately above the area where miners work or travel must always be cleaned up if material has accumulated on the bench. True/False
5. (LQ, SQ, LP, SP) The angle of repose refers to the angle at which material that is dumped into a pile comes to rest. True/False
6. (LQ, SQ, LP, SP) Material located near the top of a pit or quarry wall must be sloped no more than 5 degrees. True/False
7. (LQ, SQ, LP, SP) It is OK to mine while corrective measures for unstable ground are underway. True/False
8. (LQ, SQ, LP, SP) A person experienced in ground control must examine and test ground conditions. True/False
9. (LQ, SQ) Scaling has dangers associated with falling material, but makes working conditions safe. Therefore scalers must bypass more stringent ground-control safety rules. True/False
10. (LQ, SQ) In preparing for secondary breakage, material to be broken, other than hanging material, must be positioned or blocked to prevent any movement which would endanger persons in the work area. True/False
11. (LQ, SQ, LP, SP) Ponds or other water hazards are required to be fenced or barricaded. True/False
12. (LQ, SQ, LP, SP) Equipment defects affecting safety must be corrected before the equipment is used. True/False
13. (LQ, SQ, LP, SP) What should you do if you see loose material on a highwall or bank above a haulage road?
 - a. Stop and remove it.
 - b. Ignore it because it's not in your area.
 - c. Report it to proper authorities.
14. (LQ, SQ, LP, SP) Highwall and bank conditions are affected by rain. True/False.
15. (LQ, SQ, LP, SP) Highwall and bank conditions are affected by freezing weather. True/False.

MTU - MINE SAFETY AND HEALTH TRAINING

16. (LQ, SQ, LP, SP) Personal safety attire should be worn when hazardous conditions exist. True/False
17. (LQ, LP) If a bench located immediately above the area where miners work or travel cannot be safely cleaned, the miners must correct the problem or stop working in the area. True/False
18. (LQ, SQ, LP, SP) If a miner has to walk from his disabled loader back to the foreman's office to report a problem with the loader, can he walk over the stockpiles that were just created by the stacker-conveyor? Yes/No

Answers to Ground Control Test

1. True - where the machinery or equipment may hinder escape from falls or slides of the highwall or bank, no work or travel is permitted. However travel between vehicle and highwall or bank is permitted when it is the only way for persons to dismount or remount to reposition or move the equipment to a safe location for repairs. When the equipment is not removed for repair, it must be repositioned at the site so that workers will not be exposed to fall of ground hazards from which their escape is hindered.
2. False - A ground control plan is a plan of action in written form stating how an area will be developed and maintained to assure the safety of all persons working or traveling in that area.
3. False - In special situations, more than one bench above the area where miners work or travel must be maintained in a condition adequate to retain material that may come onto the bench from the wall, bank, or slope. It is normally expected that one bench will be so maintained, but if more than one bench above the area where miners work or travel is necessary, only the number of benches necessary to provide adequate protection will be required to be maintained.
4. False - In making a judgment the inspector considers the following factors: (1) the method of mining; (2) the amount of material on the bench; (3) the amount and rate of material coming onto the bench; (4) the angle of the bank, wall, or slope, particularly if it is close to the angle of repose; (5) the composition of the wall, bank, or slope; and (6) the configuration of the bench.
5. True - This is important, as this angle is the angle at which the slope is just barely able to support itself. Traveling on a slope at this angle almost guarantees a slide of material.
6. False - In places where persons work or travel in performing their assigned tasks, loose or unconsolidated material must be sloped to the angle of repose or stripped back for at least 10 feet from the top of the pit or quarry wall. Other conditions at or near the perimeter of the pit or quarry wall, which create a fall-of-material hazard to persons, shall be corrected.
7. False - If workers can enter the area inadvertently, posting a warning against entry is required until corrective work is completed. In addition, barriers are required if the area is left unattended prior to the completion of the corrective work.
8. True - Under 56/57.3401 the mine operator must designate the persons experienced in ground control that will examine and test ground conditions. These persons may be supervisors or miners. Mine management retains the responsibility for examination and testing of ground conditions. The standard also specifies when examinations and tests must be made.
9. False - Scaling must be performed from a location that will not expose persons to injury from falling material. Otherwise other protection from falling material must be provided. Where manual scaling is performed, a scaling bar must be provided. This bar must be of a length and design that will allow the removal of loose material without exposing the person performing this work to injury.
10. True - Secondary breakage must be done from a location that doesn't expose persons to danger.
11. False - Although water hazards can present a danger to mobile equipment and foot traffic, it is the travelways that require the berms and barriers, not the water.
12. True - The only exceptions are things which can wait until the end of the shift without affecting safety such as, for example, windshield wipers on a day when there is no rain.
13. c) Report it to proper authorities
14. True - rain can make a stable highwall unstable.
15. True - freezing and thawing can make a stable highwall unstable.
16. True
17. True - Other measures must be taken to protect miners such as placing a berm at the base of the wall, bank, or slope to prevent the over-travel of material into the area where miners work or travel or ceasing mining in the affected area.
18. No. The stockpile is at its angle of repose and is thus subject to sliding - a hazardous situation to persons on foot. Under-pile draw points present the additional hazard of engulfment.

Stockpiles



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 859 - Stockpiling Hazards and Safety Practices on Surge Piles - MSHA - 11 min

VC 831 - Stockpiling Hazards of Coal Stockpiling - MSHA - 26 min

VC 858 - Dump Point Safety - Stockpiles and Waste Piles - MSHA 1997 - 14 min

VC 859 - Hazards and Safe Practices on Surge Piles - MSHA 1997 - 11 min

The following is a Slide/Tape program available from MSHA

AV23 - Hazards due to stockpile instability - MSHA - 18 min

This pamphlet on Stockpiling is also available from MSHA.

SM 30 - "Stockpiling Safety" MSHA Safety Manual (58 pages)

7. Mine Map; Escapeways; Emergency Evacuation & Preparedness

Although this item on the MSHA Form 5000-23 appears to have been directed toward underground mining, surface mining operations still need to consider it. Numerous things can go wrong at a surface mine that require evacuation or other types of emergency preparedness. The following are some items that should be discussed in your training

FIRES IN SURFACE BUILDINGS

What are the building evacuation routes? Where are fire exits located? Where are fire extinguishers located? What is the procedure for notifying emergency services? What special precautions are needed when explosives are involved in a fire? Who is in charge in an emergency?

TOXIC CHEMICAL SPILLS

Are miners aware of possible toxic chemicals in their workplace? Where are MSDSs located? Who is qualified to clean up a spill?

SEVERE WEATHER

What precautions are taken during an electrical storm? (Lightning is the largest cause of weather-related fatalities.) What is to be done in case of a tornado or hurricane warning? Is flooding a possibility at the mine site?

CRIMINAL ACTIVITY

This can be any type of illegal activity that threatens personal safety and may require evacuation of the work site.

All mining operations should have an emergency-preparedness plan that addresses these questions. Miners need to be made aware of these plans.



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at: <http://www.msha.gov/TRAINING/prodintr.htm>

VC 838 - Emergency Response Planning - Who needs it? - MSHA 1995 - 16 min

The Emergency Action Plan



Emergency Response Test

1. An emergency response plan should address the following items: a) a control center and its location, b) an emergency call list, c) designation of who's responsible for each aspect, including media contact.
2. The law requires an emergency communications system. True/False
3. The law requires fire-fighting drills: True/False
4. The law requires that a competent person designated by the mine operator be in attendance to take charge in an emergency.
5. Emergency hoists for hoisting persons must conform to more stringent safety requirements than other hoists. True/False
6. Mine operations are required to establish emergency fire-fighting, evacuation, and rescue procedures and to coordinate these procedures with available fire-fighting organizations in advance. True/False
7. All training including hazard training to non-miners must include training in emergency evacuation procedures. True/False

Answers to Emergency Response Test

1. All are correct.
2. True - 30 CFR § 56.18013 states: "A suitable communication system shall be provided at the mine to obtain assistance in the event of an emergency."
3. True - 30 CFR § 56.4331 states: Emergency fire fighting drills shall be held at least once every six months for persons assigned fire fighting responsibilities by the mine operator.
4. True - 30 CFR § 56.18009 states: "When persons are working at the mine, a competent person designated by the mine operator shall be in attendance to take charge in case of an emergency."
5. True - 30 CFR § 56.19000
 - (a) The hoisting standards in this subpart apply to those hoists and appurtenances used for hoisting persons. However, where persons may be endangered by hoists and appurtenances used solely for handling ore, rock, and materials, the appropriate standards should be applied.
 - (b) Standards 56.19021 through 56.19028 apply to wire ropes in service used to hoist persons with an incline hoist on the surface.
 - (c) Emergency hoisting facilities should conform to the extent possible to safety requirements for other hoists, and should be adequate to remove the persons from the mine with a minimum of delay.
6. True - 30 CFR § 56.4330 states:
 - (a) Mine operators shall establish emergency fire-fighting, evacuation, and rescue procedures. These procedures shall be coordinated in advance with available fire-fighting organizations.
 - (b) Fire alarm procedures or systems shall be established to promptly warn every person who could be endangered by a fire.
 - (c) Fire alarm systems shall be maintained in operable condition.
7. True

30 CFR § 56.18010- First Aid

An individual capable of providing first aid shall be available on all shifts. The individual shall be currently trained and have the skills to perform patient assessment and artificial respiration; control bleeding; and treat shock, wounds, burns, and musculo-skeletal injuries. First aid training shall be made available to all interested miners.

Fire Safety



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at: <http://www.msha.gov/TRAINING/prodintr.htm>

VC 879 - Fire Extinguishers - MSHA 1989 - 35 min



Below are listed (in order of occurrence) the MNM Fatalgrams involving Fires. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

14. 04/04/1995 - Fire - Surface - Gold - NV - Driver burned when haul truck catches fire.



Fire Warning and Fire Fighting Test

(Answers follow test.)

Objective: The trainee will be able to correctly answer questions demonstrating a knowledge of the causes of fires, the four classes of fires and the proper fire extinguishers, precautions and limitations in fighting fires, and some requirements of OSHA and MSHA laws.

1. Fuel oil burning is a class A fire. True/False
2. Electrical fires are class C fires. True/False
3. Class D fires involving combustible metals are extinguished by water. True/False.
4. A fire prevention plan spelling out everyone's rolls is required. True/False
5. If you don't know what's burning, try anything to get the fire out. True/False.
6. To die from a fire, you must be exposed to severe heat. True/False.
7. Material safety data sheets contain information on the flammability of materials. True/False.
8. Vapors from flammable liquids are usually a) lighter than air, b) heavier than air.
9. Drums containing flammable liquids should be stored with the bung cap tight. True/False.
10. A drum containing flammable liquids should be connected to a grounding system. True/False.
11. Drums containing flammable liquids should be stored in a properly ventilated storage room or safety cabinet. True/False.
12. Transfer of flammable liquids from drums can only be done with a pump. True/False.
13. Oily rag containers require special ventilated cans with spring loaded lids. True/False.
14. Spill cleanup should wait until the end of the shift. True/False.
15. Any absorbent material can be used to clean up an oil spill. True/False.
16. A slippage detection system on conveyor belts, which can automatically stop the drive pulley, is required:
 - a) in surge tunnels,
 - b) where combustibles are within 25 feet of the belt,
 - c) in a restricted area where a conveyor belt fire could hinder the escape of personnel who normally work in that area.
17. Surface buildings or structures shall always have a sufficient number of exits to permit prompt escape in case of fire. True/False
18. Storage buildings or storage rooms for combustible liquids within 100 feet of any person's work station are adequate if they are properly ventilated. True/False
19. Grease is a flammable liquid. True/False
20. Storage buildings or storage rooms for combustible liquids within 100 feet of any person's workstation must be constructed to meet a fire resistance rating of at least one hour. True/False.
21. Flammable or combustible liquids in use for day-to-day maintenance and operational activities are considered to be in storage under the 30 CFR § 56.4531 standard and must comply with the requirements given in item 20 above.
22. Abandoned electric circuits must be de-energized and isolated.
23. Smoking or the use of an open flame is prohibited where flammable or combustible liquids, including greases, or flammable gases are (a) Used, b) transported in a manner that could create a fire hazard; or (c) stored or handled.
24. Readily visible signs prohibiting smoking and open flames are required where a fire or explosion hazard exists. True/False

25. Flammable or combustible liquid spillage or leakage must be removed. True/False
26. Diesel-powered equipment must be turned off before fueling. True/False
27. Until disposed of properly, waste or rags containing flammable or combustible liquids that could create a fire hazard must be placed in covered metal containers or other equivalent containers with flame containment characteristics. True/False
28. Fire extinguishers must be inspected visually at least twice a year to determine that they are fully charged and operable. True/False
29. At least once every 5 years, maintenance checks must be made of mechanical parts of fire extinguishers, the amount and condition of extinguishing agent and expellant, and the condition of the hose, nozzle, and vessel to determine that the fire extinguishers will operate effectively. True/False
30. Fire extinguishers must be hydrostatically tested after periods of use of either 5 or 12 years depending on the extinguisher. True/False
31. Water pipes, valves, outlets, hydrants, and hoses that are part of the mine's fire fighting system shall be visually inspected at least once every year for damage or deterioration and use-tested at least once every two years to determine that they remain functional. True/False
32. Fire suppression systems must be inspected at least once every twelve months. True/False
33. Written inspection records are required. True/False
34. Combustible materials that create a hazard to persons if ignited cannot be stored or allowed to accumulate nor can dry vegetation grow within 25 feet of: a) an electric substation, b) unburied, flammable or combustible liquid storage tanks, c) any group of containers used for storage of more than 60 gallons of flammable or combustible liquids, d) all of the above.
35. A mine needs onsite fire fighting equipment for fighting fires in their early stages unless it has made prior arrangements with a local fire department to fight such fires. True/False
36. A mine must have onsite fire fighting equipment for fighting fires beyond their early stages. True/False
37. The only requirement for a fire hydrant that is part of the mine's fire fighting equipment is that it have a sufficient capacity of water. True/False
38. Fire extinguishers must be recharged once per year. True/False
39. A fire extinguisher is needed on all self-propelled equipment. True/False
40. If a fire or its effects could not impede escape of the operator from the self-propelled equipment a fire extinguisher may still be needed. True/False
41. A fire suppression system on self-propelled equipment is a suitable alternative for a fire extinguisher. True/False
42. Fire extinguishers or fire suppression systems must be of a type and size that can extinguish class B fires. True/False
43. Emergency fire fighting drills are required for persons assigned fire fighting responsibilities by the mine operator - a) once each month, b) once every 6 months, c) once every 2 years.
44. Small quantities of flammable liquids drawn from storage must be kept in properly labeled safety cans. True/False
45. Requirements for storage facilities are spelled out by MSHA. True/False
46. Flammable liquids cannot be used for cleaning. True/False

47. Solvents cannot be used near an open flame or other ignition source, near any source of heat, or in an atmosphere that can elevate the temperature of the solvent above the flash point. True/False.
48. Battery-charging stations require ventilation a) to keep the batteries cool, b) to preserve the charge, or c) to prevent the accumulation of explosive hydrogen gas.
49. Smoking, use of open flames, or other activities are not restricted at the battery charging station when batteries are being charged. True/False
50. Readily visible signs prohibiting smoking or open flames must be posted at battery-charging stations during battery charging. True/False
51. What three elements must exist simultaneously before a fire can exist?
 - a. Smoke, flame, and ember
 - b. Heat, fuel, and oxygen
 - c. Flame, fuel, and spark
52. If one or more of the three elements mentioned above is removed from the fire, what happens?
53. A multi-purpose, dry chemical fire extinguisher can be used on what types of fires?
 - a. A and B class fires
 - b. B and C class fires
 - c. A, B, and C class fires
 - d. All four classes of fires
54. The area around fuel storage tanks must be kept free of combustible material for a distance of:
 - a. 10 feet
 - b. 25 feet
 - c. 50 feet
 - d. 75 feet
55. Before fighting an electrical fire, what should be done, if possible?
56. MSHA regulations require that fire extinguishers be inspected and the inspection be recorded every:
 - a. Month
 - b. Quarter
 - c. 6 Months
 - d. Year
57. MSHA regulations require that surface employees assigned fire fighting responsibilities be instructed in the use of fire extinguishers every:
 - a. Month
 - b. Quarter
 - c. 6 Months
 - d. Year
58. Mobile equipment such as loaders, dozers, trucks, etc. must be equipped with a fire extinguisher. True/False
59. The chemical used in a dry chemical fire extinguisher is completely harmless to humans and the environment. True / False
60. Other than a dry chemical fire extinguisher, name two ways to extinguish a Class A fire.
61. Other than a dry chemical fire extinguisher, name two ways to extinguish a Class B fire.
62. Other than a dry chemical fire extinguisher, name two ways to extinguish a Class C fire.
63. Name two reasons it is important to be 8--12 feet from the fire when starting to use a fire extinguisher to control it.

64. How long would you expect a 10lb multi-purpose, dry chemical fire extinguisher to last?
 - a. About 5 minutes
 - b. 2-3 minutes
 - c. 1 minute
 - d. 20-30 seconds
65. After using only half an extinguisher to control a small fire, you should put the extinguisher back where you found it. True/False
66. After turning off the power feeding an electrical fire, it is okay to use water to control the fire. True/False

Answers to Fire Warning and Fire Fighting Test

1. False - A class A fire includes combustible solids other than metals that typically leave an ash residue and can be extinguished with water. Fuel oil burning is a class B fire, which needs a dry chemical extinguisher, foam or carbon dioxide. Use of water by untrained persons on a class B fire would only spread the fire farther.
2. True - A non-conducting agent is needed to put them out such as carbon dioxide or dry chemical.
3. False - Dry powder extinguishers specific for the metal hazard present must be used. Magnesium is an example of a combustible metal.
4. True. This plan can include escape routes, fire reporting procedures and employee fire fighting training.
5. False - Life-threatening dangers can result from use of improper equipment or techniques. Call for trained help.
6. False - Most people die from smoke inhalation, lack of oxygen and noxious fumes – smoke alarms are important, crawl to exits as air near the floor is usually less dangerous to breathe.
7. True - They also contain any special information needed to fight a fire involving that material. This is important as some materials that are not usually hazardous can produce hazardous combustion by-products. Example: Even ordinary paper can produce carbon monoxide (a deadly gas) when burned in an atmosphere with low oxygen.
8. b - Heavier than air causing them to accumulate and concentrate along the floor until contacting an ignition source which results in an explosion.
9. False - Replace the bung cap with a drum vent to prevent pressure buildup if the drum is exposed to heat. (Ventilation is needed to remove vapors).
10. True - Grounding is necessary to prevent static electricity sparks.
11. True
12. False - Gravity flow can be used when the drums are stored horizontally, but the pump method empties the drum faster and more completely, doesn't require a drip can for leaks, and hoses are bonded eliminating static electricity sparks.
13. True - Oily rags in a confined space can combust spontaneously.
14. False - Flammable vapors travel fast and, if spills are not cleaned up at once, an explosion and fire may occur. Also, spills present a slipping hazard.
15. False - Special materials are needed, which when saturated must be sealed in a disposal drum or specialized vacuum equipment.
16. All are true.
17. False - This standard applies only to surface buildings in which persons normally work. Excluded from the requirements of this standard are those areas where persons work infrequently, such as change rooms, surge tunnels, toilet facilities, and cafeterias. "Exits" may be doorways, passageways, windows, or other openings that lead out of the building or structure. While the standard uses the word "exits", a single exit may be acceptable where it permits the prompt escape of persons in case of fire.
18. True - Such buildings shall be ventilated with a sufficient volume of air to prevent the accumulation of flammable vapors.
19. True - Grease is considered to be a flammable liquid by MSHA.
20. True - But an automatic fire suppression system or an early warning fire detection device that will alert any person who could be endangered by a fire may be used instead, provided that no person's work station is in the building.

21. False
22. True
23. a, b, and c
24. True
25. False - They either must be removed in a timely manner or controlled to prevent a fire hazard (absorbents).
26. False - Internal combustion engines must be switched off before refueling if the fuel tanks are integral parts of the equipment, but diesel equipment is an exception to this rule.
27. True - Oily rags in a confined space can combust spontaneously.
28. False - They must be inspected at least once a month.
29. False - Once every 12 months
30. True - According to 30 CFR § 56.4201, Table C-1 or a schedule based on the manufacturer's specifications to determine the integrity of extinguishing agent vessels.
31. False - Visual inspection must take place every 3 months, and use-testing, every 12 months.
32. True - But the inspection frequency for individual components must be according to manufacturer's specifications. Surface fire suppression systems are exempt if a fire would affect no persons.
33. True - At the completion of each inspection or test required by this standard, the person making the inspection or test shall certify that the inspection or test has been made and the date on which it was made. Certifications of hydrostatic testing shall be retained until the fire extinguisher is retested or permanently removed from service. Other certifications shall be retained for one year.
34. d) all of the above
35. False - True only for fighting fires that could endanger persons in their early stages.
36. True - If the mine has not made arrangements with a local fire department to fight such fires, onsite fire fighting equipment shall be (1) of type, size, quantity that can extinguish fires of any class which the hazards presents; and (2) strategically located, accessible, plainly marked, maintained in ready condition.
37. False - Fire hydrants that are part of the mine's fire fighting system must have (a) Uniform fittings or readily available adapters for onsite fire fighting equipment; (b) readily available wrenches or keys to open the valves; and (c) readily available adapters capable of connecting hydrant fittings to the hose equipment of any fire fighting organization relied upon by the mine.
38. False - They must be recharged promptly after any discharge.
39. False - Whenever a fire or its effects could impede escape from self-propelled equipment, a fire extinguisher shall be on the equipment. (Note: Although MSHA only requires fire extinguishers on mobile equipment under certain circumstances, a mine's insurance carrier may have stricter rules. Consult your company's safety policy for details).
40. True - An extinguisher must also be on the equipment or within 100 feet of it if an equipment fire could affect the escape of other persons in the area.
41. True - If the system can be manually activated.
42. False - they must be suitable for any class in their early stages, which could originate from the equipment's inherent fire hazards. Fire extinguishers or manual actuators for the suppression system must be located to permit their use by persons whose escape could be impeded by fire.

43. b - Once every 6 months
44. True
45. True - They are spelled out in 30 CFR § 56.4430
46. True - Flammable liquids cannot be used for cleaning
47. True
48. c - To prevent the accumulation of explosive hydrogen gas.
49. False - Any ignition source is prohibited at the battery charging station during battery charging.
50. True
51. b - Heat, fuel, and oxygen
52. A fire will not occur
53. c - A, B, and C class fires
54. b - 25 feet
55. De-energize the circuit.
56. a - Month
57. c - 6 Months
58. False - Only required when the fire or its effect could impede escape.
59. False - There are many dry chemicals used. If it's necessary to put out a fire on a person, put the extinguisher on the stretcher with him so the hospital knows how to counteract the effects of the extinguishing agent.
60. Water or foam
61. Halon, carbon dioxide and foam are also used at times.
62. Halon or carbon dioxide
63. Heat, toxic gases, and flash or flare-up. When first sprayed at the fire, any extinguisher will push air in front of the stream of extinguishing agent and act, momentarily, like blowing air on a flame. The fire flares up at first.
64. d - 20-30 seconds
65. False - It should be recharged before putting it back or disposed of if it's a one-use extinguisher.
66. True - if the power is truly off, the danger of electrocution is greatly reduced.

8. Cleanup; Housekeeping



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC908 - Clean Up and Housekeeping (Underground Salt Mine) - MSHA 1987 - 9 min



Suggested Pictures: Use any of the “Housekeeping” pictures from the download section of: <http://www.mine-safety.mtu.edu> . Using pictures taken at the specific mine site is better.

9. Mandatory Health & Safety Standards



"Regulation Football"

(See Appendix 3) Regulation Football is a game that provides an interesting and informative way to present this topic. The Questions in Appendix 3 may also be used for other Q&A type games.

Audits

Audits can be a useful training tool as well as a tool used to measure a company's compliance with regulations. The Michigan Mine Safety and Health Training Program web site has safety audits for download at: www.mine-safety.mtu.edu . One of these audits is based on MSHA's top 20 most cited violations.

10. Authority & Responsibility of Supervisors & Miner's Representatives

The Michigan Mine Safety and Health Program has produced a Mine Safety Manual for Supervisors. The following is an excerpt on Supervisor responsibility from that manual. For further information about this manual, please phone (906) 487-2453 or e-mail dcarlson@mtu.edu

As a supervisor, what sort of effects do you have on worker safety?

1. Supervisor attitude toward safety is the principle-determining factor in workplace safety and health.
2. A supervisor's attitude is reflected in how they do things. These actions (more than words) effect worker attitudes towards safety.
3. Barriers to safe worker behavior are either created or eliminated primarily by the supervisor.
4. Mine supervisory personnel, as a category, have a higher incidence of fatalities than many other categories of mine workers.

Sections 110 of the Mine Act contain provisions allowing certain individuals to face civil and (or) criminal penalties.

- (a) The operator of a coal or other mine in which a violation occurs of a mandatory health or safety standard or who violates any other provision of this Act, shall be assessed a civil penalty by the Secretary which penalty shall not be more than \$10,000 for each such violation. Each occurrence of a violation of a mandatory health or safety standard may constitute a separate offense.
- (b) Any operator who fails to correct a violation for which a citation has been issued under section 104(a) within the period permitted for it's correction may be assessed a civil penalty of not more than \$1000 for each day during which such failure or violation continues.
- (c) Whenever a corporate operator violates a mandatory health or safety standard or who knowingly violates or fails or refuses to comply with any order issued under this act or any order incorporated in a final decision issued under this act, except an order incorporated in a decision issued under subsection (a) or section 105(c), any director, officer, or agent of such corporation who knowingly authorized, ordered, or carried out such violation, failure or refusal shall be subject to the same civil penalties, fines and imprisonment that may be imposed upon a person under subsections (a) and (d).
- (d) Any operator who willfully violates a mandatory health or safety standard, or knowingly violates or fails or refuses to comply with any order issued under section 104 and section 107, or any order incorporated in a final decision issued under this title, except an order incorporated in a decision under subsection (a) or section 105(c), shall, upon conviction, be punished by a fine of not more than \$25,000 or imprisonment for not more than one year, or both, except that if the conviction is for a violation committed after the first

conviction of such operator under this act, punishment shall be a fine of not more than \$50,000 or imprisonment for not more than 5 years or both.

Individuals can also be penalized with the following:

- (a) Fines up to \$1000 or 6 months in prison for giving advance notice of an inspection.
- (b) A fine up to \$250 per occurrence for violation of a mandatory safety standard relating to smoking or carrying smoking materials.
- (c) Fines up to \$10,000 or imprisonment up to 5 years or both for a false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to the act. Note that this punishment is to the person, not the company and includes lying to an inspector.

Definitions

- An **“agent of the company”** means any person charged with responsibility for the operation of all or a part of a coal or other mine or the supervision of the miners in a coal or other mine – any one that directs the workforce (including hourly employees who direct the workforce). Supervisors obviously meet the definition of Agent of the company.
- **“Knowingly”** means knowing or having reason to know. A person has reason to know when the person has such information as would lead a person exercising reasonable care to acquire knowledge of the fact in question or to infer its existence. If, for example, an equipment operator is operating equipment with safety defects, and the mine operator has demonstrated no system for the reporting and correcting of defects affecting safety, MSHA can determine that the mine operator was knowingly allowing the operation of the equipment with safety defects because the mine operator should have known. The phrase "a person exercising reasonable care" can be taken to mean that the person is making an effort to comply with the regulations. Thus a supervisor or other person directing the work can be held civilly liable (pay a personal fine) for knowingly violating regulations.
- **"Willfully"** means intentionally disobeying the standard or recklessly disregarding its requirements. Reckless disregard means closing of the eyes to or deliberate indifference toward the requirements of a mandatory safety standard, which the defendant should have known and had reason to know at the time of the violation.

11. Industrial Health

Dust



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 936 - Plain Talk about a Serious Problem: Silicosis - MSHA 1983 – 18 min

VC SA1- The National Campaign to Eliminate Silicosis - MSHA 1996 - 27 min

VC 829 - Coal Dust Hazards and Controls - MSHA 1980 - 14 min

VC 826 - Stop Silicosis (Silicosis in the '30s)- MSHA 1938 - 12 min

VC 843 - Dust Control - It's Everyone's Business - MSHA 1997 - 19 min.



Dust & Respirators - Power Point Program for download from www.mine-safety.mtu.edu . This is a short Microsoft PowerPoint program that describes the harmful effects of dust and describes the use of respirators.

The following information on Dust is available at MSHA's Internet site at: www.msha.gov

Dust Control - www.msha.gov/S&HINFO/HEALTH.HTM

Silicosis Prevention - www.msha.gov/S&HINFO/HEALTH.HTM

Tips for Dusty Jobs - www.msha.gov/hhicm.htm



Dust Test (Answers follow test.)

Objective - The trainee will be able to correctly answer questions demonstrating a knowledge of the following. 1) The makeup of hazardous mineral dust. 2) The effects of exposure to dust containing respirable crystalline silica. 3) The various causes of overexposure. 4) Various engineering controls. 5) Some MSHA standards including the need for respirators, fit testing, and monitoring where personnel are overexposed.

1. The amount of harm from mineral dusts depends on the particle size and composition. True/False
2. Beach sand is largely crystalline quartz. True/False.
3. Rocks found in mining do not contain crystalline quartz. True/False
4. Visible dust is a good indicator that respirable dust is present. True/False
5. One major source of exposure to respirable dust is improper housekeeping and a poor choice of cleanup procedures. True/False
6. Hosing down the ore pile is a good way to reduce dust. True/False
7. Properly functioning water sprays at critical locations in conveying, crushing, screening and sizing operations can significantly reduce respirable dust emissions. True/False
8. Dry dust control systems are ineffective. True/False
9. Operator isolation is an effective dust exposure control method. True/False
10. Surface drills located out in the open air are a serious dust concern. True/False
11. Road dust is a) a safety concern, b) a health concern, c) both a & b.
12. MSHA requires dust, gas, and fume surveys by the mine operator. True/False
13. When a miner is overexposed to dust as defined by the 1973 TLVs, operators need to establish a respirator program. True/False
14. Sand blasting is a very serious health concern. True/False
15. Silicosis can be both a long term and a short-term health hazard. True/False
16. Crystalline silica is the same thing as crystalline quartz. True/False
17. Silicosis is a condition where crystalline silica causes the lung tissue to react by developing fibrotic nodules and scarring around the trapped silica particles. True/False
18. Silicosis is a disease, the effects of which can be reversed, given time. True/False
19. The correct use of dust respirators requires training. True/False

Answers to Dust Test

1. True - Only very fine, invisible “respirable” dust particles are fine enough to enter deep into the lung passages where the greatest harm is done. Dusts containing minerals such as crystalline quartz or asbestos can be more harmful than other mineral dusts.
2. True - But the particles are usually much too coarse to be respirable and therefore they are not a health concern. Of concern is where beach sand or materials made of beach sand such as cement blocks or concrete are cut or abraded producing small respirable dust particles.
3. False - Crystalline quartz is so common it is found virtually everywhere and usually makes up significant portions of the ores that are mined. Therefore, any handling or crushing of these ores generates dust that is a serious health concern.
4. True - But the lack of visible dust does not necessarily mean that respirable dust is not present.
5. True - Respirable dust from plant operations settles throughout the plant continually. When the settled dust is disturbed, miners are often overexposed. Sweeping stirs settled dust up and also may overexpose personnel. Hosing down areas, where electrical hazards do not exist, or vacuuming using special HEPA filters are ways to avoid overexposure.
6. True - If sufficient water is used to increase the moisture content to about 2 %, dust emissions during subsequent processing may be greatly decreased. Maintaining the ore in a wet state will reduce dust emissions during loading, hauling and conveying, but dust emissions during subsequent crushing and screening also depend upon whether or not the water is able to reach the innermost parts of the ore (the ore’s permeability to water). Water sprays from correctly designed nozzles at critical locations are very effective in controlling dust emissions.
7. True - Specially designed systems are commercially available for reducing dust emissions in mineral processing operations.
8. False - dry dust control systems consist of enclosing the points where dust is emitted and ducting the dust to dust collectors. These systems are typically more effective than the wet systems, but are also more expensive to purchase and tend to make the equipment more difficult to maintain.
9. True - The operator and controls can be located in an enclosed area with windows overlooking the operation. While this reduces the exposure of the operator to dust when the plant is operating, it does not reduce the exposure of other personnel who may travel through the plant.
10. True - Drills (including quarry drills, etc.) must always have a method in use to control drill dust, such as the use of water, a dust collector, etc. Drilling with no dust controls is an MSHA violation and natural water in the hole is not considered a compliance measure.
11. Both a and b. Road dust not only blocks visibility for drivers, but is very likely to contain high concentrations of hazardous respirable crystalline quartz. Wetting down roads frequently can reduce road dust, but care is required not to create slippery roads or other dangers by doing so.
12. True - Title 30 CFR, parts 56/57.5002 requires mine operators to conduct dust, gas, mist and fume surveys as frequently as necessary to determine the adequacy of control measures. This could include carbon monoxide in underground mines, nitrogen oxides after blasting, welding fumes, silica-containing dust, mercury and any other airborne

contaminant, especially where there is a history of overexposures. It does not include noise. There are many methods used to measure airborne contaminants. The sampling and analytical methods used by the mine operator should be consistent with established scientific principles, such as NIOSH recommended methods. The measurement methods used must provide data that can be compared to the 1973 ACGIH TLVs where the MSHA standards for airborne pollutants are listed.

13. True - Engineering controls (such as water sprays, dust collectors etc.) are required by the law, but, respiratory protection is required when controls are not feasible, as well as while establishing controls, and during occasional entry into hazardous atmospheres to perform short-term maintenance or investigations. The respirator program must contain all elements of the standard, which incorporates ANSI Z88.2-1969 (see standard in 30 CFR, 56/57.5005). An MSHA inspector will evaluate the effectiveness of the respiratory protection to determine whether miners are protected from overexposure. If the operator's respiratory protection program fails to include proper selection and fit testing, the .5001(a)/.5005 violation is considered significant and substantial ("S and S").
14. True - Sand blasters are among those that have the highest incidence of silicosis as a result of inhaling toxic respirable quartz.
15. True - Development of chronic silicosis is a long-term process taking years, but terminal acute silicosis can be acquired in periods of days, weeks or months if exposure to crystalline silica is unusually high for short periods of time.
16. False - quartz is the common form of crystalline silica. Other toxic forms of crystalline silica are tridymite, cristobalite, and tripoli. Only crystalline quartz is normally measured.
17. True
18. False - The scarring in the lungs from silicosis is permanent. In fact, in third stage or late stage silicosis, the lung fibrosis (scarring) continues even after the exposure to silica has been stopped.
19. True - Dust respirators must be properly fitted and the user must be trained.

Noise



The following information on noise is available at MSHA's Internet site at: www.msha.gov
Health Standards for Occupational Noise Exposure: www.msha.gov/S&HINFO/SAFETY.HTM
Noise Sources - standard, measure, control: www.msha.gov/1999noise/noise.htm



Noise Hazards Test (Answers follow test.)

Objectives: Trainees will be able to correctly answer questions demonstrating their awareness of: the serious adverse effects of overexposure to noise, ways to recognize excessive noise, engineering and administrative controls to prevent overexposure, and the importance and correct use of personal protective equipment.

1. Exposure to too much noise can cause hearing loss. True/False
2. MSHA requires hearing protection when noise sounds too loud. True/False.
3. Signs that you should get your hearing tested include: a) Ringing in the ears b) ear wax c) voices sound muffled
4. Noise in the workplace can be reduced by a) replacing worn machine parts, b) placing heavy machinery on rubber mountings, c) both a & b.
5. Earplugs are the preferred noise control PPE. True/False
6. You can make your own hearing protectors. True/False.
7. Canal caps seal the entrance to the ear canal; earplugs go in the ear canal. True/False
8. Ear protectors, when purchased, usually include instructions on how to keep them clean. True/False
9. Initial audiometric hearing tests set a baseline so re-tests can be compared to determine if workplace damage has occurred. True/False
10. You should report and replace ear protectors if inspection finds that they're a) loose, b) cracked, c) dirty, or d) both a & b.
11. High frequency sound can be more damaging to ears than low frequency sound. True/false
12. A sound intensity in excess of 85 decibels may cause hearing loss. True/false
13. Too much noise can make you tired and irritable. True/false
14. Noise can be controlled. True/false
15. A sound level meter's main use is to measure a person's exposure to noise. True/False
16. If hearing protection doesn't work well enough, the company must use engineering and/or administrative controls to reduce the noise hazard. True/false
17. It is not possible for a worker to estimate if he is being overexposed without sophisticated instrumentation. True/false
18. Audiograms are used to determine if a person's hearing has degraded. True/false
19. Changing your work schedule is an engineering control for noise. True/false
20. NIOSH studies have shown that hearing protectors are better than they are rated. True/False

21. Are miners subject to noise levels over 85 dBA? Yes/No
22. Can noise-induced hearing loss be repaired. Yes/No
23. Can noise-induced hearing loss occur in a short time interval? Yes/No.
24. Hearing loss due to noise usually appears during the first five to ten years of exposure. True/False
25. If you suspect that you are in danger of noise-induced hearing loss, you should start using hearing protection. True/False.
26. Is it wise for a small employer to own noise measurement instrumentation? Yes/No.
27. Ringing in the ears and difficulty in hearing after work are signs that you may be overexposed to noise. True/False.
28. Hearing protectors must have a noise reduction value to meet MSHA requirements. True/False.
29. The current MSHA standard or Permissible Exposure Limit for noise exposure of miners is 90 dBA for 8 hours. True/False
30. The allowable exposure time is reduced by one half for every 3-dBA noise exposure increase. True/False
31. The maximum allowable noise exposure level is 115 dBA for exposures of 15 minutes or less per day. True/False
32. For comparison to the PEL, MSHA uses a noise dosimeter that responds to and measures only noise above 90 dBA to which it is exposed, and expresses the result as a percentage of the allowable exposure at 90 dBA. True/False.
33. MSHA issues a citation when the reading exceeds 100 %. True/False.
34. A sound level meter is more useful in determining how to control noise than is a dosimeter. True/False.
35. The best times to make measurements with a noise dosimeter are when conditions are not normal in the workplace. True/False.

Answers to Noise Hazards Test

1. True - High Frequency Hearing Loss is the typical type of hearing loss caused by exposure to excessive noise. This type of hearing loss is non-correctable and is not helped by hearing aids.
2. False - Some sounds may be unpleasant or startling, but this is too subjective a measurement for MSHA. MSHA says that protection may be needed for noise greater than 85 decibels as measured with a sound level meter. However, if you don't have a sound level meter with you, background noise that requires you to shout to be heard from 3 feet away is probably loud enough to suggest the need for controls and to require hearing protection.
3. a & c
4. c
5. False - Earmuffs – not ear plugs -- usually are the best personal protective equipment (PPE). However, both earmuffs and earplugs can be ineffective if worn improperly. MSHA regulations require that PPE be used only as a temporary measure until adequate engineering controls have been installed. PPE for noise control, in general, has the associated danger of making it difficult for the employee to hear danger signals as well as to communicate, and employees may not always use PPE when it is needed.
6. False - While you could make your own hearing protection PPE and it might work, homemade devices are not legally acceptable (largely because inspectors have no way of knowing if homemade devices work correctly or not). Therefore, use only the protective devices assigned to you.
7. True – Canal caps should only be worn in areas that present a mild hearing loss hazard as they are the least effective type of hearing protector.
8. True - Because processes and materials used by specific manufacturers may differ widely, it is recommended that the manufacturers cleaning instructions be followed closely to avoid damage which reduces the effectiveness and comfort of the devices.
9. True - The tests are conducted to determine if noise controls in the workplace are adequate. In general, if the worker's hearing reduction remains within normal limits for age related hearing degradation, then controls are adequate.
10. d
11. False - Both types do damage, but noise induced hearing loss decreases the ability to hear high frequencies and, as this loss progresses, speech and other noises become less intelligible.
12. True - Damaging exposure to noise is a combination of sound intensity (measured in decibels) and the amount of time exposed. Since certain frequencies are more harmful than others are, MSHA requires noise level measurements be made in decibels on the 'A' frequency scale. Measurements are reported in 'dba'. Noise that is measured at 100 dbA would cause damage in a shorter period of time than noise measured at 90 dbA. 85 dbA is presently considered by experts as the upper limit for noise exposure over an 8-hour work period. Note that even 85 dbA can cause problems over a longer period.
13. True - Noise has also been shown to increase blood pressure and cause physical problems other than just hearing loss.
14. True - Heavy machinery can be placed in an area away from as many personnel as possible, machinery can be placed on rubber mountings, sound-absorbing acoustical tiles and blankets can be used on floors, walls, and ceilings, work schedules can be arranged to reduce the time each worker spends in a noisy area.

15. False - a sound level meter is ordinarily used to measure the intensity of the sound itself, but readings may be used to estimate exposure. A dosimeter measures a worker's exposure to noise.
16. False - Engineering and administrative controls are the first line of defense required by MSHA. Requiring PPE is considered to be only a temporary measure until engineering and administrative controls reduce exposure below the maximum legal limits.
17. False - The very rough rule of thumb for determining overexposure is that if you must shout to talk to someone two or three feet away, the noise most likely exceeds 85 decibels. (Note: This rule of thumb works only if you're shouting at someone with normal hearing. Some individuals with a hearing loss become good at lip reading and will apparently understand you even if you talked normally in a noisy area.)
18. True - audiograms are used to compare a person's hearing with earlier results over a number of MSHA prescribed frequencies. Annual tests are used for those exposed to 85 decibels or more to look for an STS (standard threshold shift from the baseline audiogram). If there has been an STS, a worker may need to be reassigned to a job that won't contribute to further hearing loss.
19. False - changing work schedules is an administrative control. It does nothing to actually change what's causing the noise. Engineering controls involve physically altering the noisy environment such as installing baffles, rubber cushions, plastic vs. metal, pads for vibration, maintenance, control booths, etc.
20. False - Studies by NIOSH have shown that, in actual use, these devices are only about half as good as the ratings indicate. Therefore, NIOSH currently recommends that the noise reduction rating (NRR) be lowered by 25%, 50% and 70% for earmuffs, formable earplugs, and other earplugs. This discrepancy between the manufacturers rating and the actual rating is probably due to the worker's improper use or fitting of the hearing protection. This is another reason that MSHA prefers administrative or engineering controls for noise. Hearing PPE has too many variables involved making it an unreliable form of protection.
21. Yes - In mining over 400,000 workers are exposed to average noise levels exceeding 85 dBA.
22. No - Occupational noise-induced hearing loss is permanent and irreversible. Hearing aids may provide partial relief, but will not restore your ability to communicate as before.
23. Yes - while noise-induced hearing loss is usually gradual, serious and permanent loss can occur much more quickly. A significant impairment may develop within just a few months and the sound of an explosive blast or gunshot can cause significant impairment instantaneously.
24. True - the first symptoms of noise-induced hearing loss are usually inability to hear the higher frequencies (at or above 4000 hz).
25. True - while the use of hearing protection is not the preferred approach to control, it is wise to wear hearing protection until engineering and administrative controls are in place and have been found to be effective in maintaining noise intensity below 85 dBA.
26. Yes - start out by purchasing a sound level meter from your local equipment supplier. They will be able to tell you how to use it properly. When you've determined that you have a problem, go to the manufacturers of noisy equipment you're using to determine how to reduce the noise. Also contact the loss control services representative from your insurance company or workers compensation carrier. Step-by-step improvements will usually follow from these initial efforts if you follow up as directed.

27. True
28. True - but it need not necessarily be a noise reduction rating (NRR).
29. True
30. False – MSHA reduces the allowable exposure time by 1/2 for every 5-dB increase.
31. True - 90 dBA = 8 hr, 95 dBA = 4 hr, 100 dBA = 2 hr, 105 dBA = 1 hr, 110 dBA = 30 min, 115 dBA = 15 min. If a 30 second test shows the noise exposure averages 115dbA, the noise is over the MSHA standard.
32. True - In this way a value of 100% corresponds to a noise exposure of 90 dBA for 8 hours or equivalent (for example, 95 dBA for 4 hours is equivalent to 90 dBA for 8 hours or 100 % – 95 dBA for 8 hours would produce a reading of 200 %).
33. False - a citation is not issued until the reading reaches 132%.
34. True - a sound level meter allows the person to determine noise levels at specific times and locations to determine where correction is needed, while a dosimeter requires a reading over time to be meaningful.
35. False - measurement conditions should be as normal as possible so that the readings are representative of the typical exposure.

Hazard Communication

MSHA regulations require that mine workers be aware of hazards presented by chemicals they work with. MSDSs are provided by the chemical manufacturers to supply information about a product and its chemical hazards.



A humorous instructional version of an MSDS is available for download from our web site at www.mine-safety.mtu.edu

Information on MSDS links can be found at the MSHA Internet site at:
www.msha.gov/S&HINFO/HEALTH.HTM

MSHA's proposed "Hazard Communication" standard is expected to take effect near the end of the year 2001. A copy of the proposed regulation can be downloaded from <http://www.msha.gov/hazcom/hazcom.htm> .



Hazard Communication Test (Answers follow tests.)

1. A good Hazard Communication Program informs all employees about chemical hazards and protections in the work place.
 True False
2. A chemical's physical hazards may include:
 Fire Explosion Reactivity
3. To identify a chemical's hazards, check its:
 Smell MSDS Container label Taste
4. Employers should have a written hazard communication program.
 True False
5. Employees need hazard communication training.
 True False
6. Every chemical requires the same protective measures.
 True False
7. A reactive chemical may have a dangerous reaction with:
 Air Other chemicals Water
8. It's best to keep all chemical containers closed when not in use.
 True False
9. Food, drinks, and cigarettes don't belong in a work area that contains chemicals.
 True False
10. The MSDS will tell you how to store and handle a chemical correctly.
 True False

MSDS Test (Answers follow tests.)

1. MSDS is an abbreviation for mine safety data sheet.
 True False
2. The MSDS contains information about a chemical's hazards and protective measures.
 True False
3. MSDSs can be kept in a secure place such as the company safe.
 True False
4. Permissible Exposure Limits (PELs) are the maximum allowable time-weighted levels of employee exposure to airborne chemicals.
 True False
5. The MSDS tells you if the chemical could catch fire but not how to put out a fire.
 True False
6. Two substances, that react violently when mixed, can be stored together as long as you don't mix them.
 True False
7. Routes by which chemicals can enter your body are inhalation, swallowing, or by absorption through the skin.
 True False
8. Acute health effects of chemical exposure may take years to develop; chronic effects show up immediately.
 True False
9. Your doctor is the only source of information about a chemical's possible effects on health.
 True False
10. The instructions and precautions on the MSDS are your best guide to working safely with a chemical.
 True False



Answers to Hazard Communications Test Questions

1. True
2. Fire, explosion, and reactivity are all physical hazards.
3. MSDS and container label.
4. True.
5. True - Employers should provide employees with information and training on the hazardous chemicals used on the job.
6. False - You have to check the label and MSDS to know the hazards and the required protective measures.
7. Air, other chemicals, and water.
8. True - although flammable liquids need vented cabinets and special covers that will release pressure when exposed to heat.
9. True.
10. True.

Answers to MSDS Test Questions

1. False. - Material Safety Data Sheet.
2. True.
3. False - Employees must have access to MSDSs at all times.
4. True.
5. False – It also tells you what to use on a fire and any special procedures.
6. False - You should use, handle, and store them separately to prevent dangerous reactions.
7. True.
8. False - Acute effects show up immediately, chronic effects show up over time.
9. False - The MSDS tells you about possible health problems.
10. True.

Material Handling (Ergonomics)

Ergonomics Test Questions (Answers follow test.)



1. Injuries related to workplace ergonomics cost employers more than any other safety or health related workplace injuries.
 True False
2. Good ergonomics makes the job fit the person and not the person fit the job.
 True False
3. Good ergonomics helps people do their jobs without injury.
 True False
4. Only a supervisor can tell when a task has poor ergonomic design.
 True False
5. Cumulative trauma disorders (CTDs) may cause pain or numbness in arms, hands, and wrists.
 True False
6. You can tell immediately if a vibrating tool is causing a cumulative trauma disorder.
 True False
7. Engineering controls like redesigning tools or modifying workstation design are one way to improve ergonomics.
 True False
8. You can improve ergonomics by changing how you work to avoid too much reaching, bending, and twisting.
 True False
9. It's better ergonomically to operate a tool with one finger or hand rather than two.
 True False
10. Back injuries can result if you twist while lifting or carrying a load.
 True False
11. You should ignore symptoms of cumulative trauma disorders until the pain is too much to bear.
 True False

Answers to Ergonomics Test Questions

1. True – Many of these are back injuries.
2. True
3. True
4. False - Only the person doing the job knows when it causes pain or strain.
5. True
6. False -You may not feel the effects on fingers and hands for months or years.
7. True
8. True
9. False - Two-fingered triggers, two-handed tool supports, padded handles, and textured grips reduce the strain of using tools.
10. True
11. False - Be alert to any pain, discomfort, or numbness and report it immediately. Fast action makes long-term problems less likely.

Back Safety



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 938 - Control of Back Injuries in Mining - MSHA 1995 - 25 min

VC 810 - Oh! My Aching Back - Bureau of Mines 1965 - 21 min

VC 937 - A Scientific look at Back Belts - Bureau of Mines 1995 - 16 min

12. Electrical Hazards



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

- VC 877 - Electrical Grounding - MSHA 1989 - 28 Min
- VC 812 - Safety around Power Lines - MSHA 1994 - 13 Min
- VC 864 - Electrical Lock-out Procedures - MESA 1976 - 11 Min
- VC 852 - LockOut/TagOut for Safety - MSHA 1994 - 9 min



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Electric Shock. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm.

1995/1996

- 15. 04/10/1995 - Electrical - Surface - Limestone - FL - Forman electrocuted when crane contacts power line.
- 30. 09/07/1995 - Electrical - Underground - Potash - NM - Underground mechanic contacts bare 480-volt line to fan.
- 31. 09/12/1995 - Electrical - Surface - Phosphate - FL - Lineman electrocuted when connecting power to slurry pump.
- 35. 09/23/1995 - Electrical - Surface - Potash - NM - Electrician's tool contacts energized line & ground in electric box.
- 42. 10/31/1995 - Electrical - Mill/Prep Plant - Copper - AZ - Electrician contacts energized feeder buss
- 46. 12/08/1995 - Electrical - Surface - Traprock - NJ - Crusher operator electrocuted at traprock quarry.
- 16. 04/26/1996 - Electrical - Surface - Stone (CB) - AR - Plant operator contacts energized metal building.
- 30. 07/21/1996 - Electrical - Surface - Limestone - VA - Boy electrocuted in water energized by faulty conveyor.

1997

- 21. 04/10/1997 - Electrical - Underground - Copper - AZ - Supervisor electrocuted dusting inside of electric cabinet.
- 31. 05/16/1997 - Electrical - Surface - Clay (Common) - KY - Supervisor shocked by extension cords repaired wrong.
- 34. 06/07/1997 - Electrical - Surface - Copper - NM - Supervisor puts test leads on breaker terminals and it explodes.
- 39. 07/11/1997 - Electrical - Underground - Limestone (CB) - KY - Mechanic hooks up washer wrong; electrocuted.
- 45. 08/08/1997 - Electrical - Surface - Traprock (CB) - NJ - Truck's elevated bed contacts power lines.

1998

- 38. 08/28/1998 - Electrical - UG - Soda Ash - Superintendent electrocuted while checking cable with hands.

1999

- 34. 09/07/1999 - Electrical - Surface - Granite - While stringing inactive powerline, line contacts active 40,000-volt line.
- 49. 11/29/1999 - Electrical - Surface - S&G - Miner electrocuted when clamp contacted 440-v line on discharge hose.



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Lockout/Tagout. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm.

1995

- 45. 12/05/1995 - Machinery - Surface - Limestone - TN - Welder killed in crusher when it unexpectedly started.

1997

- 1. 01/08/1997 - Machinery - Surface - Sand and Gravel - WA - Mechanic caught in blade mill when it starts.
- 2. 01/14/1997 - Powered Haulage - Surface - Gold - NV - Crusher helper caught in conveyor tail pulley when it starts.
- 59. 11/12/1997 - Powered Haulage - Surface - Sand and Gravel - NY - Crusher operator is entangled in the tail pulley.
- 60. 12/03/1997 - Powered Haulage -Surface -Sand and Gravel-NY -Laborer caught in machinery & drawn into washer.

1998

- 14. 03/14/1998 - Powered Haulage - Surface - Sand and Gravel - TX - Welder drawn into stockpile chute.
- 15. 04/11/1998 - Powered Haulage - Surface - Sandstone - PA - Plant manager caught between tail and snubber pulley.
- 18. 04/28/1998 - Powered Haulage - Surface - Limestone (CB) - TN - Worker is caught in conveyor.
- 19. 04/29/1998 - Powered Haulage - Surface - Traprock (CB) - PA - Mechanic caught in conveyor while adjusting it.
- 29. 07/14/1998 - Machinery - Surface - Sand and Gravel - IA - Dredge operator drawn into crusher drive belts.

1999

- 23. 07/01/1999 - Electrical - Surface - Limestone - Contractor electrician electrocuted when contacts 4160 transformer.
- 42. 10/20/1999 - Electrical - Surface - Phosphate - Electrician connecting conductors in panel when power turned on.



Electrical Test (Answers follow test.)

Objective: The trainee will be able to correctly answer questions regarding the following. 1) a knowledge of some of the terminology used in electrical circuits, 2) that the ground wire is most important for personal safety, 3) a GFCI protects a person using electrical tools by detecting extremely small stray currents to ground, 4) some of the electrical energy procedures and precautions for use in a mine, 5) various MSHA standards, 6) the effects of electrical shock and the dangers of high voltage wires, 7) some precautions when working with lead storage batteries, and 8) precautions in the rescue of victims of electrocution and the need for CPR.

1. Connecting the metal that encloses electrical circuits - including the frames of non-battery powered electrical equipment - to the source ground by a ground wire helps protect personnel from electrocution. True/False
2. Proper grounding removes the need for a correctly sized, rapid-acting circuit breaker or fuse. True/False
3. For a ground to work properly, the wire connecting the exposed part to ground must have very low resistance and be capable of conducting at least as much current as the hot-wire. True/False
4. Wearing rubber boots provides some protection against electrocution. True/False
5. A person who accidentally contacts an energized part is more likely to be electrocuted if the ground is wet. True/False
6. It is impossible to revive a person who has been electrocuted. True/False
7. The hazards of rescuing a person who has been electrocuted are the same as for rescuing anyone else. True/False
8. Replacing circuit breakers or fuses with equal-sized circuit breakers or fuses by a different manufacturer is safe. True/False
9. The best electrical protection when using hand-held electrical tools is the GFCI. True/False
10. A correctly-working GFCI will stop the flow of current if it detects leakage in excess of 6 milliamps. True/False
11. All hand tools must have the third (ground) wire to be safe for use. True/False
12. Its OK to work in water with a double insulated tool. True/False
13. A GFCI is a self-testing device. True/False
14. If the GFCI repeatedly trips, remove it and use the electrical equipment without it. True/False
15. Any GFCI can be used at a mine. True/False
16. Having the correct polarity in an outlet is an important safety consideration. True/False
17. Extension cords must be tested annually for correct polarity and resistance. True/False
18. Rubber tires on mobile equipment provide sufficient protection if the equipment touches power lines. True/False
19. It is dangerous to use a ladder made from a material that conducts electricity. True/False
20. Trucks and cranes should maintain the following distances from power lines. a) 5 ft, b) 10 ft, c) 20 ft, d) 40 ft.
21. Minimum ground clearances for most power lines is set at a) 15 feet, b) 30 feet, c) 60 feet.
22. Certain areas within substations may contain exposed wires and connections. True/False

23. The overhead, secondary distribution power line that is transformed (by a pole-mounted transformer) to the 120/240/480 volts used by most home and industry processes usually starts out at what voltage? a) 640 volts, b) 1280 volts, c) 4800 volts, d) 12,470 volts.
24. It is important to have rubber mats on the floor in front of electrical switches. True/False
25. Only a trained person should make electrical splices. True/False
26. The percentage of electrical injuries due to arcs is over a) 20%, b) 40%, c) 60%, or d) 80%.
27. Replacing a fuse or circuit breaker with one that has a higher amperage rating is likely to result in a) overheating the wires, b) failure of the device to switch the power off in the event of a ground fault, c) lower energy costs.
28. Visual disconnects (disconnecting devices that allow a person to determine by visual observation that a circuit is “dead” or de-energized) are required on all electrical circuits True/False
29. Lockout includes turning the current off at the switch box and placing a padlock on the switch while in the off position. Tagout involves placing a warning tag on the switch or plug that clearly shows the circuit is being worked on and that it must not be reconnected. Which of the following persons is it safest to allow to disconnect and tag such circuits or remove the lock and tag and reconnect them? a) The supervisor of the person working on the circuit, b) the person working on the circuit, c) the shift foreman, d) a person authorized by the operator or person working on the circuit.
30. The best way to ensure that the circuit is actually disconnected before working on it is to: a) try to start the electrical device on the circuit and see if it works, b) test the circuit with an electrical tester, c) both a and b.
31. A wire entering a metal enclosure or electrical equipment must have a bushed or insulated fitting. The fitting should be: a) loose so the wire can move in and out, b) tight so the wire cannot move in and out.
32. Cracked and/or brittle insulation on a wire can be a sign of the wire overheating. True/False
33. The number of amps is the measure of current flow rate. True/False
34. The number of volts is a measure of the force behind the current similar to pressure in a water system. True/False
35. The number of ohms is a measure of the resistance to current flow. True/False
36. The number of watts is a measure of the amount of energy that is being used per second and can be used to determine the cost per hour. True/False
37. It is OK to tie a square knot in a cable. True/False
38. A splice must be twice as strong as the original connection. True/False
39. The metallic box of an electrical enclosure containing energized electrical parts must be grounded. True/False
40. Lead storage batteries are hazardous and require great caution and the use of eye protection during maintenance. Correct lockout (blocking etc.)/tagout procedures should be used when jump-starting any vehicle. Which of the following are dangers associated with lead storage batteries? a) They can explode, b) they may leak corrosive chemicals that can cause severe burns and permanent blindness, c) they may easily be shorted out and start fires, d) they produce alternating current which is more dangerous than direct current, e) when connected in series, they may produce voltages that are high enough to result in serious injury or death.

41. Good ventilation and restrictions against smoking are important in battery-charging areas. True/False
42. Baking soda is good for cleaning batteries. True/False
43. Jump starting a vehicle is not dangerous because almost everyone has a set of jumper cables and knows how to use them. True/False
44. A GFCI protects against line to line shock hazards. True/False
45. The GFCI's primary purpose is to protect people. True/False.
46. Proper grounding helps to prevent a voltage from existing on the exposed parts or frame of a piece of equipment. True/False
47. The following are important considerations when jump starting a vehicle using the battery of another vehicle: a) vehicles must not be touching, b) vehicle batteries must have the same voltage, c) vehicles must have the same polarity (for example, both have negative terminals connected to ground), d) battery fluid level must be correct, e) a face shield should be used.
48. Assuming both vehicles have the negative terminals connected to ground, the positive terminals of the two batteries are connected first using the red cable. True/False
49. Assuming both vehicles have the negative terminals connected to ground, the negative terminals of the two batteries are connected using the black cable. True/False
50. Once the connections are made, the danger of jump-starting is over. True/False
51. If battery acid sprays in your face, you should immediately flush your eyes with water for a) 5 minutes, b) 10 minutes, c) 15 minutes, d) until emergency help arrives.
52. As the voltage increases, the amount of insulation needed to stop the current flow increases. True/False

Electrical Test Answers

1. True - Because such grounding is so important, the following checks must be made at regular intervals. - 1) A continuity test is done to ensure that the equipment-grounding conductor is electrically continuous back to the source ground. The test must be performed on receptacles that are not part of the permanent wiring, on all cord sets, and on cord and plug connected equipment that is required to be grounded. 2) A test is done to ensure that the equipment-grounding conductor is connected to its proper terminal.
2. False - Protection relies on the fuse or circuit breaker turning off the power when there is an electrical fault that energizes the exposed parts. Otherwise a person who comes into contact with the energized parts may be electrocuted.
3. True
4. True - Electrocution usually occurs when a person's body becomes the conductor between an energized circuit and the earth. A good pair of boots made from a non-conducting material which water will not penetrate reduces the flow of electricity to ground. If the resulting current to ground is sufficiently low, electrocution will not occur.
5. True - wet conditions (wet feet, etc.) increase the current flow between the person's body and the earth and thereby increase the likelihood of electrocution.
6. False - Electrocution usually affects the heart rhythms causing it to stop or beat erratically. Therefore, CPR is essential to keep oxygen flowing to the person's brain and other vital organs. In electrocution, the heart's normal rhythm may return spontaneously but, if not, emergency personnel must use a device known as a defibrillator to restore the heart's rhythm.
7. False - It is essential that the power be turned off before touching the person, or if the power cannot be turned off, that the rescuer be aware of the energized area and use an insulating pole or other device to pull the injured person out of the energized circuit. If the source is a very high voltage line, the surrounding earth may be energized. If a main power line is down, the earth may be energized for 100 feet or more from the downed line.
8. False - Such replacement is dangerous without sufficient information to ensure that the replacement will provide equal protection in the particular circuit.
9. True - GFCIs provide personal protection in that they actually control the current that is allowed to leak through a person's body when the person contacts an energized hand tool. GFCIs are most effective when assigned to monitor a single piece of electrical equipment.
10. True - At 6 milliamps, the person will have a sensation of shock, but it is generally not painful. The person can let go of a tool at will if the current is this low. Currents above 15 milliamps cause pain and muscle contraction and a person can't let go of the energized tool. About 100 milliamps is required to stop the heart.
11. False - Tools that are not double insulated need the third (ground) wire. Tools that are double insulated do not need a ground wire because the case is made of a non-conducting material. Note: Any tool with a two-prong plug is unsafe if not clearly labeled as a double-insulated tool.
12. False - Working on wet ground or in water with electrical hand tools is very dangerous. If work in water or on wet surfaces is required, battery-powered tools should be used.
13. False - The test button on the GFCI is to be used each time your life is dependent on the protection provided. If pressing the test button doesn't shut off the power, the GFCI is not functioning.

14. False - A continually tripping GFCI indicates: a) a dangerous ground fault in the tool, b) that the GFCI is being used to protect too many pieces of equipment, or c) that the wire is too long between the GFCI and the tool.
15. False - A GFCI used at a mine should be an industrial quality GFCI.
16. True - The power to a tool or other device is usually switched on the hot wire only. Outlets must have the correct polarity and MSHA inspectors check to make sure. Having the correct polarity means that the hot wire is disconnected when the tool is turned off. If the reverse is true, the hot wire will not be disconnected when the tool is turned off and all of the neutral wire in the tool is hot whether the switch is on or off. For instance, if you poked a fork in your toaster with the polarity reversed, you could get electrocuted with the switch turned off.
17. True - While the law requires only annual checks, it is prudent for the person using the cord to always be sure the polarity and resistance are correct. If the resistance on the third wire (ground) is too great, the fuse or circuit breaker that actually protects the user will not trip in the event that the tool develops a ground fault. The person holding the tool then becomes the conductor to ground.
18. False - If the voltage is high enough, electric current will pass right through the tires to the earth. Even if the tires stop current flow, as soon as the operator steps out of the vehicle, the operator may touch the vehicle and become the path to the earth, resulting in electrocution. With sufficiently high voltages, the earth itself may become charged and the difference in potential between a person's feet may be sufficient to cause electrocution. The safest course of action is usually for the equipment operator to stay in the cab until the circuit has been de-energized.
19. True - Many persons have been killed when the ladder that they are carrying, setting up, or standing on touches a power line or other energized circuit. In general, it is wise to purchase ladders that are made from non-conducting materials.
20. b - 10 feet is the rule, although it is prudent to maintain even greater distances if possible.
21. a - 15 feet.
22. True - Therefore they are usually protected by locked buildings, 6-foot high fences with locked gates, or installed with energized parts at least 8 feet above ground level.
23. d - 12,470 volts
24. True - They act as insulators and help prevent electrical shock from energized panels by helping to prevent the flow of current through a persons body to the earth.
25. True - Improper splices and disconnected metallic shielding present the worst hazards around high voltage underground cables. (See 30CFR Part 56.12013 for splicing requirements.)
26. d - Over 80 % of electrical injuries are from arcs.
27. a and b - Using a higher amperage fuse or circuit breaker allows the circuit to carry more current than the wires can safely carry, thereby overheating the wires, destroying the insulation, and eventually causing a fire or other unsafe condition. Furthermore, the circuit breaker may not turn the power off in the event of a ground fault, thereby endangering personnel who must work around the only-partly-protected equipment.
28. True - The disconnects may be blade switches or plug-receptacle combinations.
29. B - It is safest to allow only the person working on the circuit to disconnect, lock and tag and remove the lock and tag. There are, however, rare cases where another person authorized by the operator or the person himself needs to assist. But this authority should be used extremely judiciously to ensure that the person working on the circuit

- approves and is clear of hazards before the lock and tag are removed and the circuit reconnected.
30. c - both - Test with a tester at the switch to be locked out and then after placing your lock and tag on the switch, try to start the equipment to make sure the correct switch is locked out.
 31. b - Tight to prevent any strain on the electrical connections within the enclosure. Also to prevent rubbing of the wire on the edges of the hole. Vibrating equipment can cause loose wires to rub so much that the insulation can be breached, causing the box or equipment casing to become energized.
 32. True - This often indicates that the wire is too small for the current it must carry and the fuse or circuit breaker is too large for the wire. External heat sources (such as a space heater next to the wire) can also cause wire insulation to deteriorate. Age is another factor. Wires with deteriorated insulation are a shock and fire hazard. Determine the cause of the deterioration and replace the wire with one that is appropriate to that circuit.
 33. True
 34. True
 35. True
 36. True
 37. False - A knot should not be tied in a cable, nor should electrical wires be kinked.
 38. False - It must be as strong as the original cable and must be able to conduct the same amount of electricity without any heat buildup. Therefore, there should be no increase in resistance. (30CFR Part 56.12013).
 39. True - This provides ground fault protection for a person who touches the case. Furthermore, to maintain ground fault protection when working on the circuit, the ground wire should be disconnected last when an electrical circuit must be disconnected.
 40. a, b, c, and e. Batteries, which produce direct current contain corrosive sulfuric acid. Batteries can be linked in series and produce several hundred volts. Batteries emit the very explosive hydrogen gas, which can be set off by a spark. If a battery becomes shorted out by somehow connecting the positive to the negative terminal, a high amperage flow results which can easily start the cable insulation or leaked lubricants on fire.
 41. True - Good ventilation prevents hydrogen gas from building up to the point where a spark could set off an explosion.
 42. True - The baking soda neutralizes leaked battery acid. Care must be exercised not to get the soda inside the battery, because sulfuric acid is a necessary constituent to the functioning of the common lead storage battery.
 43. False - Jump starting is fraught with dangers including: hydrogen gas buildup causing a battery explosion resulting in serious injury, death or permanent blindness to persons standing nearby; damage to the vehicles alternator and computer by connecting the wrong cable to the battery terminal; burns to hands from acid leaks on the battery; unexpected vehicle movement if attempting to start vehicle while it is in gear. For this reason care must be exercised to follow the correct procedures.
 44. False - Line to line hazards occur when you are between the hot and neutral wire. While much less common than line to ground hazards, line to line hazards are very dangerous since the current flows through your body. A GFCI will not shut the circuit off unless there is at least 5 milliamps of current going from your body somewhere other than to the neutral wire.
 45. True

46. True - However, a correctly sized circuit breaker is essential for the system to function as intended. It is important that the equipment be frame grounded and that the grounding electrode, which conducts the ground fault current back to the source ground, have less than 1 ohm of resistance. It is also important that the resistance of the source grounding electrodes measured by procedures supplied by MSHA be less than 25 ohms. The MSHA Procedures manual says the following:

“Grounding systems typically include the following:

1. **Equipment grounding conductors** - the conductors used to connect the metal frames or enclosures of electrical equipment to the grounding electrode conductor;
2. **Grounding electrode conductor** - the conductors connecting the grounding electrode to the equipment grounding conductor; and
3. **Grounding electrodes** - usually driven rods connected to each other by suitable means, buried metal, or other effective methods located at the source, to provide a low resistance earth connection.

Operators are required by MSHA to conduct the following tests:

1. **Equipment grounding conductors** - continuity and resistance must be tested immediately after installation, repair, or modification, and annually if conductors are subjected to vibration, flexing or corrosive environments;
2. **Grounding electrode conductor** - continuity and resistance must be tested immediately after installation, repair, or modification, and annually if conductors are subjected to vibration, flexing or corrosive environments; and
3. **Grounding electrodes** - resistance must be tested immediately after installation, repair, or modification, and annually thereafter.

Conductors in fixed installations, such as rigid conduit, armored cable, raceways, cable trays, etc., that are not subjected to vibrations, flexing or corrosive environments may be examined annually by visual observation to check for damage in lieu of the annual resistance test. When operators elect to conduct this visual examination as a method of compliance with 30 CFR 56/57.12028, MSHA will require that a record be maintained of the most recent annual visual examination.

The grounding conductors in trailing cables, power cables, and cords that supply power to tools and portable or mobile equipment must be tested as prescribed in the regulation. This requirement does not apply to double insulated tools or circuits protected by ground-fault-circuit interrupters that trip at 5 milliamps or less.

Testing of equipment-grounding conductors and grounding-electrode conductors is not required if a fail-safe ground wire monitor is used to continuously monitor the grounding circuit and which will cause the circuit protective devices to operate when the grounding conductor continuity is broken.

A record of the most recent resistance tests conducted must be kept and made available to the Secretary or his authorized representative upon request. When a record of testing is required by the standard, MSHA intends that the test results be recorded in resistance value in ohms.”

47. All are correct.
48. True - The positive terminals of the two batteries are connected first using the red cable. If the negative terminals were connected first, connecting the positive cable to the second vehicle would be inherently dangerous in that almost any part inadvertently touched by the positive cable end would be negatively grounded and create an electrical short circuit with associated serious hazards. However if the positive terminals are connected first, touching the negative cable end to most any part on the second vehicle, other than the positive cable, would not cause a short. Furthermore, it is relatively easy on the second vehicle to find a location to connect the negative cable, which is electrically connected to the negative battery terminal, while finding a point to connect the positive cable is much more difficult. Note: Only when polarities on the two vehicles are reversed, does touching one vehicle to the other cause a short during jumping. The only way that vehicles with different polarities can be used to jump each other is to connect the jumper cables directly to the battery terminals. (Positive to Positive and Negative to Negative.) Be extremely careful that either cable touches no vehicle parts.
49. False - While this is usually easiest to connect to negative terminals on both batteries, the final negative terminal connection starts the flow of current, and if the battery is to explode, this is the likely time for an explosion to occur. Therefore, it is safer to be standing away from the battery when this final connection is made and to make the connection to another location to which the negative terminal on the bad battery is electrically connected. (However, see note in previous answer.)
50. False - Personnel must not be standing near either vehicle when attempting to start the vehicle. There is a great danger of personnel being run over or becoming pinched between vehicles when the second vehicle either starts in gear or freely rolls when the clutch is engaged.
51. d - The eyes should be washed until emergency help arrives, but at least for 15 minutes.
52. True.

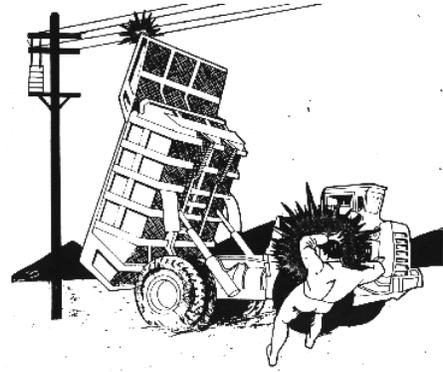


Electrical Primer Test (Answers follow test.)

Objective - The trainee will be able to answer questions which demonstrate an awareness: that voltage is the critical parameter in determining the degree of hazard from electrical energy, a knowledge of materials that are good conductors and those which are not, that the ground wire is the most important wire from the point of view of personal safety, the importance of a correctly-sized circuit breaker both to resist overheating of the wires and to make the ground circuit work to protect personnel, the effects of electrical shock, the dangers of high voltage wires, and precautions in rescue of victims of electrocution and the need for CPR.

1. Resistance (measured in ohms) is the term for the amount of resistance a conductor has to the flow of electrons and is analogous to the resistance to water flow caused by too small a pipe or a restriction in the pipe. True/False
2. Amperage (measured in amps) is the term for the flow rate of electrons through a conductor. It is analogous to the gallons per minute flow-rate of water through a pipe. True/False
3. Voltage (measured in volts) is the term for the amount of electrical driving force (like water pressure) and, in large part, controls the amount of current that will pass through a person's body. True/False
4. Ohms law ($\text{amps} = \text{volts}/\text{ohms}$) is a mathematical expression which shows that if you increase the voltage (electrical driving force) without changing the resistance, more current will flow through a conductor and if you decrease the voltage, less current will flow. True/False
5. As a general rule, metals are good conductors of electricity and nonmetals such as plastics, rubber, etc. are poor conductors. True/False
6. In a two-wire 120-volt cord, the hot wire connects a tool, appliance, or light to the current source and the neutral wire provides a return path for the current. True/False
7. If a number of conductors with different resistances are each connected from the same hot wire to ground, the electricity will: a) follow the path of least resistance to ground. b) follow all possible paths to ground.
8. The third or ground wire is not needed for a tool or appliance to function. True/False
9. If too much current flows through a wire, the wire will become hot, damaging the insulation and possibly causing a fire. True/False
10. Wires are sized so they will not become hot when carrying the amount of current they are designed to carry. True/False
11. Circuit breakers or fuses are devices that are designed to quickly turn off the supply of electricity when the current is too high for a given wire size. True/False
12. A properly sized circuit breaker only protects the wires from overheating, but provides little, if any, protection against electrocution. True/False
13. The ground wire in a cord (for example, the wire connected to the third prong on a 120-volt plug) provides an alternate path to ground in case the neutral wire fails. True/False
14. Very high voltage sources such as those on overhead power lines can cause the current to jump through the air. True/False

15. A fallen high voltage wire can energize the ground so that a person walking along the ground may be electrocuted without even touching the fallen wire. True/False
16. Current flow through a person's body can cause him/her to lose the ability to move away release his/her grip on an energized tool. True/False.
17. A victim of electrocution may not be breathing and may not have a pulse. True/False
18. It is not dangerous to rescue a person who has been electrocuted. True/False
19. CPR is of no use to a victim of electrocution. True/False
20. Since Ground Fault Circuit Interrupters detect current differences between the hot wire and the neutral wire, any differences detected could mean that current is leaking to ground somewhere beyond the location of the GFCI. True/False



Answers to Electrical Primer Test

1. True - Resistance (measured in ohms) is the term for the resistance a conductor offers to the flow of electrons. This is analogous to the resistance to water flow caused by a restriction in a water pipe. Different metals have different resistance to the flow of electricity. Non-metals usually have very high resistance to current flow, and insulators are made of non-metallic materials.
2. True - The amperage measured in amps is a measure of the flow rate of electrons through a conductor in a given time (coulombs/sec).
3. True - Voltage (measured in volts) is the term for the amount of electrical driving force and is analogous to pressure in a water pipe. The greater the voltage, the more amperage per unit time it can force through a given resistor (such as the human body).
4. True
5. True - As a general rule, metals are good conductors of electricity and nonmetals such as plastics, rubber, etc. are poor conductors.
6. True - It is essential to have a complete circuit from the source, through the tool and back for the tool to function.
7. b) - Electricity will follow all paths to ground. The lower the resistance in a given path to ground, the greater the current flow along that path. The fraction of the current flowing along any given path is determined primarily by the resistance of that path with respect to the other and the voltage applied rather than by the fact that there are alternate paths to ground with lower resistance.
8. True - The third or ground wire is a safety feature, which connects the part of a tool or appliance a person contacts to ground. If the tool or appliance body becomes energized by contacting a live wire in the tool (ground fault), this third wire conducts current away from the energized body to ground. If the ground wire and circuit breaker are sized correctly, this will cause the circuit breaker to trip, turning off the power and protecting the user from electrocution.
9. True - The flow of too much current through a conductor will heat up the conductor and damage the insulation, and even if a fire does not start, the insulation will become brittle.
10. True - Wire sizes are chosen based on the equipment that is to be used and the number of amps of current needed to operate that equipment.
11. True - The size of the circuit breaker is selected to protect a given wire size. For example, a 20-amp circuit breaker is used to protect a wire capable of carrying 20 amps of current (a number 12 wire).
12. False - A properly-sized circuit breaker protects the wire from overheating, and is an essential component for the ground wire system to protect personnel from electrocution.
13. False - The ground wire connects the frame or casing of the electrical appliance or tool to ground. It is for personnel safety only. The ground-wire ordinarily carries no current. However, if a ground fault develops causing the frame to become energized, a correctly-sized, properly-connected, undamaged ground wire provides a low resistance path to ground. This low resistance path allows more current to flow from the frame or casing to ground than the fuse or circuit breaker will allow to flow. If the circuit breaker is the correct size and type, it trips and stops the current flow, protecting personnel from electrocution. If the ground path is not continuous (ground prong cut from plug, ground wire not connected inside outlet etc.), the casing or frame of the tool or

appliance will remain energized, and when a user touches it, his/her body becomes the ground conductor causing electrocution. Note: An improperly-sized circuit breaker can also cause the tool or appliance to remain energized.

14. True - The distance the current can jump increases with increasing voltage or with increasing humidity in the air. In general, equipment and personnel should be kept a minimum distance of 10 feet from all wires with voltages from 300 to 50,000 volts, and greater distances should be used for voltages above 50,000 volts.
15. True - A fallen high voltage line can energize the ground so that a person walking along the ground will be electrocuted due to the voltage difference between his/her feet.
16. True - As little as 15 milliamps of current flowing through a person's body can cause him/her to lose the ability to move away from or to drop an energized tool.
17. True - Electrocution can stop both breathing and the heart.
18. False - When a person has been electrocuted, if possible, the electric current should be turned off before attempting to move the person from the source. For lower voltages, a non-conducting pole (dry wood, fiberglass, and plastic) can be used to assist separating the person from the current source. If the source is a high voltage one such as an overhead power line, the whole surrounding area may be energized and attempts to move the person should be made only by highly-trained persons who are fully aware of the hazards and how to minimize them.
19. False - Rescue breathing and CPR are often essential to keep oxygen flowing to the brain and other vital organs until a paramedic with a defibrillator is available to restore the heart rhythm.
20. True - If the current coming back through the neutral wire is less than the current traveling through the hot wire, then some of the current is leaking out of the circuit and is taking a different path back to the power source. The most likely alternate path is through the operator and into the earth. When the current difference between the hot wire and the neutral wire reaches 6 milliamps, the GFCI will trip the circuit. A current of 6 milliamps will not seriously injure a person.

Lock Out/Tag Out



Lock-out/Tag-out Basics Test (Answers follow test.)

1. Proper lock-out/tag-out procedures help prevent accidents by ensuring that the power is shut off before a machine is repaired, cleaned, or maintained.
 True False
2. Lock-out/tag-out must follow specific steps.
 True False
3. You lock out a machine before turning off the power.
 True False
4. Lock-out/tag-out steps include releasing energy stored in springs, pressure systems, etc.
 True False
5. Locks or tags are equally good choices for preventing unwanted start-up of machinery.
 True False
6. Once equipment is locked out, it has to be tested to be sure it can't start accidentally.
 True False
7. Employees not involved in lock-out/tag-out should not need to give attention to locks and tags.
 True False
8. You're permitted to bypass lock-out/tag-out procedures for emergency repairs.
 True False
9. Lock-out/tag-out procedures are common sense and should not require special training.
 True False

Answers to Lock-out/Tag-out Basics Test

1. True
2. True
3. False - Turn off the machine and the main power switch before locking it out.
4. True
5. False - Tags are for warning only. They do not guarantee that energy is shut off.
6. True
7. False - No one should ignore or bypass a lock or tag.
8. False
9. False - Training in lock-out/tag-out procedures should include all employees.



Lockout/Tag-out Details Test (Answers follow test.)

1. The initial Lock-out/Tag-out training of affected employees is sufficient because most lock-out/tag-out procedures are easy to remember. True/False
2. Which of the following is not necessarily a part of the lockout/tag-out program?
 - a) Development of procedure.
 - b) Procedure documentation.
 - c) Informing security about lock opening procedures.
 - d) Validation of procedure.
3. The lock-out/tag-out boundary is the point within which lock-out/tag-out actions are effective. Lock-out/tag-out actions are not effective outside of this boundary. True/False
4. Lock-out/tag-out training should not include which of the following:
 - a) Provide an understanding of the purpose of the program.
 - b) Ensure that employees have the knowledge and skills to identify proper lock-out/tag-out boundaries.
 - c) Ensure that supervisors or other responsible persons remove all locks and tags.
 - d) Ensure that employees know how to safely install and remove locks and tags.
5. Individual lock-out or tag-out devices should NOT be:
 - a) Identifiable as a lockout device.
 - b) Capable of being opened with a single master key.
 - c) Durable and able to withstand the environment.
 - d) Standardized as to color, shape, and size.
 - e) Substantial enough to prevent removal without excessive force.
 - f) Only used for this purpose.
6. Supervisors should occasionally inspect to see that lock-out/tag-out procedures are being followed correctly and check that required protection is being offered. True/False
7. Workers should test to determine that lockout is working correctly. True/False
8. It is important that lock-out/tag-out procedures also address the independent testing of special types of equipment. This ensures that this equipment is removed from service prior to maintenance work and then restored to service after the work is completed. True/False
9. Which are true? At shift turnover:
 - a) All locks should be removed and new locks installed by the oncoming foreman.
 - b) Existing lock-out/tag-outs should be reviewed.
 - c) Affected personnel that come on shift should add their own locks and tags.
 - d) A company lock should be installed and left on.

10. In an individual-controlled lock-out/tag-out system, the individual worker is responsible for taking all the necessary actions to ensure personal safety and the safety of others during maintenance. True/False
11. Where significant hazards require that plant activities be centrally controlled, workers should use a centrally controlled lock-out/tag-out system. True/False
12. Generic lock-out/tag-out training (such as provided by a state program) is suitable for preparing workers to implement a safe system. True/False
13. Which are not correct? A lock-out/tag-out program should include:
 - a) Clearly defined terms and definitions.
 - b) Detailed procedures that describe the logical sequence of steps necessary to establish and remove, under normal and emergency conditions, locks and tags.
 - c) Clear assignment of duties and responsibilities for control and release of locks and tags.
 - d) Adequate training and retraining on procedures, forms, tags, and the process.
 - e) Practical exercises to resolve problems or questions.
 - f) Disciplinary action to be taken against violators including a termination process for repeat violations.
14. Only workers trained in the procedure and who are familiar with the system (including the interface and facility drawings) should use lock-out/tag-out. True/False
15. Which are correct? Worker training should include:
 - a) Awareness of lock-out/tag-out boundaries and how to remain within them.
 - b) How to verify lock-out/tag-out boundaries.
 - c) How to be sure that no hazardous energy exists within these boundaries.
16. Individual workers should verify that no hazardous energy exists before beginning tasks. True/False
17. Each employee should take responsibility for ensuring that no violations of lock-out/tag-out procedures occur either by themselves or by others. True/False
18. All workers must follow the company's established lock-out/tag-out procedures, whether they are company personnel or outside contractors. True/False

Answers to Lock-out/Tag-out Details Test

1. False -- It is extremely important that all affected employees be properly trained and that the training be refreshed and updated regularly.
2. c
3. True -- A lock-out/tag-out boundary is the point within which a lock-out/tag-out action (such as shutting off an electrical switch) is effective. Outside this boundary, lock-out/tag-out actions are not effective.
4. c is false. The best practice is to have the lock removed only by the person who installed it.
5. b -- Only the correct key should open the lock. Keep spare keys in a secure location and use them only under very special, well-planned circumstances.
6. True -- Supervisors should check to see that lock-out/tag-out procedures are being correctly followed. They need to ensure that the required protection is being offered by the procedures used. They should check often initially and then at least once per year when procedures are well established.
7. True -- Verification methods should be well planned. (Such as: trying to start a machine that is locked out before anyone begins working on it.)
8. True - It is important that lock-out/tag-out procedures include separate verification that safety and fire-fighting equipment (some of which have backup generators) are removed from and restored to service according to the procedure.
9. b, c, and d are true. The supervisor needs the company lock mentioned in "d" to ensure that the machine remains locked out at shift change (once workers remove individual locks). "a" is untrue because workers who install the individual locks should be the ones who remove them.
10. True -- Workers use individual control where the system is simple and fully understood by the individual worker.
11. True - Use a centrally controlled lock-out/tag-out system where significant hazards require that plant activities be centrally controlled.
12. False -- Training on plant-specific procedures and protocols is essential to ensure that workers are aware of local procedures and how to implement them correctly.
13. None are incorrect.
14. True -- Personnel, who are familiar with the system, the interface and facility drawings (and who know the procedures) should be the only ones who use lock-out/tag-out.
15. All are correct
16. True -- Employees should take personal responsibility for their own safety by such verification.
17. True -- Each employee should take responsibility for ensuring that no violations of lock-out/tag-out procedures occur either by themselves or by others.
18. True -- The Company must train outside contractors in the company's lockout/tag-out procedures.

13. First Aid

General First Aid review is part of many types of MSHA required safety training (such as annual refresher.) Review questions for first aid are available here, and as part of our computer based “Mine Safety Jopardy” game.

MSHA First Aid - Provider Requirement

30 CFR § 56.18010 - First Aid

An individual capable of providing first aid shall be available on all shifts. The individual shall be currently trained and have the skills to perform patient assessment and artificial respiration; control bleeding; and treat shock, wounds, burns, and musculo-skeletal injuries. First aid training shall be made available to all interested miners.

[61 FR 50436, Sept.26, 1996]



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC886 - First Aid Video - MSHA 1996- 72min

The American Red Cross has an excellent First Aid video entitled: Workplace Training: Standard First Aid Videotape. (Current cost approx: \$48.) Contact your local American Red Cross chapter for details, classes and possible videotape purchase.

Michigan Mine Safety and Health Training Program has a Microsoft PowerPoint based 4hr First Aid Program that meets the minimum MSHA requirements as set out in 30 CFR 56(57).18010. Michigan Mines: For information on presenting this class, contact our program (Michigan Mine Safety & Health) at 906-487-2453 or e-mail dcarlson@mtu.edu.

First Aid Questions



Easy Questions

1. An accident victim should only be moved when exposed to further _____(danger).
2. In first aid, ABC stands for _____(Airway), _____(Breathing), and _____(Circulation).
3. To start mouth-to-mouth breathing, _____(two) full breaths should be given.
4. To check circulation on an unconscious victim, the pulse should be checked at the _____(Carotid) artery.
5. The Carotid Artery is located in the _____(neck).
6. If there is no pulse or breathing, _____(CPR) should be given. A _____ (trained) person should give CPR. For victims with an object caught in the throat, the most effective way of dislodging it is the _____(Heimlich Maneuver).
7. Bright red, spurting blood indicates bleeding from a (an) _____(artery). Bleeding from a vein is continuous and _____(dark) red.
8. A pressure point is where a blood vessel passes close to the surface of the skin over a bony surface. There are _____(thirteen) pressure points on each side of the body.
9. Physical shock occurs because of a lack of _____(oxygen) to all parts of the body.
10. It's important to _____(talk) to a victim of physical shock.
11. An important treatment for physical shock is to help the victim maintain normal body _____(temperature).
12. During shock treatment, continue to monitor the _____(ABCs).
13. Injury to the spine usually results in partial or total _____(paralysis).
14. A victim of fainting should lie down with their head _____(lower) than their feet.
15. If an unconscious victim is suspected of having a spinal injury, this may be determined by running a sharp object along the bottom of the _____(foot).
16. Should injuries occur to the neck, the _____(head) must be immobilized in the position found.
17. In fractures, you should never try to _____(straighten) the bones.
18. An injury that causes the shoulder to droop forward is often a fractured _____(Collar bone).
19. Skull fractures are serious because of possible damage to the _____(brain).
20. Dislocations should be repaired by a _____(doctor).
21. Areas with chemical burns should be flushed with clean _____(water).
22. Burn dressings should be applied _____(loosely).
23. If a stretcher is used to transport an accident victim, a person of _____ (equal) or _____ (greater) weight should test it.
24. Strains result from over stretching of muscles and tendons. (True) / False
25. Do not give alcoholic drinks to a victim of shock. (True) / False
26. Physical shock occurs to some degree after every injury. (True) / False.
27. Spurting blood will not clot easily. (True) / False.
28. At the top of the throat is a flap called the trachea. True / (False).
29. A "bleeder" is a person whose blood will not _____(clot).
30. Sterile dressing is a dressing that is free from all _____(Pathogens).
31. Inflatable plastic splints can be used for fractures of the _____(limbs).

Medium Questions

32. _____(Fluids) should not be given to an unconscious person.
33. To check for breathing on an unconscious accident victim, the first aid provider should _____(look), _____(listen), and _____(feel) for breathing.
34. The most common cause of airway obstruction is the _____(tongue).
35. A sign that shows that an unconscious, non-breathing victim has experienced electric shock are possible _____(burns) on the body at the point of contact.
36. Unless a back or neck injury is suspected, the most effective way to open the airway is to lift up the _____(chin).
37. If a neck injury is suspected, the _____(Modified Jaw-thrust) should be used to open the airway.
38. In addition to mouth-to-mouth an effective way to give artificial ventilation is _____(Mouth-to-Nose).
39. Between breaths, the first aid provider should watch the _____(chest) for rising and falling.
40. A sign that indicates that artificial ventilation is NOT being done correctly is that the _____(stomach) will rise.
41. One problem that the first aid provider should be aware of while giving artificial ventilation is the victim will possibly _____(vomit).
42. _____(Cardiac arrest) is the term used when the heart stops pumping blood.
43. The pulse should be checked for at least _____(5) seconds but no more than ten seconds.
44. If a pulse is present but there is no breathing, continue giving mouth-to-mouth ventilation every _____(five) seconds.
45. In the Heimlich Maneuver, the hands of the first aid provider should be placed just above the _____(navel).
46. A quick, effective way to control bleeding is to apply direct _____(pressure).
47. If, as a last resort, a tourniquet has to be applied to control bleeding of a limb, the tourniquet should not be _____(loosened).
48. Cold and clammy skin, weak and rapid pulse, possible thirst, enlarged pupils, nausea, and possible pain in the body indicate _____(Internal) bleeding.
49. In internal bleeding it is important not to give the victim anything to _____(drink).
50. To some extent, every injury or illness is accompanied by _____(physical shock).
51. One symptom of shock is the pulse will be _____(weak) and _____(rapid).
52. Shock will result in _____(shallow), irregular breathing.
53. A victim of shock may be allowed to stand. True / (False)
54. In shock treatment, do not give stimulants. (True) / False
55. A temporary loss of consciousness due to an inadequate supply of blood to the brain is known as _____(fainting).
56. The spinal cord is mostly protected by _____(vertebrae).
57. If a life threatening condition exists for a victim with a spinal injury, its best to move the victim by pulling them by their _____(clothes).
58. The following are signs of a _____(fracture); Deformity, swelling, discoloration, loss of function, grating sounds, pain, and a possibility of exposed bones.
59. In fractures, _____(cold) compresses may be applied directly to the wound.
60. If fractures are treated with an improvised splint, the splint should be long enough to support _____(joints) above and below the fracture.
61. When splints are applied to limbs, the _____(fingers) or _____(toes) should be exposed to check circulation.

62. If inflatable splints are used, they should be checked when exposed to extreme changes in _____(temperature).
63. A serious danger associated with broken ribs is possible hazards to the _____(lungs).
64. A possible symptom of a punctured lung would be _____(frothy blood) in the victim's mouth.
65. A _____(dislocation) is a separation of two bones that usually fit together to form a joint.
66. Usually a noticeable symptom of a dislocation is _____(deformity).
67. An accident victim that has one leg longer than another leg may be suffering from a dislocated or fractured _____(hip).
68. A wound to the skin that is caused by rubbing or scraping is usually referred to as a (an) _____(abrasion).
69. To reduce the chance of infection, wounds should be directly covered with a _____(sterile) material.
70. Should bandages become blood soaked, they should not be _____(removed).
71. Second-degree burns can be characterized by the forming of _____(blisters).
72. Third degree burns are sometimes _____(painless) because nerves are destroyed.
73. Burns should be treated by cooling the burn and then applying _____(dry), sterile gauze.
74. The _____(first aid caregiver) is responsible to see that an injured person is transported safely.
75. Under normal circumstances, do not move an accident victim until a thorough _____(examination) is made.
76. Patients should be transported without being subjected to further _____(injury), shock, or unnecessary pain.
77. The great danger with a fractured pelvis is that the _____(Bladder) may be punctured.
78. The Radial pulse and pressure point is located at the _____(Wrist).
79. In the lungs, _____(Carbon Dioxide) and other waste products of the body are exchanged for oxygen.

Difficult Questions

80. The most common things that cause breathing to stop are drowning, suffocation, dangerous gases, and _____(electric shock).
81. Without oxygen, brain cells will begin to die in _____(4 to 6) minutes.
82. If artificial ventilation is started, it should only be stopped when the victim revives, another person as qualified or more qualified than you relieves you, the scene becomes unsafe, or _____(you are physically unable to continue).
83. The average adult has about _____(ten to twelve) pints of blood.
84. In adults, the loss of _____(3) pints of blood is usually life threatening.
85. Death from bleeding can occur in as little as _____(30) seconds.
86. Thread like arteries that carry blood to all body tissue are called _____(capillaries).
87. Perhaps the greatest danger of bleeding from capillaries is _____(infection).
88. Some signs of skull fracture are unconsciousness, skull deformity, blood or fluid seeping from ears and nose, sleepiness, open head wound, and _____(unequal) pupils.
89. Do not try to remove _____(embedded) objects from a wound.
90. In the treatment of serious burns, _____(grease) or _____(oil) should not be applied.

91. Burned surfaces should not be allowed to _____(contact) each other.
92. The two dangers associated with open wounds are _____ (severe bleeding) and _____(infection).
93. What is the term for a narrow, deep, open wound caused by a pointed instrument? (puncture)
94. Name one instance when you do not raise the legs of a victim of shock. (Severe bleeding from the head, or leg injury, or spinal injury).
95. The purpose of a sling is to support and _____(immobilize) the limb.
96. The _____(Good Samaritan Law) is to protect citizens who render assistance to someone who is injured or ill.
97. The entire supply of blood in the body circulates through the body in an average time of _____(75 seconds).
98. A mixture of blood and serum flowing from one or both ears is one symptom of a _____(fractured skull).
99. Bleeding from _____(capillaries) is usually not serious.
100. The thin muscle located under the lungs is the _____(diaphragm).
101. When a bone is broken, but there is little displacement of the broken end, it is called a _____(simple) fracture.
102. The edges of a _____(laceration) wound are bruised and torn.
103. The _____(Brachial) pressure point is used to control bleeding when an arm has been cut.
104. The person with first aid training should _____(Not Remove) embedded objects from a puncture wound.
105. If you are the first to arrive at the scene of an accident, the first thing to check for is _____(hazardous conditions).

14. Mine Gases

MSHA Pamphlet on Mine Gasses. Order "Safety Manual No.2 - Mine Gasses"

Confined Spaces



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC 815 - Confined Spaces in Mining - MSHA 1994 - 9 min



Below are listed (in order of occurrence) the MNM Fatalgrams involving Mine Gases. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1999

19. 05/18/1999 - Other - Underground - Gold - Owner overcome by carbon monoxide at bottom of shaft.

15. Explosives



The following videos are available from the Mine Safety and Health Academy at Beaver, WV. For the most up-to-date listing of available videos, visit the MSHA Internet site at:

<http://www.msha.gov/TRAINING/prodintr.htm>

VC904 - Use of Explosives (Underground Salt) - MSHA 1995 - 10



Below are listed (in order of occurrence) the MNM Fatalgrams from 1995 to 1999 involving Explosives. (See Appendix 2 for complete list of fatalgrams from 1995 to 1999.) Recent fatalgrams may be found at MSHA's Internet Site: www.msha.gov/fatals/fab.htm .

1995

38. 10/06/1995 - Explosives/Breaking Agents - Surface - Granite - CA - Quarryman drills into unexploded charge.

1996

18. 05/08/1996 - Explosives & Breaking Agents - Surface - Stone (CB) - Primer detonates as worker is preparing it.

1997

40. 07/16/1997 - Explosives - Surface - Traprock (CB) - CT - Blaster, freeing up hang-up, detonates charge.

1999

52. 12/21/1999 - Explosives - Surface - Crushed Limestone - Miner guarding blast site hit by fly rock.

Explosives in Mining Operations

- I. When blasting is being conducted at surface mines, a code of blasting signals shall be posted in one or more conspicuous places at the operation, and employees shall be required to familiarize themselves with the code and conform to it.

Example of surface blasting signals. (Signals given by a horn or siren)

Warning signal-- a one-minute series of long blasts five minutes prior to the blast signal.

Blast signal--- a series of short blasts one minute prior to the shot

All clear signal-- a prolonged blast following the inspection of the blast site.

- Normally, the certified blaster and/or surface foreman block roads leading to the blast area.
- II. Vehicles carrying blasting materials are identified by a sign, usually diamond-shaped, which indicates the class type explosive being carried. (Class a or class b type explosives.) Explosives must be carried in vehicles specifically designed for transporting explosives.
- III. Explosive storage area, magazines or bulk ANFO storage areas are clearly marked with signs stating "danger explosives" and "no smoking."
- IV. Powder magazines must not be within 300 feet of mine openings, occupied buildings or public roads, or any other designated road, to promote safety. However, if sufficiently barricaded and approved, magazines may be located less than 300 feet from roads. Magazines are kept locked when unattended.
- V. Any time blasted rock is hauled from a mine site, there is a chance that un-detonated explosives are included.
- VI. If undetonated explosives are found, notify a powder representative to dispose of them.
- VII. "Never burn, bury or dissolve in water any types of blasting materials. Always contact a powder company representative.
- VIII Obey all warning signs concerning blasting areas and locations of powder magazines or bulk ANFO storage areas.
- IX. Stay well away from blasting areas, obey warning signals, and remain in your vehicle for added protection.
- X. Obey signs asking you to "turn-off two-way radios in blast area. Cellular type telephones should also be turned off.
- XI. "Never attempt to watch a shot being fired, be alert to fly-rock or any other unplanned event during blasting".
- XII. Persons have been killed by fly-rock as far as one half mile away.

Blasting and Explosives Handling



Blasting Safety- Questions for non-blasters

Correct Answers are CAPITALIZED

General Safety

1. Undetonated explosives are easy for anyone to identify. True / FALSE
2. A written blasting plan is required for using explosives. TRUE / False

Explosives Storage

3. An explosives magazine may be located near which of the following? a) power lines, b) fuel storage areas, c) damp, moisture laden areas, d) heavily populated areas, e) NONE OF THE ABOVE.
4. Explosive magazines should not be identifiable as such to the general public. (True/FALSE)
5. Explosives should never be stored with: a) Cast boosters, b) detonating cord, c) non-electric or other blasting caps, d) ALL OF THE ABOVE.

Transportation

6. Explosives and detonators must always be transported separately. (TRUE/False)
7. Never transport people or other materials in the cargo space along with blasting materials. (TRUE/False)
8. Only one warning sign is needed on vehicles transporting explosives True/FALSE

Handling And Use

9. Modern explosives are safe enough to be handled by personnel without special training. True/FALSE
10. If sensitive body areas are contacted by explosives material, they should be flushed with large quantities of water. TRUE/False
11. Only major roads leading to the blast site need guarding during a blast. True/FALSE
12. The guarding of haulage roads into the blast area is limited to active haul roads only. True/FALSE
13. Visual warning signals prior to a blast are an acceptable alternative to audible warning signals. True/FALSE
14. Prearranged signals and timetables need only be posted. True/FALSE

Avoiding Flyrock Damage Or Injury

15. Flyrock is a minor safety concern during blasting. True/FALSE
16. Keeping to the same blasting schedule from shot to shot minimizes flyrock damage. (TRUE/False)

Post Blast

17. Deteriorated or damaged explosives are not dangerous. True/FALSE
18. Never reuse any explosive material packaging. TRUE/False
19. Never burn explosive materials packaging in a confined area. TRUE/False
20. Stay away from blast area until fumes, dusts or mists have subsided. Never breathe dusts or vapors from explosive materials. TRUE/False
21. Misfires in muck piles are of little danger to large equipment. True/FALSE
22. Only an experienced competent person, knowledgeable of the blast design, locations and types of explosive materials, should handle misfires. TRUE/False

16. Other

General Safety



Class Exercise: Find as many violations in the following story as you can.

A Bad day at the Yoursen Mine

Pat Mibunns has just arrived at work at the Yoursen Mine for another day's work. Today, he is assigned to help dismantle a stacking conveyor for shipment to another property. He walks through the mud to the tool shed and grabs an impact wrench from the "needs inspection" pile of tools. Remembering that paperwork is all-important; he signs off the tool as having been inspected, in case foreman Borman asks. He also grabs a 100ft-extension cord that he has to yank out from under some other tools. Tossing the tool and cord in a service pickup, he immediately hops in, starts the engine and roars off to the pit (ignoring the "do not operate tag" which had fallen off the steering wheel anyway.)

Upon arrival at the conveyor, Pat finds out that this is the truck with the bad brakes. He conveniently stops the vehicle by sliding into a utility pole. He then discovers that the windshield is not as hard as his head and makes a blurry mental note to tell maintenance to also fix the windshield and the front bumper as well as the brakes.

After plugging the extension chord into a GFCI that has been plugged into a service outlet, he unravels the chord out to the conveyor and plugs in the impact wrench. The wrench fails to function. Slogging back to the service outlet, Pat discovers that the GFCI has tripped. He resets it. He tries the tool. It doesn't work. The GFCI tripped again. Pat unplugs the GFCI and plugs the tool directly into the service out let. The tool works. Except for the little tingling buzz that Pat gets while holding the tool, everything seems O.K.

Standing on several boxes, Pat proceeds to remove the bolts holding an unsupported section of the conveyor. As the last bolt comes out, the unsupported section of the conveyor is now free to seek support...from the ground below. At the same time, Pat is also seeking support from the ground, as the falling section of conveyor has disarranged his work platform.

Pat lands, butt first on a hard, wet and injurious surface. Pat's impact wrench lands next to Pat in the mud. Pat now discovers the source of the tingling he felt before as the electricity from energized tool casing also seeks the ground. With a good path to ground finally established, the impact wrench proceeds to incinerate itself. Pat is lucky he was wearing rubber boots when he was operating the tool before. Pat is lucky he isn't dead, or worse, cooked in his own body fat. (Adds a whole new meaning to the word "Barbecue" doesn't it?)

Foreman Borman is wandering by on his daily safety inspection. Seeing Pat Mibunns sitting next to the ruins of the conveyor, he wonders what the company wit is up to now. He then sees the sparking, smoldering impact wrench and wonders why fuse hasn't blown. Probably should not have replaced that fuse with a penny.

As Foreman Borman turns toward the main service cut-off switch on the damaged utility pole, he sees the pole majestically topple over onto the service truck. Sparks then ignite gasoline fumes from a leak in the gas tank. The resulting explosion sends both pole and utility truck sailing off into the next county, effectively cutting the power and ending this embarrassing and potentially deadly incident. At least until MSHA shows up and gives them enough fines to send them into Chapter 11 bankruptcy.

Moral of the story: "If this is in any way similar to your company, you and the company are living with one foot on a banana peel, and the other in the grave. Not good."

Appendix 1



Training Materials available On Line

We make no claims as to the accuracy of these materials, to their suitability for a specific purpose or to their compliance with current standards. All materials need to be checked for suitability and compliance with current standards. Materials are available for download at: <http://www.mine-safety.mtu.edu>.

Mine Safety Jopardy

This is a computer game (based on Jeopardy) using HTML, the language of the Internet. Because of the flexible nature of web-based documents, this makes for a very interactive presentation. See Appendix 3 for System Requirements and Rules.

1995-1998 Web Based Fatalgrams

These are the same fatalgrams that you can view at MSHA's web site, but these can be loaded onto your own hard drive, eliminating the need to access the MSHA web site.

1985-1994 Word 2.0 Fatalgrams

Fatalgrams in MS Word 2.0 format: This is a selection of modified metal/nonmetal MSHA fatalgrams from 1985 to 1994. The text portion of the fatalgram has been condensed to make the fatalgram more suitable for overhead projection. For a complete set of all of these earlier fatalgrams, a CD-ROM is available.

Surface MNM Mining Pictures and Clip Art

These are JPEG format pictures taken at surface mining operations and clip art done specifically for the mining industry.

Video Lesson Plan Generator

This is a template in MS Word 2.0 that makes it easier to create a lesson plan from any video. The template includes instructions.

PowerPoint Presentations

PowerPoint Slides: This is a selection of presentations created with Microsoft PowerPoint. For those people who don't have PowerPoint, these programs can be downloaded as stand-alone programs. With stand-alone programs, MS PowerPoint is not needed to run them. Also included in this section on the web site is an HTML preview version of the slides.

MS Word Documents

These are lesson plans & other documents in MS Word 2.0 format.

Other Materials

Other materials are continuously being added to the web site.

Videos Listing

List of videos available for loan in Michigan from our Video Library.

MSHA's Internet Site

This is a list of materials available at MSHA's Web Site.

Some Training Materials on MSHA's Internet Site -- <http://www.msha.gov>

Category	Sub-Category	Material	Internet Site
Accident Prevention	Remedies for fatalities	Post Accident Investigation Remedies	http://www.msha.gov/techsupp/arp/arpmain.htm
Accident Prevention	Solutions	Accident Solutions	http://www.msha.gov/techsupp/arp/arpmain.htm
Accident Prevention	Suggestions	A Bulletin Board of Your Suggestions	http://www.msha.gov/techsupp/arp/arpmain.htm
Accident Prevention	Tips	Accident Buster Awareness Tips	http://www.msha.gov/techsupp/arp/arpmain.htm
Accident Reports	Lists by Year	Listing of accidents & injuries reported	http://www.msha.gov/SAFEINFO.HTM
Dust	Control	Dust Control	http://www.msha.gov/S&HINFO/HEALTH.HTM
Dust	Silicosis	Silicosis Prevention	http://www.msha.gov/S&HINFO/HEALTH.HTM
Dust Control	Tips	Tips for Dusty Jobs	http://www.msha.gov/hhcm.htm
Equipment, mobile	Analysis of accidents	Analysis of Surf Powered-H Accidents	http://www.msha.gov/S&HINFO/SAFETY.HTM
Equipment, Mobile	Haulage	Powered Haulage Safety (125 slides - 1.5 hrs)	http://www.msha.gov/training/surfhaul/index.htm
Equipment, Mobile	Tires and rims	Tire and Rim Safety Awareness Prog.	http://www.msha.gov/S&HINFO/SAFETY.HTM
Fall Protection	Highwalls	Fall Protection on Highwalls(35 slides)	http://www.msha.gov/S&HINFO/SAFETY.HTM
Fatal accident information	Metal/Nonmetal	1995-2000 fatal grams/alert bulletins/reports	http://www.msha.gov/FATALS/FABM.HTM
Fatalities, non-employee	Site access	List of fatalities for 1999 & 2000	http://www.msha.gov/places/fatalstats.htm
Fatals -- listing by date	Metal/Nonmetal	2000, 1999, 1998 fatalities	http://www.msha.gov/FATALS/FAB.HTM
General	Holmes Bulletins	Holmes Safety Bulletins	http://www.msha.gov/S&HINFO/SAFETY.HTM
General	various	Safety Hazard Alert Bulletins	http://www.msha.gov/S&HINFO/SAFETY.HTM
General	various	Safety Hazard Pocket Cards	http://www.msha.gov/S&HINFO/SAFETY.HTM
General	various	Special Alert Bulletins	http://www.msha.gov/S&HINFO/SAFETY.HTM
General	various	Technical Papers	http://www.msha.gov/S&HINFO/SAFETY.HTM
Guarding	Equipment	MSHA's Guide to Equipment Guarding	http://www.msha.gov/s&hinfo/equipguard/equipguard.htm
HazCom	MSDS	MSDS Links	http://www.msha.gov/S&HINFO/HEALTH.HTM
Hazard Info	General	Safety Hazard Information	http://www.msha.gov/S&HINFO/SAFETY.HTM
Hazards, general	Small Mine Hazards	MSHA's Small Mine Pocket cards	http://www.msha.gov/SAFEINFO.HTM
Health Hazards	Hazard Information	Health Hazard Information	http://www.msha.gov/S&HINFO/HEALTH.HTM
Health Hazards	Health	Health Hazard Info	http://www.msha.gov/hhcm.htm
Injury reports	Lists by Year	Mine Injury Statistics & Summaries	http://www.msha.gov/STATS/STATINFO.HTM
Noise	Standards	Health Standards for Occup Noise Exp	http://www.msha.gov/S&HINFO/HEALTH.HTM
Noise	All	Noise resources - standard, measure, control	http://www.msha.gov/1999noise/noise.htm
Regulations	Title 30 CFR	Statutory and Regulatory Information	http://www.msha.gov/REGSINFO.HTM
Safety Information	general	Safety Information Home Page	http://www.msha.gov/S&HINFO/SAFETY.HTM
Training module	Sand & Gravel	Description of 19 topics	http://www.msha.gov/training/part46/ig40/ig40.htm

Appendix 2

Short M/NM Fatalgram Descriptions

The following is a list of MSHA fatalgrams and bulletins that can be used to illustrate hazards associated with the topic areas listed in the previous chapter of this manual. The fatalgrams are available as a compressed computer file in the HTML format (fatmain.zip), located at our web site: <http://www.mine-safety.mtu.edu>

The most recent Fatalgrams can be accessed at MSHA's Internet Site at: www.msha.gov/fatals/fab.htm

All fatalgrams for each year are listed in alphabetical order according to accident type.

1995

53 fatalities occurred in metal/nonmetal mining for the calendar year of 1995.

04/10/1995 - Electrical - Surface - Limestone - FL - Forman electrocuted when crane contacts power line.
 09/07/1995 - Electrical - Underground - Potash - NM - Underground mechanic contacts bare 480-volt line to fan.
 09/12/1995 - Electrical - Surface - Phosphate - FL - Lineman electrocuted when connecting power to slurry pump.
 09/23/1995 - Electrical Surface - Potash - NM - Electrician's tool contacts energized line & ground in electric box.
 10/31/1995 - Electrical - Mill/Prep Plant - Copper - AZ - Electrician contacts energized feeder buss
 12/08/1995 - Electrical - Surface - Traprock - NJ - Crusher operator electrocuted at traprock quarry.
 10/06/1995 - Explosives/Breaking Agents - Surface - Granite - CA - Quarryman drills into unexploded charge.
 01/05/1995 - Fall of Highwall - Surface - Gold - SD - A large fall of material onto a shovel loading a haul truck.
 05/19/1995 - Fall of Highwall - Surface - Sand & Gravel - WA - Crusher operator covered when highwall collapses.
 05/19/1995 - Fall of Highwall - Surface - Sand & Gravel - WA - 5 year old boy engulfed when highwall collapses.
 10/20/1995 - Fall of Roof - Underground - Lead/Zinc - TN - Worker outside his scaler is stuck by roof fall.
 01/12/1995 - Falling/Sliding Material - Surface - Gold - NV - Powderman struck by falling prill tank.
 02/10/1995 - Falling/Sliding Material - Mill/Prep Plant - Limestone - VA - Cement form collapses on carpenter.
 02/24/1995 - Falling/Sliding Material - Surface - Stone - CA - Stockpile sloughs and covers customer truck driver.
 08/21/1995 - Falling/Sliding Material - Underground - Platinum - MT- Rock in chute breaks free & miner covered.
 04/04/1995 - Fire - Surface - Gold - NV - Driver burned when haul truck catches fire.
 09/21/1995 - Hand Tools - Surface - Clay - GA - Worker struck by falling sledge hammer.
 11/30/1995 - Handling Material - Surface - Sand and Gravel - CA - Worker dies after surgery on back injury.
 02/17/1995 - Machinery - Surface - Limestone - MO - Driller's clothing caught on moving drill stem.
 03/10/1995 - Machinery - Surface - Copper - NV - Wood chipper yoke moves crushing contractor employee.
 08/03/1995 - Machinery - Surface - Granite - GA - Ledge man fell when ladder struck by falling grout rock.
 08/16/1995 - Machinery - Surface - Limestone - NY - Contract dozer operator falls under his moving dozer.
 08/20/1995 - Machinery - Surface - Nonmetal - PA - Truck driver struck when suspended steel plates falls.
 09/18/1995 - Machinery - Surface - Sand & Gravel - CA - Dozer goes through berm and falls into water filled pit.
 10/04/1995 - Machinery - Mill/Prep Plant - Sand & Gravel - MD - Foreman falls off weight being lifted by crane.
 12/05/1995 - Machinery - Surface - Limestone - TN - Welder killed in crusher when it unexpectedly started.
 12/14/1995 - Machinery - Surface - Limestone - OH - Dozer runs over operator.
 12/22/1995 - Machinery - Surface - Sand & Gravel - MI - Truck driver crushed as conveyor slips off crane hook.
 12/27/1995 - Machinery - Mill/Prep Plant - Borate - NV - Cable breaks holding crane basket with 2 men.
 11/03/1995 - Other (Drowning) - Mill/Prep Plant - Lime - MI - Worker found drowned near plant dock.
 12/12/1995 - Other (Drowning) - Dredge Mining - Sand & Gravel - MS - Employee falls into water from johnboat.
 02/03/1995 - Other (Seismic Event)- Surface - Trona - WY - Massive underground pillar failure.
 01/10/1995 - Powered Haulage - Surface - Clay - GA - A truck spotter is run over by a truck.
 01/18/1995 - Powered Haulage - Surface - Copper - AZ - Truck goes through berm of waste rock dump.
 02/02/1995 - Powered Haulage - Surface - Sand & Gravel - AZ - Loader goes over edge of 30-ft slope.
 03/14/1995 - Powered Haulage - Surface - Granite - AL - Fast moving water truck rolls over in turn.
 03/17/1995 - Powered Haulage - Surface - Limestone - MO - Truck driver struck by another truck backing up.
 03/27/1995 - Powered Haulage - Surface - Boron Minerals - CA - Mechanic's vehicle is run over by haul truck.
 05/12/1995 - Powered Haulage - Surface - Gold - NV - Water truck driver rolls truck.
 05/22/1995 - Powered Haulage - Mill/Prep Plant - Cement - NV - Mechanic under vehicle when it moves.
 07/19/1995 - Powered Haulage - Surface - Molybdenum - CO - Delivery truck driver struck by falling beam.
 08/03/1995 - Powered Haulage - Surface - Sand & Gravel - CT - Loader tips into pit when pitwall sloughs.
 09/19/1995 - Powered Haulage - Surface - Gold - AK - Apprentice truck driver overturns truck into trench.

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10/03/1995 - Powered Haulage Surface - Granite - SC - Truck drives through berm and over 50-ft highwall.
10/09/1995 - Powered Haulage - Mill/Prep Plant - Uranium - UT - Unattended truck tractor rolls over truck driver.
10/31/1995 - Powered Haulage - Underground - Salt - LA - Worker struck by loader backing through vent curtain.
12/09/1995 - Powered Haulage - Surface - Gold - NV - Haul truck goes over berm on elevated waste dump.
12/11/1995 - Powered Haulage - Surface - Sand & Gravel - MO - Employee crushed by descending dump truck bed.
12/24/1995 - Powered Haulage - Underground - Copper - AZ - Truck operator run over by truck.
05/31/1995 - Slip/Fall of Person - Surface - Limestone - FL - Contract worker falls 42 feet off of conveyor.
06/09/1995 - Slip/Fall of Person - Surface - Copper - MT - Mechanic falls while changing hinge pin on haul truck.
08/19/1995 - Slip/Fall of Person - Surface - Granite - SC - Contract project manager falls from conveyor.
09/01/1995 - Slip/Fall of Person - Surface - Sand & Gravel - VA - Equipment operator falls washing conveyor.

1996

46 fatalities occurred in metal/nonmetal mining for the calendar year of 1996.

04/26/1996 - Electrical - Surface - Stone (CB) - AR - Plant operator contacts energized metal building.
07/21/1996 - Electrical - Surface - Limestone - VA - Boy electrocuted in water energized by faulty conveyor.
05/08/1996 - Explosives & Breaking Agents - Surface - Stone (CB) - Primer detonates as worker is preparing it.
05/28/1996 - Fall of Face/Highwall - Surface - Sandstone (DM) - NC - Company VP struck by falling rock.
12/17/1996 - Fall of Face/Highwall - Surface - Limestone (CB) - Contract blaster falls when ledge gives way.
07/24/1996 - Fall of Rib - Underground - Gold - NV - Driller engulfed by roof fall.
05/10/1996 - Fall of Roof/Back - Underground - Limestone (CB) - MO - Fall of roof crushes pickup (1).
05/10/1996 - Fall of Roof/Back - Underground - Limestone (CB) - MO - Fall of roof crushes pickup (2).
07/17/1996 - Falling/Sliding Material - Surface - Limestone - KY - Welder engulfed when surge pile sloughs.
09/16/1996 - Falling/Sliding Material - Surface - Cement - PR - Worker burned when kiln material breaks loose.
09/16/1996 - Falling/Sliding Material - Surface - Cement - PR - Worker burned when kiln material breaks loose.
10/09/1996 - Falling/Sliding Material - Surface - Granite (CB) - NC - Worker pinned between when block slips.
03/09/1996 - Hand Tools - Underground - Gold - NV - Contract core driller struck in head by wrench.
02/09/1996 - Handling Material - Surface - Limestone - TX - Refractory worker struck by kiln liner.
02/09/1996 - Handling Material - Surface - Limestone - TX - Refractory supervisor struck by kiln liner.
03/20/1996 - Handling Material - Surface - Sand and Gravel - CA - Mechanic struck when moving a spreader bar.
04/10/1996 - Ignition or Explosion of Gas - Surface - Sand and Gravel - UT - Welding causes fuel tank to explode.
02/14/1996 - Machinery - Surface - Sand and Gravel - CA - Mechanic run over by tracked drill rig.
04/23/1996 - Machinery - Surface - Stone (CB) - NV - Worker driving mobile crane hits bump and tips over.
10/29/1996 - Machinery - Surface - Limestone - SC - Backhoe slips into water-filled pit.
04/17/1996 - Other (Drowning) - Surface - Sand and Gravel - MD - Boat from dredge capsizes (1).
04/17/1996 - Other (Drowning) - Surface - Sand and Gravel - MD - Boat from dredge capsizes (2).
07/28/1996 - Other - Surface - Boron Mineral - CA - Contractor heating lug nuts stuck when loader tire explodes.
01/11/1996 - Powered Haulage - Surface - Traprock - OR - Worker riding as passenger falls from loader.
01/25/1996 - Powered Haulage - Surface - Copper - AZ - Haul truck backs through berm at dumpsite.
02/06/1996 - Powered Haulage - Surface - Granite - PA - Worker caught between skid-steer loader lift arm & ROPS.
02/15/1996 - Powered Haulage - Surface - Limestone - OK - Loader backs over plant operator
03/19/1996 - Powered Haulage - Surface - Copper - AZ - Electrician in pickup truck run over by haul truck.
04/03/1996 - Powered Haulage - Underground - Zinc - TN - Operator run over by his own loader.
05/07/1996 - Powered Haulage - Surface - Stone (CB) - OR - Worker caught between two crushers during setup.
05/16/1996 - Powered Haulage - Surface - Sand and Gravel - IA - Worker on conveyor caught when it's started.
05/18/1996 - Powered Haulage - Underground - Gold - CA - Supervisor's truck rolls over embankment.
06/19/1996 - Powered Haulage - Surface - Sand and Gravel - IL - Customer truck driver run over by haul truck.
06/29/1996 - Powered Haulage - Surface - Limestone - OK - Worker crushed while working from loader bucket.
07/08/1996 - Powered Haulage - Surface - Limestone - IL - Mechanic crushed when haul truck starts unexpectedly.
10/04/1996 - Powered Haulage - Surface - Limestone - TX - Worker falls between rail cars & is pinned by wheels.
10/09/1996 - Powered Haulage - Surface - Sand and Gravel - MT - Loader runs off road into trench.
11/05/1996 - Powered Haulage - Surface - Limestone (CB) - FL - Truck goes off road into a water-filled quarry.
11/18/1996 - Powered Haulage - Surface - Gold - NV - Worker backing truck down access road runs off edge.
12/02/1996 - Powered Haulage - Surface - Limestone - MI - Mechanic pinned between lift arm and loader body.
12/12/1996 - Powered Haulage - Surface - Limestone (CB) - Forklift overturns.
05/10/1996 - Slip/Fall of Person - Surface - Limestone (CB) - WI - Plant foreman falls off crusher.
06/26/1996 - Slip/Fall of Person - Surface - Sand and Gravel - PA - Worker falls through floor into bin.
08/07/1996 - Slip/Fall of Person - Surface - Limestone (CB) - MO - Contractor cement driver falls from truck.
09/10/1996 - Slip/Fall of Person - Surface - Sand and Gravel - MS - Worker slips off pipe from dredge to shore.
09/12/1996 - Slip/Fall of Person - Underground - Silver - ID - Timber repairman falls into raise.

1997

61 fatalities occurred in metal/nonmetal mining for the calendar year of 1997.

- 04/10/1997 - Electrical - Underground - Copper - AZ - Supervisor electrocuted dusting inside of electric cabinet.
- 05/16/1997 - Electrical - Surface - Clay (Common) - KY - Supervisor shocked by extension cords repaired wrong.
- 06/07/1997 - Electrical - Surface - Copper - NM - Supervisor puts test leads on breaker terminals and it explodes.
- 07/11/1997 - Electrical - Underground - Limestone (CB) - KY - Mechanic hooks up washer wrong; electrocuted.
- 08/08/1997 - Electrical - Surface - Traprock (CB) - NJ - Truck's elevated bed contacts power lines.
- 03/06/1997 - Exploding Vessels Under Pressure - Surface - Limestone (CB) - FL - Welding on tank = explosion.
- 07/16/1997 - Explosives - Surface - Traprock (CB) - CT - Blaster, freeing up hang-up, detonates charge.
- 02/03/1997 - Fall of Roof - Underground - Zinc - TN - Underground driller crushed in massive roof fall.
- 02/05/1997 - Fall of Roof - Underground - Gold -NN - Miner, who had been scaling, found under roof fall.
- 02/15/1997 - Fall of Face/Highwall - Surface - Limestone (CB) - MO - Rock breaks free and falls on excavator.
- 02/26/1997 - Fall of Face/Highwall - Surface - Iron Ore - CA - Drilling over abandoned mine; ground caves.
- 04/01/1997 - Fall of Face - Underground - Limestone (CB) - TN - Ground fall from a pillar crushes driller.
- 08/18/1997 - Falling/Sliding Material - Surface - Limestone (CB) - IL - Driver buried when stockpile sloughs.
- 10/07/1997 - Falling/Sliding Material - Surface - Sand and Gravel - Supervisor struck as barrier plate falls off crusher.
- 12/18/1997 - Falling/Sliding Material - Surface - Granite (DM) - GA - Ledgeman has slab of granite fall on him.
- 04/21/1997 - Hand Tools - Surface - Limestone (CB) - TN - Mech struck by loader arm when hydraulics released.
- 06/20/1997 - Hand Tools - Surface - Limestone (CB) - MO - Worker struck as come-along holding fender fails.
- 08/06/1997 - Hand Tools - Surface - Clay (Comm) - GA - PVC pipe from flatbed trailer falls on truck driver.
- 05/26/1997 - Hoisting - Underground - Gold - NV - Contractor employee struck by shaft sinking bucket.
- 01/08/1997 - Machinery - Surface - Sand and Gravel - WA - Mechanic caught in blade mill when it starts.
- 03/15/1997 - Machinery - Surface - Sand and Gravel - CA - Loader tire slips off hook on truck mounted boom.
- 04/26/1997 - Machinery - Surface - Limestone (CB) - FL - Tram chain slips causing dredge to slip into water.(1)
- 04/26/1997 - Machinery - Surface - Limestone (CB) - FL - Tram chain slips causing dredge to slip into water.(2)
- 07/24/1997 - Machinery - Surface - Limestone (CB) - TX - Rail wheels fall off blocking, landing on mechanic.
- 09/03/1997 - Machinery - Surface - Limestone (CB) - IL - Hammer feed chain broke causing driller to fall.
- 09/08/1997 - Machinery - Surface - Cement - TX - Machinist caught when crane hoist drum he was on, moved.
- 09/29/1997 - Machinery - Surface - Limestone (CB) - Service technician has suspended loader tire fall on him.
- 05/05/1997 - Other (Drowning) - Surface - Sand and Gravel - OR - Maintenance coordinator found drowned.
- 12/25/1997 - Other (Drowning) - Surface - Phosphate - FL - Guard's pick-up truck traveled over a berm into a ditch.
- 10/27/1997 - Other - Surface - Sand and Gravel - NJ - Dredge operator falls from the boat after starting motor.
- 01/14/1997 - Powered Haulage - Surface - Gold - NV - Crusher helper caught in conveyor tail pulley when it starts.
- 01/15/1997 - Powered Haulage - Underground - Gold - NV - Employee walking along rib crushed by loader.
- 02/03/1997 - Powered Haulage - Surface - Sand and Gravel - CA - Operator found under pile of material.
- 02/03/1997 - Powered Haulage - Surface - Stone (CB) - OR - Haul truck slips off elevated road into pond.
- 02/14/1997 - Powered Haulage - Surface - Stone (CB) - TX - Loader drives over edge of highwall.
- 02/17/1997 - Powered Haulage - Surface - Sand and Gravel - KS - Driver exits his truck; is run over by other truck.
- 02/20/1997 - Powered Haulage - Surface - Gold - SC - Worker doing pre-shift run over when truck is started.
- 02/24/1997 - Powered Haulage - Surface - Sand and Gravel - KS - Driver drove his truck into a pond.
- 03/13/1997 - Powered Haulage - Surface - Gold - CA - Foreman's pickup goes off roadway and rolls down slope.
- 03/24/1997 - Powered Haulage - Surface - Sand and Gravel - TX - Operator caught in the tailpulley.
- 04/09/1997 - Powered Haulage - Surface - Limestone (CB) - MO - Material slides, engulfs worker taking sample.
- 04/26/1997 - Powered Haulage - Surface - Granite (CB) - AZ - Welder jumps from loader and is run over.
- 05/02/1997 - Powered Haulage - Surface - Sand and Gravel - MI - Foreman wedged between conveyor and idler.
- 06/06/1997 - Powered Haulage - Surface - Limestone (CB) - IL - Bump causes driver to strike head on cab frame.
- 07/08/1997 - Powered Haulage - Surface - Granite (CB) - NC - Over-the-road truck is struck by a freight train.
- 07/09/1997 - Powered Haulage - Surface - Limestone (CB) - Over-the-road truck struck by a freight train.
- 07/19/1997 - Powered Haulage - Surface - Sand and Gravel - CO - Operator pinned between machine parts
- 07/25/1997 - Powered Haulage - Surface - Traprock (CB) - MA - Driver loses control, goes up over a berm.
- 08/28/1997 - Powered Haulage - Underground - Boron Mineral - CA - Worker run over by load-haul-dump unit.
- 09/16/1997 - Powered Haulage - Surface - Gold - NV - Contract truck driver run over as he tried to stop rollaway.
- 09/30/1997 - Powered Haulage - Surface - Sand and Gravel - NH - Scraper runs over stockpile and rolls over.
- 10/20/1997 - Powered Haulage - Surface - Granite (CB) - GA Worker in front of train run over when train moves.
- 11/12/1997 - Powered Haulage - Surface - Sand and Gravel - NY - Crusher operator is entangled in the tail pulley.
- 12/03/1997 - Powered Haulage - Surface - Sand and Gravel - NY - Laborer caught in machinery & drawn into washer.
- 01/17/1997 - Slip/Fall of Person - Surface - Cement - FL - Contractor employee fell through opening in handrail.
- 04/22/1997 - Slip/Fall of Person - Underground - Copper - AZ - Trapper/car loader falls from ladder.
- 04/27/1997 - Slip/Fall of Person - Surface - Lime - IA - Truck driver falls off trailer.
- 06/25/1997 - Slip/Fall of Person - Surface - Cement - UT - Maintenance specialist falls 13 ft down mill elevator shaft.
- 08/19/1997 - Slip/Fall of Person - Surface - Sand and Gravel - CA - Contract electrician/welder falls 10-12 feet.
- 09/28/1997 - Slip/Fall of Person - Surface (Dredge) - Sand and Gravel - Superintendent falls off stone barge.

10/20/1997 - Slip/Fall of Person - Surface - Stone (CB) - ID - Owner/operator falls into operating jaw crusher.

1998

49 fatalities occurred in metal/nonmetal mining for the calendar year of 1998.

08/28/98 - Electrical - UG - Soda Ash - Superintendent electrocuted while checking cable with hands.
04/22/98 - Exploding Vessels Under Pressure -Surface -Limestone - Tire explodes as torch cuts brake drum.
08/23/98 - Exploding Vessel - Surface - Iron Ore - Shift manager over-inflates a waterline patch.
08/28/98 - Exploding Vessel - Surface - S&G - Maintenance man over-inflates deteriorated tire.
04/16/98 - Fall of Material - Surface - Sand & Gravel - Plant superintendent struck by falling screen cloth.
10/12/98 - Fall of Material - Surface - Lime - Bin collapsed over victim, engulfing him in material.
11/04/98 - Fall of Rib - UG - Uranium - Material falls from the rib, crushing driller.
01/19/98 - Fall of Roof - Underground - Lead/Zinc - An area of the back falls on surveyor.
03/04/98 - Fall of Roof - Underground - Copper - Miner installing pony sets struck by fall of ground.
01/21/98 - Hand Tools - Surface - Sand and Gravel - Laborer struck by hammer thrown from crusher.
02/06/98 - Handling Material- Surface -Sand and Gravel - Customer engulfed when loading from stockpile.
02/25/98 - Machinery - Surface at Underground - Copper - Salvage worker struck by falling material.
04/29/98 - Machinery - Surface - Sand & Gravel - Dozer operator is struck when towing chain breaks.
04/30/98 - Machinery - Surface - Stone (CB) - Crusher operator struck by hammer dropped into crusher.
05/26/98 - Machinery - Surface - Sand & Gravel - Crusher operator tangled in unguarded shaft coupling.
06/22/98 - Machinery - Surface - Limestone (CB) - Superintendent caught between track and frame of dozer.
07/14/98 - Machinery - Surface - Sand and Gravel - Dredge operator drawn into crusher drive belts.
09/02/98 - Machinery - Surface - Crushed Stone - Dozer rolls into pit after narrow bench collapses.
02/07/98 - Other - Surface - Phosphate - Man lift crane topples with maintenance mechanic.
03/06/98 - Other - Surface - Sand and Gravel - Deck hand on dredge found under skiff.
12/07/98 - Other (Drowning) - Surface - Limestone - Construction worker drowned when floating pump tipped.
01/19/98 - Powered Haulage - Surface - Limestone (CB) - Truck driver loses control and strikes berm.
02/13/98 - Powered Haulage - Surface - Molybdenum - Driver loses control of truck and goes over berm.
03/13/98 - Powered Haulage - Surface - Limestone (CB) - Driver pinned between trailers as truck moves.
03/14/98 - Powered Haulage - Surface - Sand and Gravel - Welder drawn into stockpile chute.
04/11/98 - Powered Haulage - Surface - Sandstone - Plant manager caught between tail and snubber pulley.
04/28/98 - Powered Haulage - Surface - Limestone (CB) - Worker is caught in conveyor.
04/29/98 - Powered Haulage - Surface - Traprock (CB) - Mechanic caught in conveyor while adjusting it.
05/04/98 - Powered Haulage - Surface - Granite (CB) - Mechanic repairing rail car struck by car.
05/14/98 - Powered Haulage - Surface - Limestone (CB) - Haul truck backs over edge of waste dump pile.
05/28/98 - Powered Haulage - Surface - Sand & Gravel - Truck driver struck by following truck.
07/01/98 - Powered Haulage - Open Pit- Cement - Serviceman in sweeper struck by rail car.
07/23/98 - Powered Haulage - Surface - Clay - Water truck jack-knives.
08/01/98 - Powered Haulage - Surface - Alumina - Contractor crushed by improperly blocked bucket.
08/15/98 - Powered Haulage - Surface - Crushed Granite - Security guard run over by his own truck.
09/18/98 - Powered Haulage - Surface - Sandstone - Defective loader attachment actuated.
09/18/98 - Powered Haulage - Surface - S& G - Loader operator backs over pitwall.
09/22/98 - Powered Haulage - Surface - S& G - Dozer operator on surge pile is pulled into draw point.
09/28/98 - Powered Haulage - Surface - Gold - Contract mechanic struck by a 190-ton haul truck.
11/05/98 - Powered Haulage - UG - Salt - Operator of rear-steer loader struck head while it was outside of cab.
11/09/98 - Powered Haulage - Surface - Granite - Haul truck goes over loaded out stockpile wall; wall collapses.
01/19/98 - Slip/Fall of Person - Surface - Limestone - Welder falls 50 feet from the top of a hopper.
01/27/98 - Slip/Fall of Person - Underground - Silver - Shaft repairman falls into shaft trying to free skip.
03/12/98 - Slip/Fall of Person - Surface - Crushed Stone - Truck driver, climbing back of truck, falls.
05/06/98 - Slip/Fall of Person - Surface - Limestone (CB) - Co-owner falls over highwall while burning trash.
07/17/98 - Slip/Fall of Person - Surface - Limestone - Service contractor replacing glass, slips off loader.
08/18/98 - Slip/Fall of Person - Surface - Boron - Contract driller drowns after slipping into sump.
08/21/98 - Slip/Fall of Person - Surface - Clay - Laborer engulfed in rail hopper car material.
11/13/98 - Slip/Fall of Person - Surface - Limestone - Ironworker falls 40 feet from beam.

1999

52 fatalities occurred in metal/nonmetal mining for the calendar year of 1999.

07/01/99 - Electrical - Surface - Limestone - Contractor electrician electrocuted when contacting 4160 transformer.
09/07/99 - Electrical - Surface - Granite - While stringing inactive powerline, line contacts active 40,000-volt line.
10/20/99 - Electrical - Surface - Phosphate - Electrician connecting conductors in panel when power was turned on.
11/29/99 - Electrical - Surface - S&G - Miner electrocuted when clamp contacted 440-v line on discharge hose.
02/17/99 - Exploding Vessels - Surface - S& G - Tire ruptures when contract technician heats wheel with torch.

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10/30/99 - Exploding Vessels - Surface - S& G - Mechanic mounting loader wheel struck when wheel exploded.
12/21/99 - Explosives - Surface - Crushed Limestone - Miner guarding blast site hit by fly rock.
02/27/99 - Fall of Highwall - Surface - Limestone - Contract driller struck by rock falling from highwall.
10/26/99 - Fall of Rib/Pillar - UG - Limestone - Worker struck by rock from rib while scaling.
10/12/99 - Fall of Roof/Back - UG - Gold - Roof fell while workers (2) were installing roof bolts.
10/23/99 - Fall of Roof/Back - UG - Gold - Driller struck by rock from back while inspecting drill holes.
11/09/99 - Fall of Roof - UG - Gold - 62 y old mine found under rock.
01/20/99 - Fall/Slide Material - Surface - Limestone - Contract welder pinned by feeder being hoisted by crane.
01/27/99 - Fall/Slide Material - Surface - Cement - Contractor was engulfed by sliding material in silo.
02/15/99 - Hand Tools - UG - Gold - Miner struck by violently whipping high-pressure air hose.
06/27/99 - Handling Material - Surface - Limestone - Quarry owner struck by loader wheel when removing it.
10/18/99 - Hoisting - UG - Lead/Zinc - Ore Worker pulled into roller guard when safety lanyard catches bolt.
05/26/99 - Ignition/Explosion of Gas - Surface - S& G - Man struck by impeller hub after heating it to remove it.
02/01/99 - Machinery - Surface - Limestone - Maintenance worker struck by boom while dismantling crane.
02/03/99 - Machinery - Surface - Zircon - Shipping operator crushed my mechanical sampler arm.
03/29/99 - Machinery - Surface - Limestone - Equipment operator struck by rock falling from highwall.
04/07/99 - Machinery - Surface - Stone - Driller struck in head when compressed air pipe connection fails.
04/08/99 - Machinery - Surface - Gypsum - Maintenance supervisor struck by suspension rod he was heating.
06/28/99 - Machinery - Surface - Sand & Gravel - Production manager drowns when backhoe slips into pond.
07/09/99 - Machinery - Surface - Limestone - Contractor crushed when his grader goes over bank of road
12/08/99 - Machinery - Surface - Crushed Limestone - Dozer overtravels embankment and falls into water.
05/07/99 - Other - Surface - Sand & Gravel - Crane operator drowns clearing logs from dredge anchor line.
05/18/99 - Other - UG - Gold - Owner overcome by carbon monoxide at bottom of shaft.
01/10/99 - Powered Haulage - UG - Gold Haul truck backed into victim's truck.
01/13/99 - Powered Haulage - Surface - S& G - Contract truck driver crushed by defective doors on asphalt truck.
02/15/99 - Powered Haulage - Surface - Copper - Contract technician pickup truck run over by 320-ton haul truck.
03/15/99 - Powered Haulage - Surface - Limestone - Truck driver backs truck off 100-ft highwall.
03/18/99 - Powered Haulage - Surface - Sand & Gravel - Superintendent caught in conveyor idler while cleaning it.
05/10/99 - Powered Haulage - Surface - Granite - Laborer struck by slab of rock from working face.
07/21/99 - Powered Haulage - UG - Gold - Mechanic repairing loader struck by unblocked bucket.
07/25/99 - Powered Haulage - Surface - Iron Ore - Plant repairman run over by skid-loader while directing cleanup.
07/27/99 - Powered Haulage - Surface - S& G - Plant operator engulfed while cleaning in feed hopper.
07/30/99 - Powered Haulage - Surface - Limestone - Haul truck overturns. Operator not wearing seat belt.
08/06/99 - Powered Haulage - Surface - S& G - Loader slips over elevated embankment. No seat belt worn.
08/09/99 - Powered Haulage - Surface - S&G - Laborer cleaning under conveyor is drawn into pinch point.
08/12/99 - Powered Haulage - Surface - S&G - Owner operator struck by grizzly being lifted by loader bucket.
09/16/99 - Powered Haulage - Surface - Uranium - Truck operator's water truck goes out of control.
09/29/99 - Powered Haulage - UG - Limestone - Laborer/operator crushed by loader boom.
10/14/99 - Powered Haulage - Surface - Limestone - Man servicing haul truck struck when driver drives away.
11/11/99 - Powered Haulage - Surface - Trap Rock - Driver run over by his own truck. Park brake not used.
11/18/99 - Powered Haulage - Surface - Limestone - Scraper lost power and went over edge of highwall.
12/23/99 - Powered Haulage - UG - Crushed Limestone - Worker caught in conveyor's self cleaning tail pulley.
04/01/99 - Slip/Fall of Person - UG - Gold - Contract supervisor fell down ore pass trying to catch fellow worker.
07/07/99 - Slip/Fall of Person - Surface - S& G - Contractor struck by falling hood of loader engine compartment.
07/22/99 - Slip/Fall of Person - Surface - S&G - Maintenance worker falls off on dragline shovel.
09/20/99 - Slip/Fall of Person - Surface - Gold - Welder installing catwalk grating falls. Not tied off.
10/12/99 - Slip/Fall of Person - Surface - Mill/Prep Plant Laborer falls from scaffolding that collapses.

Appendix 3

Other Exercises

Regulation Football

Regulation Football Rules

1. Divide the group into teams 7 to 10 each. Give them as many pocket copies of the safety regulations (could use our most-cited regulations) as are available for them to use during the game. (The day's content can also be reviewed, and playing safety trivia throughout the day with small candy awards for correct answers works great to prime the group and give everyone a chance when you repeat the questions).
2. Pick one referee from each team until you come up with an uneven number in case of split decisions (which are fairly frequent). Give the referees a copy of the questions and the answers.
3. The teams are given 20 seconds to begin answering the questions. One of the referees serves as the timekeeper, another as the scorekeeper and the third watches for unfair competition.
4. The trainer draws the cards and he reads off the question listing the number and page for the convenience of the referees.
5. Scoring - The score is kept on the flip chart by one of the referees. Scoring is done in points for each question. 10 yds - 1 pt.; 20 yds - 2 pts.; 40 yds. - 4 pts; field goal - 3 pts.; touchdown - 6 pts.; option card - the team may chose whatever yardage, field goal or touchdown they want; fumble card - the team loses its turn.
6. A little miniature football is necessary for the game. When a question is initially asked, the team it is asked of gets the football and keeps possession of it until the question is answered. If the team first asked the question doesn't start answering it within 20 seconds or answers it incorrectly the question passes on to the next team in a clockwise fashion. They are then given 20 seconds to answer the question. If they don't, it passes on until it is answered correctly or all teams have had a chance. Then the football passes to the next team in clockwise rotation and a new card is drawn and a new question asked.
7. The game usually runs for 30 minutes, sometimes 45 minutes. The team with the highest score at the end of the game gets the grand prize.

Reg. Football: 40 Yard & Touchdown Questions

1. What are the skills a person trained in first aid is required to perform? **.18010** patient assessment, artificial respiration, control bleeding, and treat shock, wounds, burns, and musculo-skeletal injuries.
2. In the final Policy on Examination of Working Places effective 11/18/96; What information must be included in the records to be kept? **1)** the date the examination was made **2)** the examiner's name, **3)** the working places examined.
3. When employees are overexposed to dust, what type of measures or controls does MSHA want the company to take first, before relying on respirators? **.5005:** engineering controls of some sort, to reduce or prevent exposure to airborne contaminants.
4. What's the minimum rating for a multipurpose dry chemical fire extinguisher? **.2**
Definition: a minimum rating of 2-A:10-B:C
5. What is the minimum amount of dry-chemical agent required in MSHA's definition of multi-purpose dry-chemical fire extinguisher? **.2** **Definitions:** minimum of 4.5 pounds
6. What three things are required in the examination of working places regulation? **.18002(a,b,c)** competent person designated by the operator to check once each shift, written record of such examinations to be kept for one year, operator shall promptly initiate appropriate action to correct such conditions and if imminent danger persons shall be withdrawn from area affected.
7. In places where persons work or travel in performing their assigned tasks, loose or unconsolidated material shall be: _____? **.3131** Sloped to the angle of repose or stripped back for at least 10 feet. Other conditions at or near the perimeter of the pit or quarry wall that create a fall-of-material hazard to persons shall be corrected.
8. Fill in the blank: What " _____ shall be provided and maintained to working places?" **.11001:** "Safe means of access"
9. Where elevated roadways are infrequently traveled and used by only service or maintenance vehicles, berms are not required if what conditions are met? **.9300(d)(1)-(5):** locked gates at road entrance; signs posted that the roadway is not bermed; reflective delineators along elevated shoulder; maximum speed limit posted; traction of road not impaired.
10. When is it allowable for a person to work alone? **.18020** He can communicate with others; can be seen or can be heard.
11. What is required for each branch circuit and how must it be labeled? **.12006** each branch circuit shall have a disconnect and labeled as to which circuit it controls.

12. Fill in the Blank: “Fixed ladders shall project at least _____ feet above landings, or _____ shall be provided above the landings.” **.11006:** 3 feet, substantial handholds
13. Before being placed into service, what must be done to self-propelled mobile equipment?
.14100 (a) pre-shift inspection (b) defects affecting safety corrected in a timely manner (c) When defects make continued operation hazardous, mobile equipment shall be taken out of service tagged and put in a designated area (d) Defects not corrected immediately but not affecting safety shall be reported to and recorded by mine operator, records kept until repaired.
14. To safely tow mobile equipment MSHA regulations require? **.14209** (a) a properly sized tow bar or other effective means of control (b) unless steering and braking are under the control of the equipment operator, a safety chain shall be used with tow bar.
15. The Blast Site is defined as: _____? **.6000 Definitions** the area where explosive material is handled during the loading, including the perimeter formed by the blast holes and 50 feet in all directions from loaded holes. The 50-foot rule applies in all directions along the full depth of the holes.
16. How often should fire extinguishers be hydrostatically tested? **.4201(a)(3):** according to Table C-1 or a schedule based on the manufacture’s specifications.
17. Once explosives loading operations begin, the only activity permitted within the blast site shall be: _____? **.6306** Activity directly related to the blasting operation and occasional haulage activity near the base of the highwall being loaded where no other haulage access exists.
18. Before starting crushers or moving self-propelled mobile equipment, what must equipment operators do? **.14200:** “shall sound a warning that is audible above the surrounding noise level or use other effective means to warn all persons who could be exposed to a hazard from the equipment.”
19. When must valves on compressed gas cylinders be protected by covers? **.16006:** “when being transported or stored, and by a safe location when the cylinders are in use”
20. Oxygen cylinders are not to be stored in rooms or areas used for the storage of _____ **.4601:** “flammable or combustible liquids, including grease”
21. What three things are required whenever a person enters a bin or hopper? **.16002(c):** lock out/tag out, lifeline and safety belt or harness, and a second person, similarly equipped monitoring and constantly adjusting the line to keep it as tight as needed, with minimum slack.
22. What three things are required for a correct, legal splice? **.12013(a)(b)(c):** Mechanically strong with electrical conductivity as near as possible to the original;

- Insulated equal to the original and sealed to exclude moisture; provided with damage protection as near as possible to the original including good bonding to the outer jacket.
23. The Act states that any person, including a miner, who knowingly makes a false statement either orally or in writing or who makes a false certification in an application, record, report, plan or training certificate or any other document required to be kept by MSHA shall be subject to a fine of up to _____ or imprisoned for up to ____years or _____. **New 2000 edition Miner's Rights Book pp. 44 - Section on False Statements & False Representations: Sect. 110f**
 24. What is the MSHA permissible exposure limit for noise in 8 hours? **.5050:** 90dBA
 25. Smoking is forbidden within how many feet of explosive material? **.6904:** 50 feet
 26. What's the definition of a Safety Can? **.2 Definitions:** an approved container, of not over five gallon capacity, having a spring-closing lid and spout cover
 27. What is the correct parking procedure for mobile equipment left unattended, including equipment on a grade? **.14207:** controls placed in a park position, parking brake set if provided, and wheels chocked or turned into a bank
 28. Many crushing plants have noise levels of 100 dBA or greater. What is the permissible number of hours for exposure at 100 dBA, if the noise level for the remainder of the shift is below 90dBA? **.5050:** 2 hours
 29. Fill in the blank: Unguarded conveyors next to travelways shall be equipped with: _____ or _____. **.14109:** emergency stop devices, or railings.
 30. Could a foreman or a truck driver be cited for not setting the parking brake in his vehicle if equipped with an automatic transmission and the transmission is placed in the park position? **.14207:** yes, the rule specifically states "...the controls are placed in the parked position and the parking brake, if provided, is set."
 31. What does the code say about providing separate toilet facilities for each sex? **.20008:** separate facilities shall be provided for each sex except where toilet rooms will be occupied by no more than one person at a time and can be locked from the inside.
 32. What determines the size and type of fire extinguisher at a particular location? **.4200(b)(1):** It must be capable of extinguishing fires of any class that would occur as a result of the hazards present.
 33. Name three restraint devices listed in the regulations that can be used as restraint devices at dump sites where an overtravel or overturn hazard exists? **.9301:** berms, bumper blocks, or safety hooks.
 34. When may berms have openings? **.9300(c):** to the extent necessary for roadway drainage.

35. What two regulations require that dust be controlled even if it's not related to employee health? **.9315:** when hazards to persons would be created due to impaired visibility & 58.620 the control of drill dust
36. Describe 3 types of acceptable transformer installations? **.12067:** totally enclosed, or at least 8 feet above the ground, or installed in a transformer house, or surrounded by a substantial fence at least 6 feet high and at least 3 feet from any energized parts, casings, or wires.
37. What must the label on the seatbelts in off-road equipment have on them? **.14130(h)** complies with SAEJ386 and SAEJ1194
38. List the three conditions that require the replacement of damaged glass in the operator's cab? **.14103:** If damaged windows obscure visibility necessary for safe operation; create a hazard to the equipment operator; or if absence of a window would expose the operator to hazardous environmental conditions.
39. What are three requirements for onsite fire equipment? **.4200(b)(2):** Onsite fire fighting equipment should be, strategically located, readily accessible and plainly marked.

Reg. Football: 20 Yard & Field Goal Questions

1. How large must electrical conductors be? **.12004** Electrical conductors shall of sufficient size and load carrying capacity.
2. What is the definition of a competent person? **.2 Definitions:** a person having abilities and experience that fully qualify him to perform the duty to which he is assigned.
3. The minimum vertical clearance above stair steps shall be: _____? **.11010 Stair step clearance** A minimum of seven feet, or suitable warning signs or similar devices.
4. True or False: MSHA is to be notified when mining begins at a location and when it ends at a location. **.1000:** True
5. What is the minimum requirement for parking brakes on self-propelled mobile equipment? **.14101(2):** "parking brakes shall be capable of holding the equipment with its typical load on the maximum grade it travels"
6. What type of containers shall waste or rags containing flammable or combustible liquids that could create a fire hazard be stored in? **.4104:** covered metal containers or an equivalent
7. How often should fire extinguishers be visually inspected? **.4201(a)(1):** at least once a month

8. What does the code say about manually operated horns provided on self-propelled mobile equipment as a safety feature? **.14132(a)**: “shall be maintained in a functional condition.”
9. How often do portable crushing plants have to do continuity and resistance tests on their grounding systems? **.12028**: every time they move. “immediately after installation, repair and modification; and annually thereafter.”
10. What do adequate First Aid supplies include? **.15001** blankets and stretchers
11. Fill in the blank: A wheel-mounted bell alarm must sound at least once for each _____ of reverse movement. **.14132(b)(1)(ii)**: three feet
12. T or F: Persons conducting the examination of working places must be “authorized to correct hazardous conditions found in the working place or be able to initiate such action promptly.” **.18002** True
13. When must overhead drive belts be guarded? **.14108**: when “the whipping action of a broken belt could be hazardous to person.
14. Multiple Choice: When is a fire extinguisher required on a loader?
a. always b. when fire could prevent escape **.4230(a)(1)**: b
15. Fill in the blank: “Fixed ladders shall be anchored securely and installed to provide at least _____ of toe clearance.” **.11005**: 3 inches
16. When is a berm required? **9300(a)**: “where a drop-off exists of sufficient grade or depth to cause a vehicle to overturn or endanger persons in the equipment.”
17. What must be posted at appropriate telephones? **.18012**: emergency telephone numbers
18. Can pulleys of conveyors be manually cleaned while the conveyor is in motion? **.14202**: No
19. Can machinery be lubricated while it is in motion? **.14204**: Yes, when application will not expose the person to injury
20. Where must "no smoking" signs be posted? **.4101**: “where a fire or explosion hazard exists”
21. When are traffic control signs required in a quarry? **.9100(b)**: when there is a hazardous condition. Examples - speed, right of way, direction of movement, use of headlights etc.
22. How often must emergency fire fighting drills be held for persons assigned to surface fire-fighting responsibilities? **.4331**: “at least once every six months”

23. What is MSHA's definition of Blast site? **.6000 Definitions:** The area where explosive material is handled during loading, including the perimeter formed by the loaded blastholes and 50 feet in all directions (30' if demarcated with a barrier) along the full depth of the hole.
24. T or F: Once the loading of explosives begins the only activity permitted in the blast site at the base of the highwall is the loader hauling shot rock to the jaw. **.6306:** False, only haulage activity if no other haulage access exists.
25. True or False: If a conveyor at ground level has a regular travelway immediately adjacent (right next to) to it on both sides, it must have an emergency stop device or a railing on both sides of the conveyor. **.14109 Policy Manual pg. 55a:** True
26. T or F: Compressed air receivers and other unfired pressure vessels are to be inspected by inspectors holding a valid National Board Commission and in accordance with the applicable chapters of the National Board Inspection Code, a Manual for Boiler and Pressure Vessel Inspectors. **.13015(a):** True
27. T or F: Self-propelled mobile equipment manufactured prior to July 1, 1969 is exempt from the ROPS and seatbelt requirements. **.14130(f)(i):** True
28. True or False: "A backup alarm system is only required when there is an obstructed view to the rear and an observer has not been provided." **.14132(b) Policy Manual pg.55c:** True
29. What shall protect circuits against excessive overloads? **.12001** fuses or circuit breakers of correct type and capacity.
30. ROPS shall have what permanently affixed to it? **.14130(c)** ROPS identification label
31. Electrical junction boxes, motor wiring boxes shall have what? **.12032** inspection and cover plates
32. T or F: When operating a grader from a standing position, the grader operator shall wear safety lines and a harness in place of a seat belt. **.14130(g):** True
33. Is it required that fuel lines be equipped with shut off valves at the source, with the exception of self-propelled equipment? **.4501:** Yes
34. T or F: Air receiver tanks are required to be equipped with pressure gages? **.13011:** True
35. When must a visible warning device be used for mobile equipment? a) all the time b) when parked mobile equipment creates a hazard c) none of the time d) running in traffic **.14208(a):** answer is 'b'
36. Smoking and use of open flames are prohibited within ____ ft of explosive materials. a) 10 ft b) 25 ft c) 50 ft d) 100 ft **.6904:** answer is 'c')

Regulation Football: 10-Yard Questions

1. How many people must be capable of providing first aid? **.18010** an individual available on all shifts.
2. What should be done when restricted clearance creates a hazard to persons? **.11008** the restricted clearance should be conspicuously marked.
3. What is required at dumpsites if danger of overtravel or overturning is present? **.9301** berms, bumper blocks, safety hooks or similar impeding devices.
4. How often must workplace exams be done? **.18002(a)** once each shift
5. How long must records of safety defects be kept? **.14100(d)** until defects are corrected
6. First Aid training shall be made available to whom? **.18010** all interested miners
7. What is one of the purposes of MSHA regulations? **.1 Purpose & scope:** the protection of life, the promotion of health and safety, and the prevention of accidents.
8. What is the definition of combustible? **.2 Definitions:** capable of being ignited and consumed by fire.
9. How loud must back-up alarms be? **.14132(b)(2):** “audible above the surrounding noise level”
10. Power cables shall have _____ as they pass into or out of power boxes? **.12008** Proper insulation and fittings
11. What is the MSHA requirement for illumination of work areas? **.17001** sufficient to provide safe working conditions.
12. What shall be done with “defects on any equipment, machinery, and tools that affect safety?” **.14100(b)** shall be corrected in a timely manner to prevent the creation of a hazard to persons.”
13. Fill in the blank: The floors of every workplace shall be maintained in a _____ and, so far as possible, _____. **20003(b) Housekeeping** clean, dry condition
14. Fill in the blank: Portable extension lights, and other lights that by their location, present a shock or burn hazard shall be _____. **.12034** guarded
15. Is there a law against breaking off the little round prong on a three-prong electrical plug? **.12025:** Yes. Grounding is required.

16. Crossovers, elevated walkways, elevated ramps and stairways are required to have what? **.11002:** Handrails (also toeboards when necessary)
17. T or F: A conveyor is required to have an audible or visual warning system before it is started up if the entire length of the conveyor is not visible from the starting switch. **.14201(b):** True
18. T or F: If a seatbelt is so dirty you can't wear it, you can be cited for it. **.14130(I):** True
19. How far must exposed moving parts be from walking or working surfaces so that they are not required to be guarded. **.14107:** at least 7 feet.
20. T or F: "Opening above, below or near travelways through which persons or materials may fall shall be protected by railings, barriers, or covers. **.11012:** True
21. T or F: Automatic pressure-relief valves are not required on air receiver tanks? **.13011:** False
22. T or F: The threads on gages and regulators for oxygen and acetylene tanks should not be oiled or greased periodically. **.4602:** True, this could cause spontaneous combustion
23. T or F: Except where automatic shutoff valves are used, safety chains or other suitable locking devices are required on high pressure hose connections with 5/8 I.D. or greater, where a connection failure would create a hazard. **.13021:** False 3/4 or greater
24. What is the maximum space between a grinder tool rest and the grinding wheel? **.14116:** 1/8"
25. Are toilet facilities required at quarries? **.20008:** yes
26. T or F: An emergency communication system shall be provided at the mine site. **.18013** True
27. Rubbish, brush and dry grass are to be cleared within ___ feet of explosive magazines? **.6101(a):** 25 feet
28. T or F: A cracked or broken cab window must always be fixed? **.14103:** No, only when visibility is affected or expose the operator to hazardous environmental conditions.
29. Could you be written up for not having a fire extinguisher "plainly marked"? **.4200(b)(2):** Yes
30. No combustible materials shall be allowed to accumulate within ____ feet unburied flammable liquid storage tanks. a) 10 b) 25 c) 35 d) 50 **.4130:** 25 feet

31. What is the minimum clearance for equipment working near power lines? **.12071:** 10 feet
32. Loose material must be stripped back how many feet from the pit or quarry wall? **.3131:** b) a) 3 feet b) 10 feet c) 25 feet d) 40 feet
33. How often does grounding and continuity have to be done on portable plants? **.12028:** every time they move.
34. T or F: a person entering a bin or hopper must wear Safety belts and lines. **.15005:** True
35. T or F: The common drinking cup and containers from which drinking water must be dipped or poured are prohibited? **.20002(b)** True
36. Where can food not be stored or consumed on mine property? **.20014** in a toilet room or in any area exposed to a toxic material
37. Do garbage cans in a break area need to be covered? **.20013** yes
38. T or F: Areas where safety or health hazards exist that are not immediately obvious to persons shall be barricaded or have warning signs posted at all approaches. **.20011** True
39. T or F: Regularly used walkways and travelways shall be sanded, salted or cleared of snow and ice as soon as practical. **.11016** True.

Mine Safety Jopardy

The incorrect spelling of “Jopardy” is intentional. This is a computer-based game for mine safety review. Its purpose is to review mine safety topics that might otherwise be dry or dull. The Jopardy Game itself and the Blank Game (with tutorial) may be obtained from Michigan Mine Safety Web Site www.mine-safety.mtu.edu

SYSTEM REQUIREMENTS FOR MINE SAFETY JEPARDY

Hardware: All web pages and games offered at Michigan Mine Safety’s Web Site have been produced on a PC. This game has not been tested using a Macintosh.

Software: (Note - Any references to software in the Jopardy tutorial or Jopardy game is referring to PC software.) Web Page Browsers - A web browser is needed to play this game. The web browser uses web pages located on your own computer’s hard drive to play the game. Access to the Internet is NOT required.

Web Browser Software with Web-Page Editing Capabilities. These are needed any time you want to modify the game or write your own questions. Netscape Communicator 4.0 and Microsoft Internet Explorer 4.0 both have web-page editing capabilities. Refer to your web browser documentation for specific instructions on installing and operating these web page editors.

USER REQUIREMENTS

The user of this game will have to have SOME basic knowledge about operating computers and using web browser software. If the game is to be modified, familiarity with an HTML web-page editor is needed. Web-page editors are similar to word processors or desktop publishing programs. Users need to refer to the documentation that came with their web-page browser/editor if they have questions about how to use it.

GAME RULES

These rules were devised to help the game work better with the available technology. You may change these rules as you see fit.

Divide the class into teams. Two teams have worked well so far. Use may two copies of the Windows Calculator to keep score on the screen. A better approach may be to appoint one person on each team to be the “Backup” scorekeeper for that team because the discussion may get so involved that the instructor forgets to add scores.

A coin can be flipped or some other method used to determine which team starts first. That team will then pick a category and point value. For Example: "Mobile Equipment for 75 points. Unlike the TV Game show where contestants have buzzers they can press, the team, which picks the question, always answers it. When they are finished, it's the next team's turn to choose and answer. Let the teams know if there are hidden Double Jopardys on the board. Continue

alternating teams until all the questions on the Game Board have been used up. It is maybe preferable to give points for correct answers, but not to subtract points for incorrect answers.

It has been suggested that a time limit is needed when answering questions to speed up the game. Using this approach, not answering within a certain time frame would be the same as a wrong answer. This might be done by having an appointed timer or by using a 30 to 60 second sound clip in the game itself (only works in Microsoft Internet Explorer.) Some sort of software clock program visible on the screen could work as well.

It is then time for Final Jeopardy. First, tell the teams what category the final question is in. Teams then wager a point value up to as high as the total points they have gotten so far. The team must write this down and give it to you. Like the TV game show, Final Jeopardy requires teams to write their answers in the form of a question. This should be a timed activity. A timed music clip may be used and the teams must write down their answers before the music stops. When the timed period ends, collect the written questions and then reveal the correct question on the screen. Any points gained (or lost) in Final Jeopardy are added (or subtracted) to the previous total. The team with the most points wins. You may give prizes. It's up to you, (and your budget.)