Part 48 – Metal/Nonmetal Deep Mines

U.S. Department of Labor
Mine Safety and Health Administration
National Mine Health and Safety Academy

Instruction Guide Series
IG 17

1981

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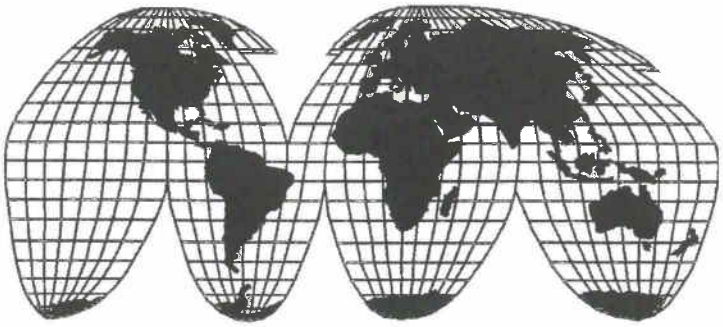

Part 48 – Metal/Nonmetal Deep Mines

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DEEP METAL / NONMETAL

NEW MINERS

PREPARED FOR THE U.S. BUREAU OF MINES

PITTSBURGH RESEARCH CENTER

UNDER CONTRACT #J0308011

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INSTRUCTOR'S MANUAL
FORTY-HOUR SAFETY TRAINING PROGRAM
ANNUAL REFRESHER TRAINING PROGRAM
FOR UNDERGROUND MINES

INTRODUCTION

The U.S. Congress in the Federal Mine Safety and Health Act of 1977 mandated a nationwide program for the training of all miners in hazard recognition and techniques for observing required safe mining practices. The Health and Safety Training and Retraining of Miners Program has been designed to implement the Federal Act specified in Part 48 of CFR 30. The materials presented in this program are written to provide assist ance to the instructors in their training programs. They are arranged in self-contained modules which cover specific training content areas.

PURPOSE

This document describes the purposes of the forty-hour safety program for new miners and the eight-hour annual refresher retraining program. It describes the manner in which the courses are designed and provides suggestions for implementing them. Discussion of the refresher training program follows in a later section of this manual.

RATIONALE FOR TRAINING

Mining is an occupation which involves numerous hazards not found in other occupations. When hazards involving unsafe acts or unsafe conditions are not properly identified and corrected, they may result in accidents involving damage to mining equipment and injury or death of miners.

Safety is important not only from the standpoint of avoiding personal suffering, but it also plays a significant part in the financial affairs of a mining company. For example, one study found that the median cost for medical treatment alone of the most common type of injury involving bruises was $69. This median cost is not sensitive to the very high cost injuries but it does appropriately describe the cost of the typical injury. The mean medical cost of bruises for 39 cases was $111. The mean multiplied by the total number of injuries gives the total cost. These figures do not include the value of lost time and time spent reporting and investigating the accidents. Further this type of injury is one which is least costly. Such injuries as burns with a median medical cost of $175 and a mean of $1,329 and fractures with a median cost of $611 and a mean of $967 involve much greater expense. When the costs of damaged materials and property, lost time and lost production, and increased insurance premiums are added to the total medical cost, one can see that safety training can be very profitable when it is effective.

The modules are written to be general in nature and to cover the majority of problems and hazards to health and safety. They cannot be written in such a

fashion that they will fit every operation. Some materials included may be irrelevant to particular operations. Materials which are important for a particular operation may not be included because it is very rare and unique to that operation. The instructor must understand that it is his or her duty to modify the modules, if necessary, to fit the particular circumstances which exist at the specific operation and to substitute other materials available from safety associations or developed locally at the mine by the instructor. The training program that is used must be approved by the Mine Safety and Health Administration prior to its use.

Obviously, training will vary from one mine to another just as mine characteristics and mining techniques vary. Similarly, the materials available to the instructors and the practicality of using the mine as the primary training aid will vary from one location to another. Therefore, these course outlines must be considered as guidelines for the development of a successful program rather than as a set of items to be followed slavishly. Some of the courses presented here may be entirely adequate for a particular mine. One would not expect, however, that all of the courses will be adequate without modification for any one mine. It is important that the instructors use care and good judgment in selecting from and adding to these materials to provide the best possible training for their particular mines.

New Miner Training Materials

The ultimate purpose of the training program is to reduce accidents and injuries by producing an awareness in the miners of the need for safety and by imparting the knowledge necessary for safe work performance. The modules in this program are designed to provide guidance for the instructors who will be teaching the courses. They are organized in two levels.

Level 1 is a general course plan which includes the overall goal for the course and some specific objectives for the types of material to be presented and for the trainee performance to be observed. They are stated as objectives to emphasize the fact that a training course needs to define the objectives in order to work toward them. Since specific mining operations may have topics of concern that are not covered, a training officer using these materials should review the objectives and add pertinent objectives as needed. As noted earlier
LEVEL 1 some instructors may wish to use just these objectives in setting up their own program of instruction. The sorts of materials which will be needed for the course are listed in the first level as are some resources which may be examined as a background for the course. In addition, this level includes in out line form the specific points of information to be covered in the course. Since there are differences from one mine to another, the instructor should remove or add topics as appropriate. The instructor might use this outline to develop a lecture and to help organize and incorporate other material which might be available at the mine.

Level 2 consists of a detailed lesson guide outline with specific infor-
LEVEL 2 mational materials and visual aids which may be used in the instructional

process. An instructor might decide to select those materials appropriate to present and use the information very nearly as written. While it is possible to make a complete forty-hour training program from these materials, most training directors will want to use their own materials and resources for some of the courses in the program. Remember that the mine itself is the best training aid. Slides, drawings, models, and simulations should be used when it is either impractical or unsafe for the trainee to be exposed to a given aspect of the mine or the equipment used in the mine.

TRAINING AIDS

The users of these materials will be required to make decisions. These decisions will include which topics to present, what audiovisual aids to use, and where some materials, such as movies, will best fit into the lesson. As with any other decision, the more information one has the better the decision will be. Therefore, a thorough review of the materials available will be helpful. Since many of these courses will be presented a number of times, there may also be instances in which you will want to change your decision based on your experience so as to improve and upgrade the program. Don't be afraid to make these changes when they are warranted.

TRAINER DECISIONS

TECHNIQUES USEFUL IN IMPLEMENTING COURSES

Each instructor has methods of teaching suited to his or her own personal tastes and skills. There are, however, some procedures which may be helpful in assuring the maximal benefit to the miners that can be incorporated into the instruction format.

LOCAL EXPERTS

Whenever practical, take advantage of resident expertise at your mine. This will add both variety and accurate technical content to your training program. You may, for example, want to schedule an experienced electrical foreman at the mine to teach or co-teach the session on electrical hazards. At a minimum you should review this material with that person for his/her input. The mine's engineering staff may be able to supply you with someone who knows the geological history and current conditions of the mine and the ore body. They may also be willing to teach parts of the "Introduction to the Work Environment" course that covers mine geology. The material on the statutory rights of miners might be taught by the director of employee relations who could also review other company safety policies. You could check with other re sources such as the local fire or police departments for assistance in teaching first aid of course, all instructors must be MSHA certified to provide such training.

In courses for which you schedule instruction from local mine experts, your most useful role as training officer may be as coordinator of their input rather than as an expert on those subjects. Regardless of whether you or someone else is teaching a particular course, an important rule is to use the actual piece of equipment, tool, or sit uation in the mine as the choice training aid whenever practical. How ever, when viewing or handling are not practical, use of visual imagery through slides and drawings supplemented by your descriptions of equipment, tools, or situations is encouraged.

REPETITION AIDS RECALL

An important learning principle which has been incorporated into the course material is that of student response followed with immediate feedback to the student. Structuring the material to be learned into relatively small segments and allowing students the opportunity to respond to questions about that material is usually helpful. Asking the same questions again at the end of a module will provide spaced repetition of the material, a technique that usually aids recall.

TESTING

While the course plans and lesson guides include frequent references to evaluation, the extent to which the evaluation is formal is left to the discretion of the instructors. A mixture of informal questioning, observation of performance and more formal paper and pencil tests will probably be useful, with the proportions of each determined by the instructor's experience and judgement. No doubt, as your program develops some changes in these proportions will occur. When it seems desirable to have the miners respond to several short paper and pencil forms in one session, it may be useful to distribute all the questionnaires at one time. This will save time and the sessions will run more smoothly, even when there are small numbers of trainees.

In those cases where an oral response is the most appropriate method of evaluation just as much care should be taken in forming the questions as would be taken with paper and pencil tests. Insofar as possible, each trainee should be asked to respond to each item of importance. Often, an instructor will find it desirable to have each trainee responding orally to a single question. When the question is difficult or requires listing several items, it will be helpful to have the more capable trainees respond first. Their responses will provide additional repetition for the less capable trainees.

While the modules are designed around specific topics, it is not required (nor necessarily desired) that all of the material related to a particular topic be presented within a single session. In many cases the mine tour will be an appropriate situation for the presentation or recall of particular topics or items even though they are covered in different modules.

Approach of Instructor

ATTITUDES

While instructors differ in the techniques which are most suited to their skills and temperaments, it is essential that you as an instructor project to the miners the attitude that safety and hazard recognition is important. Perhaps this seems too self-evident to mention, but occasionally we do things which convey impressions which we do not intend. If the wrong impression is created, some trainees may decide that safety training is merely an exercise in complying with regula tions. This could negate the effects of the training.

The materials in these modules are directed toward hazard recog nition and learning to follow safe acts and maintain safe conditions. This knowledge, of course, must be used if the individual is to be a safe worker. The motivation to be safe will occasionally be in conflict with other motives, such as increasing production or finishing work quickly before shift change. The most important part of the teaching task will be to insure that trainees become concerned with their own and others' safety and consider it an integral part of their jobs. The attitude of the instructor will affect the motivation of the trainees. If possible, supervisory personnel at various levels should be used for presenting training materials to broaden and reinforce positive attitudes toward safety.

PERSONALIZE TRAINING

A technique which can help the trainees to focus on their own place in the mine safety program is asking questions phrased in a personal way. That is, ask a question such as "What would you do in this situation?"

Use of Visual Aids

SLIDES AND DRAWINGS

The use of visual imagery has been shown to be effective in aiding learning and recall. The obvious application is through the use of pictures, models and objects in demonstrations. Pictorial representations may be made in many ways. Film slides are fairly inexpensive and easily made. Line drawings can display the major components of some apparatus or piece of equipment. In addition, it may be helpful to produce photocopies of some visual materials

included in the lesson guides to distribute to each individual. In most cases a picture or a simulation will be effective in helping the trainee understand how some thing works or fits with other equipment or facilities. In many cases the opportunity for "hands on" experience with the actual object and/or procedure is still the cheapest, easiest and most effective approach to training. However, there is no need to spend time and money creating visuals or models as training aids when you can use the actual mine and its facilities and resources in the course.

ACTUAL MINE EQUIPMENT

The several types of visual aids can be useful in producing a good training program. For the trainee to get the maximum benefit from visual aids such aids must be well integrated into the overall presen tation. Suggestions are made in the lesson guides for points at which the visuals included with the guides could be presented. These can be presented as photocopies, slides, or overheads which may be made from the original and projected onto a screen. While the points made by these visuals appear self-evident to the experienced miner, some comments directing the trainees' attention to specific points and features will help to integrate them into the overall presentation.

VISUALS MUST FIT

Another type of visual aid which can be extremely useful includes the motion picture or videotape. Because of their similarity to entertainment programs there is often immediate interest in these presentations. To realize the full benefit of these presentations, however, the miners must be primed to look for important points. While previewing the film or videotape it will be helpful to note down the points you wish to stress in the order of occurrence in the film with specific comments to be made prior to, during, or after the presentation. In some cases it may be best to stop the presentation to discuss a particular point. Some film projectors and most videotape machines allow stopping the action or presenting it in slow motion. These techniques can often be advantageous.

MOVIES & VIDEOTAPES

The Mine Safety and Health Administration has made over forty films regarding first aid and safety in metal and nonmetal mines. These films are generally generic and points made in the films are not necessarily mine specific. Relatively few commercial films have been made by private industry regarding safety in mining. These limitations mean that there may be a need to provide a bridge between what is shown in the film and the actual situations which exist in your mine. Obviously, some films may involve situations which are very specific to a particular kind of mine and its operation. However, films which illustrate principles of hazard recognition may be very helpful in involving trainees in the learning process, even when only some of the principles specifically refer to your mine. Asking trainees to suggest situations in the mine where these principles might apply is a good technique for involving them in the learning process.

PREVIEW FILMS AND TAILOR THEM

Unlike films directed at specific issues in hazard recognition, some films are primarily motivational in nature. The content of motivational films may be useful even though it may be somewhat less related to the mine situation. In order to avoid potential confusion you should preview the film to assure that the motivational point is clear.

USE FILM EXCERPTS

A list of commercially available films which may be helpful is included at the end of this Instructor's Manual. Not all of the films are specific to mining, but excerpts from some and all of others may be integrated into your training materials. The sources for these films are also listed. From time to time other relevant films might be produced by these organizations, so it will be helpful to get on their mailing lists. The training films produced by MSHA are listed in a book let available through the regional training center.

PERSONALIZE TRAINING

When videotaping devices are available they can be used to create materials specific to the particular operations and hazards at the mine. This will usually provoke great interest because of the reference to the mine itself. Much care should be taken to integrate these materials into the overall presentations, just as you would with MSHA or commercial films. In particular, the videotaped materials must be brief and to the point; therefore, they should be carefully edited. Many current training magazines contain articles suggesting guidelines for production of videotapes.

TAILORING THE COURSE TO THE MINE

Early on we emphasized the importance of using the course plans and lesson guides as generic bases for the courses to be taught but not as the courses. In this section we will look at some ways one can tailor course plans and lesson guides for specific mine operations and associated hazards. For more detailed assistance in tailoring these materials, you may want to review a tailoring manual being developed by the Mining Extension Service of West Virginia University at Morgantown, WV, 26506, or contact your regional MSHA training center.

The first thing to do is to review the prepared course plan and lesson guide for a specific topic. Following that review the best place to start in developing a specific lesson guide is with the topic outline contained in the course plan. Since the topic outline is in topical form one can easily select those topics appropriate to the mine. Having selected the topics and added any other topics you feel are important and specific to the mine, you should then review the Materials and Resources segment of the course plan for possible materials which could be used.

For convenience a checklist of possible materials has been provided. One may wish to make copies of it for use in lesson preparation. The checklist can perform two functions. The first function is to help specify which materials will be needed for a particular lesson module. The second function is to check off the materials as they are assembled prior to the actual delivery of the lesson.

The lesson guide materials are closely coordinated with the topic outline. In addition to material related to the topics, they include a number of visual aids and suggestions for their use. They also contain self-check evaluation materials and suggestions for using them. Based on the topics selected from the topic outline one can pick out items from the prepared lesson guide which best fit the mine's needs. By inserting mines specific materials, visuals, and self-check items in the appropriate places, one will have the lesson guide ready for presentation.

PLANNING GUIDE FOR INSTRUCTORS

1. (CONTENT) I want to teach _____

2. (OBJECTIVE) When the session is complete the trainee will be able to do the following:

   Demonstrate safety consciousness toward and recognize and avoid hazards associated with: _____

3. (TASK ANALYSIS) Each trainee must know the following before completing the objective in Number 2.

   ☐ a.

   ☐ b.

   ☐ c.

   ☐ .

   ☐ .

   ☐ .

ADD OR SUBTRACT STATEMENTS BOXES AS YOU NEED THEM FOR EACH UNIT. RANK EACH ITEM IN THE ORDER IN WHICH YOU'LL TEACH THEM.

4. (DIAGNOSIS) I'll be able to tell what each trainee already knows by one or more of the following:

   ☐ short pencil and paper pretest ☐ observe behavior during mine tour
   ☐ brief class discussion ☐ ask trainees individually before class

5. (GROUPING) I'll conduct this training by grouping in one or more of the following ways:

   ☐ keep the entire group together
   ☐ separate into small groups
   ☐ one or two trainees and myself

6. (METHOD) I'll train in one or more of the following ways:

   ☐ lecture by me
   ☐ outside speaker
   ☐ demonstration by me
   ☐ use of AV equipment
   ☐ a visit to the mine
   ☐ small groups practicing a behavior or written exercises

7. Parts to my lesson

A. (MENTAL SET) The following sentence will focus trainee's attention on the learning task ahead. _____

_____

B. (OBJECTIVE) At the end of this session trainees will be able to _____

C. (RATIONALE) It's important for trainees to know this material because _____

_____

D. (DIRECT INSTRUCTION) Use back of this page for additional space

1. (Major Supporting Objective) _____

_____

a. _____

b. _____

c. _____

2. (Major Supporting Objective) _____

_____

a. _____

b. _____

3. Training aids used - See Check Sheet for Lesson Materials.

E. (MODELING) I'll show trainees the behavior I'm wanting by _____

_____

F. (GUIDED PRACTICE) Under supervision the trainees will _____

_____

G. (INDEPENDENT PRACTICE) On their own the trainees will

_____

H. (Closing Remarks) _____

_____

_____

_____

_____

I. (EVALUATION) Both the trainee and I will know that he/she remembers the instructions by one or more of the following:

- ☐ asking informal questions
- ☐ observing performance
- ☐ paper & pencil test

8. The approximate amount of time this training will take is:

☐ 30 minutes ☐ 1 hour ☐ 1½ hours ☐ 2 hours

INSTRUCTOR NOTE: YOU MAY WANT TO FOLLOW THE PLANNING GUIDE STEP BY STEP FOR THE FIRST SEVERAL UNITS. GRADUALLY THESE STEPS WILL COME TO BE HABIT FOR YOU. SOME STEPS SUCH AS MENTAL SET, OBJECTIVE, AND RATIONALE ARE CLOSELY RELATED BUT STILL NEED TO BE THOUGHT OUT SEPARATELY. TAKING TIME TO CHECK THE BOXES AND FILL OUT SENTENCES WILL INCREASE YOUR OWN PREPAREDNESS AND CONFIDENCE, AS A NEW INSTRUCTOR OF THESE MATERIALS.

CHECK SHEET FOR LESSON MATERIALS

Materials needed for trainees

Handouts:

Visuals? _____

_____

_____

Evaluation Materials?

_____

Pencils? _____

Audio Visual Equipment:

Slide projector? ___ Which slides? _____

Overhead Projector? ___ Transparencies? _____

Movie Projector? ___ Movies _____

Video Recorder and TV? ___ Cartridges _____

Flip Chart? ___ Which items? _____

Simulation Materials:

_____ _____

_____ _____

Materials specific to mine:

Mine Maps? _____

Accident Reports? _____

Company policies and rules? _____

Arrangements with others:

Guest lecturer? _____

Mine Tour? _____

Revision of Lesson Guides

Proper preparation of a lesson guide will take quite a bit of time. Once completed, there may be a tendency to use it for a number of presentations. When the course is presented quite frequently the materials may remain up-to-date through several presentations. However, over time, changes may occur in the mine which will require revision of the course. Progress in the mine will often change ventilation patterns and require changes in mine maps. New equipment or modifications in old equipment may also mean revisions are needed in the course materials. Sometimes, changes in the state of the art, as in first aid, will require updating of materials. Usually the revisions will be minor in nature and will take little time. A good procedure to follow is to keep a folder for each course. When an event occurs which affects a course, the information about that event should be put into the appropriate folder.

While revisions may be infrequently needed, an instructor should always review the course materials prior to presenting the course. A post review can also be helpful in terms of immediate recall of items which were not as satis factory as desired. This may provide the basis for improvements in the next presentation. An up-to-date presentation by an informed instructor will create an impression of credibility which is essential for a good program.

NATURE AND USE OF THE SELF-CHECKS

The self-checks included in each module are designed for the convenience of the instructor. They may be used to provide feedback to the instructor on the effectiveness of his/her instruction, reinforce newly-gained knowledge, promote discussion of unclear items, alert the trainee to items he doesn't yet know, and help him to measure his own progress. They are intended to fulfill the requirements specified in part 48.5-14C regarding trainee evaluation.

Since some self checks will be too easy for a given group of trainees and some too hard for other groups, responsibility for designing appropriate self checks lies with instructors. Due to the general nature of the entire program, instructors will need to tailor these evaluations not only to specific class groups but to individual mine situations. Instructors should feel free to use any questions they can from the self check and dispose of others that are useless to them.

The following response techniques have been used: true/false, column matching, crossword puzzles, fill in the blank, multiple choice, identification of illustrations and sentence completion. These have been chosen for the purpose of stimulating trainee interest as well as teaching instructors to use variety in creating their own evaluations.

Solutions appear at the end of each lesson guide. Self checks follow immediately. In the interest of conservation self checks have been printed on one page where possible.

INTRODUCTION TO THE ANNUAL REFRESHER TRAINING PROGRAM

FRESH APPROACHES ARE EFFECTIVE

Early research on the effectiveness of coal mine health and safety training indicated that periodic reinforcement of safety training was an important element in keeping injury rates down. Subsequent evaluations of training effectiveness have confirmed the utility of refresher training. These evaluations have, however, indicated that the annual sessions need to be kept fresh and up-to-date in order to have a significant impact on the safety behavior of the work force. To be effective the trainer must provide useful information and try fresh approaches to the sessions. Variation in both content and methods of presentation are important to the success of the refresher training effort. If the sessions become too repetitious the trainees are likely to develop a negative attitude toward the company's whole safety training program.

TAILORING

This document describes the purpose of the eight hour retraining program and suggests some general training approaches designed to increase the effectiveness of the refresher program. As with new miner training materials the refresher materials have been developed in an outline format and should be modified as needed to make them fit the circumstances of each mine site. This means that these materials should be treated as guides or aids for presenting the refresher training. They are not meant to dictate what is covered or how it is presented.

TAKE ADVANTAGE OF TRAINEE EXPERIENCE

The trainer should remember that most of the retrainees have had several years experience in mining and all of the them have had at least one year on the job. The practical trainer will recognize and take advantage of this experience. By incorporating the insights of the retrainees, often many man-years, the trainer can avoid boring and repetitious classes, can improve the content of the sessions and can encourage safety awareness in miners who tend to become careless after months of contact with hazardous work conditions.

The basic key to taking advantage of the experience of the retrainees is to get them to both participate actively in the class and make substantive contributions to the course content through discussions of their experiences in the mine. While a basic responsibility of the trainer is to cover training required by Part 48, for which these materials have been developed, he or she must also see to it that classes are responsive to the health and safety issues of the mine, particularly those things that have been problems or concerns during the preceding year. Thus retraining should cover the requirements but in doing so, should focus on specific hazards the crews are encountering.

Determining Key Issues for Annual Refresher Training

A/R TRAINING SHOULD CHANGE

In order to make refresher training the most beneficial to the workforce, the trainer should attempt to keep up-to-date the training content of the refresher sessions. Such modifications are allowed through notification of the regional MSHA training center under Part 48.3L and Part 48.23L. Just as conditions in the mine change over the course of the year, so too should the refresher training given the miners change accordingly.

CHECK CURRENT RECORDS

In order to make annual refresher sessions responsive to hazards in the mine, the trainer must maintain thorough knowledge of hazardous conditions in the mine. Resources of such knowledge include his own tours of the mine, talking with experienced miners and supervisors, accident records, first aid records, and MSHA inspection records.

Once the trainer has constructed a detailed picture of current hazardous conditions in the mine, along with problems involving unsafe acts and unsafe conditions, he can better involve the workforce through the refresher program in motivating and strengthening hazard recognition and accident prevention measures.

Annual Refresher Training Materials

In order to provide basic resources for the required training content areas of hazard recognition, materials have been developed to aid the trainer in providing refresher training. Similar to the Level 1 course plan of the new miner training materials, this refresher course plan is intended to serve as an instructional guide should the trainer choose to cover the particular content area using a lecture format. Specifically, the refresher course plan states the session goal, objectives, resources, and evaluation and presents a topic outline detailing the contents of that training session.

NEW IDEAS

In order to improve the value of refresher training, new resources, demonstrations and activities have been included to add variety to these sessions. Because the topic outline is somewhat similar to the outline in the New Miner training materials, the trainer can use the corresponding Lesson Guide and Materials for information content.

LEARN BY DOING

One technique that can motivate miners and maintain their interests in refresher training is use of actual demonstrations. The phrase "people learn by doing" suggests that personal experiences with specific hazardous acts and conditions make the biggest impressions in the minds of miners.

EXAMPLES

Conditions at the mine will dictate the range and limits of the demonstrations that can be made, although a few examples can be suggested. In order to show the instability of surge piles, try having a few miners climb one. The importance of blocking tires on a vehicle stopped on an incline may be shown by demonstrating how easily a vehicle will roll on even a slight slope. The value of ear protection can be better understood by having miners try different protective devices while standing near a drill or diesel engine.

It must be emphasized that selection of these demonstrations must consider the severity of hazards to which miners are exposed. One rule of thumb might be to use only those situations in which miners may occasionally find themselves.

Facilitation of Group Discussion

BETTER A/R SESSIONS

One technique in conducting refresher training draws directly on the experiences and perceptions of the miners. By conducting group discussions on scheduled topics, the trainer can transform what might be a repetitious lecture into a motivating discussion of the safety concerns of the miners. Every miner has an opinion of safety in the mine, although some are less willing or able to express their views. By helping miners think through and express their opinions hazard awareness and recognition will increase.

WHAT'S A 'ACILITATOR?

The role of the trainer in these discussions is one of a group facilitator, a person who starts the group in a discussion of a particular topic and guides the group through stages of hazard identification, hazard analysis, and hazard resolution. Miners can readily identify hazards in their workplace in large part because of their health and safety training. Hazard analysis involves exploring the causes behind hazards, ranging from equipment design to mine safety practices. Hazard resolution consists of developing constructive solutions involving either removal of hazard or if they cannot be removed then minimizing the extent of exposure to them. The actual carrying through with these solutions will provide evidence to the miners of the mine's commitment to safety and their own role in it.

In order to assist the trainer in his role of facilitator of group discussion, some guidelines can be suggested that define which procedures to follow and which to avoid.

Things to Do. As a facilitator the trainer should follow these procedures:

1. Define the general topic of discussion, such as electrical hazards or prevention of accidents.

2. Lay the general rules of the discussion. These should include the importance of openness of opinion, and the time limits of discussion. The facilitator should try to guide discussions from one topic to another as a smooth flow rather than, for example, discuss electrical hazards for thirty minutes, halt discussion, and then attempt to start up another discussion of accident prevention. Abrupt breaks are, however, preferable to running overtime limits and not getting to other topics that should be covered.

3. Keep the discussion moving by supporting miners' comments regardless of how pointed they may be. Examples of supportive comments are: "I'm glad you brought that up," "This is something we should all be aware of." "Thanks for reminding us of that."

4. Keep the discussion on target by courteously moving the group away from aimless complaints by naming a non-complainer or neutral group member and asking him if he can think of a solution. Then ask the group to brainstorm solutions.

5. Frequently you should ask questions rather than provide answers to direct the discussion, but remember that it is the miners' observations and attitudes that are most important.

6. Summarize the discussion at its conclusion. If you took notes, briefy summarize the hazards identified and analyzed, and the solutions the group generated.

7. One method of allowing all trainees equal chances to contribute to group discussions is to pass out talking tokens to each member of the class and have them toss into a container each time they speak. This technique would be used only in anticipation of a highly verbal group whereby certain individuals might seek to monopolize group time.

Things to Avoid. Among the activities the facilitator should avoid are the following:

1. Avoid being the "expert" on matters of safety in the mine, or giving advice based on such a position. Everyone in the group is knowledgeable about mine safety.

2. Avoid favoring just a few people in the group, rather involve everyone by asking open-ended questions such as "What do you think about this, John?" of people who have not yet contributed to the discussion. Then look at them and give them time to answer.

3. Avoid taking cheap shots or taking sides in the discussion.

Job Safety Analysis

Job Safety Analysis (JSA) is an instruction technique developed by the National Safety Council. (See their Supervisors Safety Manual) available through the state safety council). JSA recognizes that a job is a sequence of activities, and that each activity has associated with it a set of hazards that can cause injury to the miner. As part of refresher training, JSAs could be developed for a particular job that the miners are familiar with. Either the miners could develop the JSAs, or the trainer could develop them before the sessions and then have them discussed and improved upon by the miners. Beyond their use in giving miners training in safe work procedures, JSAs are also useful for reviewing job procedures after accidents occur and for studying jobs for possible improvements in job methods.

PRESENT A J S A

Once a job is selected, the JSA can be performed in just a few stages.

First, the job should be broken down into its sequence of basic job steps, with an emphasis of describing what is being done. Each activity should start with an "action" word, like "remove", "open" or "start". Second, identify hazards and potential accidents. To do this, the trainer might ask such questions as "Can

the person be caught in, on, or between objects?" or, "Is there a danger of being struck by or striking against some object?" The third stage is to develop recommended safe job procedures for the miner to follow. Such solutions might be to change the physical conditions that create the hazard, or alter the job procedure to minimize exposure to the hazard.

Many mines have found JSA procedures useful in aiding miners in recognition of hazards in their jobs. Use of JSA in refresher training will motivate miners not only to think about hazards associated with the target job, but in their own jobs as well.

New Slides and Films

Over the course of the year new slide programs and films are being put out by safety organizations, USBM, MSHA, and private commercial firms. These resources can prove useful to refresher training on particular topic areas. In addition, the trainers may want to take his own slides of the mine, of areas and conditions that are particularly hazardous, or of any accidents that occur. Discussions among the miners can be easily generated through use of slides and films. Of course, the trainer must always be on the alert for repetitious use of slides and films. Showing the same set of slides or films each year will erode miners' perceptions of the mine's commitment toward safety, and their own safety motivation as well.

FILM SOURCES

Bureau of National Affairs
1231 25th Street N.W.
Washington, D.C. 20037

"The Big Lift" - Proper lifting Techniques

"Nobody's Fault" 20 min - Series of incidents leading to accident in a laboratory

"Split Second" 10 min - Alertness

ENT/Gates Films, Inc.
20 Chicago Street
Buffalo, NY 14204
(716) 856-3200

"Developing a Safe Rock Slope" 20 minute - Surface mine blasting, angle of repose

Mine Safety Appliance
608 Penn Center Blvd.
Pittsburgh, PA 15235

"Dust Your Can't See" 13 minute - Respirable dust

National Audio-Visual Center (NAC)
General Services Administration
Washington, D.C. 20409

"It Can't Happen to Me - Anotomy of an Accident" 23 minute - (Failure or refusal to use protective equipment

"Prevention of Heat Casualties" 25 minutes - Heat stress

National Coal Board
Hobart House
Crosvenor Place
London SW1X7AE

"How Not to Keep a Head While Shot-Firing" 3 minute

"Safety Boots" 3 minute

"Your Helmet" 3 minute

"Hands, Knees, and Bumps-A-Daisy" 3 minute

"A Sense of Responsibility" 3 minute

"Tidy Why" 3 minute

International Film Bureau, Inc.
332 So. Michigan Ave.
Chicago, Illinois 60604

Accident Prevention Series

"Eyes" 3½ minute

"Feet" 3 minute

"Hands" 3 minute

"Slips and Falls" 3 minute

"Striking Against Objects" 3 minutes

"Confined Space Hazards" 15½ minute

National Safety Council
444 North Michigan Avenue
Chicago, IL 60611

"Your Body Is Only Human" 15 minute - Overexertion

"Safety Afoot" 10 minute - Safety shoes

"Accidents Made Easy" 13 minute

Salenger Education Media
1625 Twelfth Street
Santa Monica, CA 90404

"Good Housekeeping Prevents Accidents" - Clean-up, housekeeping

Society for the Prevention of Blindness
79 Madison Avenue
New York, NY 10016

"Don't Push Your Luck" 10 minute

Also contact: National Film Board of Canada
1251 Avenue of the Americas
New York, New York 10020

Mining & Resource Development Films
Coller No. D Littleton,
Colorado 80127

GLOSSARY OF MINING AND MILLING TERMS

Acid Rock - Generally an igneous rock with a high proportion of silica.

Adit - Horizontal mine opening.

After damp - Gaseous products and smoke produced by a fire or explosion. Includes gases as follows: carbon dioxide, carbon monoxide, water vapor, nitrogen, oxygen, hydrocarbons and hydrogen. It is mostly carbonic acid and nitrogen and, therefore, irrespirable.

Aggregrate - Crushed or uncrushed rock, sand or gravel screened to sizes for use in concrete work or road surfaces.

Air door - A door erected in a roadway to prevent or control the flow of air.

Air split - The division of a current of air into two or more parts.

Alpha particle - Particulate radiation from a radioactive source. These particles are positively charged.

Amorphous - Term applied to rocks or minerals that possess no definite crystal structure or form.

Anthracite - Hard black coal, contains little volatile matter.

Anticline - An arch or fold in the layers of rock shaped like the crest of a wave. Opposite of syncline.

Apron - Removable side for a muck car, used to prevent spillage when loading. Also the front part of a scraper. Also a short inclined ramp.

Aqueous Solution - A solution involving water. Usually an acid included for separating some mineral.

Asphyxiation - Loss of oxygen because of presence of other elements which reduce the available supply of oxygen resulting in unconsciousness or death.

Auger mine - Coal mine (usually near surface) in which horizontally boring auger is used to remove the coal.

Autogenous grinding - The grinding of ore by tumbling pieces of ore in a revolving cylinder with no balls or bars taking part in the operation.

Back - Any rock or concrete over head. The roof of a mine passage.

Backfill - The material excavated from a site and used in refilling. The excavation of some other site.

Backstope - A stope that is advanced by essentially vertical blast holes.

Bad air - Air that is deficient in oxygen or contaminated.

Bailer - A long cylindrical vessel fitted with a bail at the upper end and a flap or tongue valve at the lower end, used to remove water, sand, mud and cuttings-laden liquid from a drill hole.

Ball Mill - Device for grinding ore into small particles, a cylindrical container filled with steel balls which is rotated causing the balls to grind the ore.

Bank - The surface around the mouth of a shaft, a mass of soil rising above the digging level.

Barricade - Wall built to contain space secure from the influx of toxic or asphyxiating gases following an explosion.

Barring down - Knocking down loose rock from roof and face of a passage way. (Same as scaling).

Bathhouse - Building equipped with showers, hanging baskets and/or lockers for changing clothes and cleaning up.

Batter - Timbering term referring to the angle at which posts are set for maximum strength and support.

Bazooka - A megaphone-shaped device powered by air for ventilation purposes.

Beam - A bar or straight girder used to support a span or roof between two support props or walls.

Bearing plate - A plate used to distribute a given load. In roof bolting, plate used between the bolt head and the roof.

Bed - A coal seam. A layer of sedimentary rock.

Bedding plane - In rock or soil, the division planes that separate the individual layers into beds or strata.

Bed Rock - Any solid rock overlain by unconsolidated material.

Bench - A landing place, a level layer worked separately in a mine, a more or less level step between steep risers or a level step graded into a hillside.

Benching - In surface mining refers to creation of benches (a terracing effect) on sides of wall. In underground mining it refers to cutting a wider segment at the top of the seam and bolting the roof before taking out the bench.

Bench mark - A permanently fixed reference mark used in determining elevation.

Beneficiation - A series of processing steps which improve the physical and chemical properties of the ore, usually used in describing treatment of raw or natural ore. Also called ore dressing.

Bentonite - A clay with great ability to absorb water which is used to form pellets for ease of transporation from mill to smelter.

Berm - A raised surface (usually of dirt) along surface haulways and at dump sites whose purpose is to keep the wheels of trucks and loaders from going off the road.

Beta particle - Particulate radiation (negatively charged) from a radioactive source. Has smaller mass than an alpha particle.

Binder - Fine particles of sand and soil that cause gravel and coarse rocks to hold together.

Bit - The part of a hole drilling device that impacts the material to be penetrated.

Bit knocker - Device for removing bits from steels.

Bitch links - Piece of metal with a specially cut hole in it which allows it to be locked into place any where along a length of chain. Used in slushing.

Bituminous - A coal softer than anthracite and harder than lignite with 15-50 percent volatile matter. Soft coal.

Blackdamp - Carbon dioxide and nitrogen in oversupply creating an oxygen deficient atmosphere.

Blocking - Pieces of wood placed and secured to hold lagging or rocks in place.

Blow pipe - A 6' - 10' pipe bent into an "L" at one end with valve to blow sludge from small blast holes.

Blue tops - Wooden grade stakes with a blue top and a blue line to indicate the finish grade level. Arrows point up to the blue line for fill, down for cut.

Bolt Torque - The turning force applied to a roof bolt to achieve an installed tension in footpounds.

Bombsticks - Boards (1" x 2") or round willow poles used to place an explosive charge in a hang-up.

B.O. - Broken or out of order.

Bone - A hard coal-like substance high in noncombustible mineral matter found above, below or between layers of coal.

Bone yard - Area used to store new, used or B.O. materials.

Boom - A heavy beam projecting from the derrick or drill floor, hinged and anchored at one end with weight lifting devices attached to the other end used to lift heavy tools and equipment.

Bootleg hole - That portion of a drill hole not broken by blasting.

Borehole - A hole bored from the surface of the ground to the inside of a mine. Sometimes refers to holes underground.

Borer - A machine used to remove coal by boring.

Bow saw - A hand crosscut saw with bow-shaped frame holding saw blade across ends of bow.

Box-check - A stopping with a hole in it to allow a conveyor belt or pan line to pass through it.

Box hole - A short raise or opening driven above a drift for the purpose of drawing ore from a stope, or to permit access.

Brattice - A curtain like affair used to direct the flow of air near the face.

Break line - The line along which the roof of a coal mine is expected to break, roughly following the rear edges of the pillars that are being drawn or mined.

Breast board - The timber or boards placed across the face of an excavation to prevent caving or inflow of material.

Breast timber - A leaning brace from the floor of an excavation to the wall support.

Buffer - Devices or materials designed to reduce shock, a pile of blasted rock left against or near a face to improve fragmentation and reduce scattering from the next blast.

Bulkhead - A solid or cribbed barrier closing an opening.

Burn cut - A drill hole pattern drilled parallel into the center of the face, one or more holes are left unloaded for the others to break into when the blasting charge is detonated.

Buzzy - A small pipe wrench with a hammer head.
- rotator, stoper.

Cable hook - An insulated hand held device used for moving electrical cables

Cable pad - A bridging device used to allow vehicle access across electrical cables.

Cage - A compartment used to transport men and materials in the shaft.

Cage alert - An emergency warning system used to signal the hoistmen.

Cager - A person responsible for operating the cage.

Cap - An explosive detonator. Also a timber placed on top of two upright timbers used in the construction of bulkheads or roof supports.

Cap block - A flat piece of wood inserted between the top of the cap and the roof to provide bearing support.

Cap delay - A time delay detonating device manufactured with "built in" time delay.

Cap lamp - Light attached to miner's hard hat operated from a battery on the belt.

Carbon dioxide, CO_2 - A gas which is produced in the breathing process and is exhaled. May also be produced in explosions and fires. Colorless but has slight acid taste in high concentration. Heavier than air. It can be tolerated in air to be breathed only in minute amounts.

Carbon monoxide, CO - A colorless, odorless, tasteless gas which is just slightly lighter than air. It is produced by combustion and also may be produced by certain coals without combustion. It combines more readily than oxygen with the hemoglobin of the blood, thus limiting the oxygen-carrying capacity of the blood. It is flammable over the range of 12.5 to 24 -volume percent mixture with air.

Caving - Mining process of forming an opening so that the rock falls and fills the opening and taking the material (ore) out.

Block caving - Large blocks of ore are undercut and the ore breaks and caves under its own weight.

Sublevel caving - The drift undercuts the ore, support is removed, the ore caves or is blasted partially and LHD's remove the ore.

Cheater - A pipe placed on the end of a wrench to give more leverage.

Check curtain - Curtain used in mine to direct airflow. It has one or more slits in it to allow men and machinery to pass through.

Chipping - The process of loosening shallow rock by the use of light blasting or air hammers.

Churn drill - A machine that drills holes by dropping and raising a bit attached to the lower end of a drill string. Also called cable tool drill or spudder.

Chute - A structure for loading muck into cars.

Cleat - A vertical crack in a coal seam. Face cleats run east and west and butt cleats run north and south.

Classification - Sizing of particles.

Cleavage plane - The plane along which a crystalline substance such as diamond or quartz may be split. A uniform joint or crack along which a rock will break easily when dug or blasted.

Clevis - U-shaped device with a pin used for attaching one thing to another.

CFR, Code of Federal Regulations - Federal code which establishes the basic requirements for operation of mines.

Collar - The first level of a shaft. The start or beginning of a drill hole.

Collaring - The process of beginning the drilling of a borehole or start of shaft sinking.

Collar brace - A brace between the posts below the cap in timbering.

Collection - A selective change in the surface of a mineral species present in ore, caused by the addition of a chemical reagent to the pulp to bring about adherence between solid ore particles and air bubbles to produce flotation while other mineral species remain unaffected.

Comminution - Pulverizing, includes all the crushing and grinding operations on ore, coal or rocks.

Concentrate - Separation of ore or metal from its containing rock or earth. The resultant of the separation process.

Cone crusher - Used in secondary crushing process, has action similar to gyratory crusher.

Contaminant - Particle, gas, etc. which degrades the quality of the air or produces a health hazard.

Continuous Mining - A system of mining in which a mining machine (continuous miner) is used to cut or rip coal from the face and load the coal into cars or conveyors.

Conventional mining - A system of mining that includes cutting the coal, drilling shot holes, charging and shooting, loading the broken coal and installing roof supports.

Core drill (diamond drill) - A drill used for removing cylindrical rock samples.

Country rock - Term used to describe the general mass of rock adjacent to an orebody as distinguished from the ore deposit itself.

Coyote hole - A small tunnel driven horizontally into the rock at a right angle to the face of a quarry. It may have two or more crosscuts driven parallel to the face. Explosive charges are placed in the ends of the crosscuts. The remaining space in the tunnel is filled with rock, sand, and timbers to act as stemming for the explosive. May also be used to induce block caving.

Crest line - The edge of a bank

Crib - A structure composed of frame or timber laid horizontally upon one another, or of timbers built up as in the walls of a log cabin.

Crossbar - The horizontal member of a roof timber set supported by props located either on roadways or at the face.

Crosscut - A passageway driven at right or other angles to the main entry.

Cut and fill - Procedure whereby the ore is removed in slices or lifts, and the excavation is filled with rock or other waste material known as backfill.

Cut bank - The side of a bank that is being excavated.

Cutting machine - A machine used to undercut or shear a coal face.

Decibel, dB - A unit of measurement of sound levels relative to a standard level (usually .0002 dynes/cm^2). The decibel is p.1 Bel. The scale is logarithmic with an increase of one Bel (10dB) representing a 10-fold increase in sound level.

Dehydration - Loss of water or body fluids. Severe dehydration can be dangerous to life.

Delay, short period or delay action - An electric blasting cap used in firing of a round of shots arranged in a planned sequence so that the cut or relief holes are blown first, successive shots are separated by milliseconds.

Diffusion - Bending of a gas and air, resulting in a homogeneous mixture. Blending of two or more gases.

Disseminated ore - Ore carrying small particles of valuable minerals, spread more or less uniformly through the gangue matter.

Dewatering - In mining, removing water by pumping, drainage or evaporation; in metaullurgy, a process used to remove most of the water by mechanical classifiers, wet cyclones and filters, leaving a damp mineral cake.

Diamond drill - A rotary drilling machine used for exploration work by drilling core and/or blast holes. Exploration drilling involves rotating a hollow, circular, diamond studded bit that cuts a circular channel around a core of ore or rock, the core can be recovered and provide a columnar sample of the rock. Diamond drilling uses drill inset with diamonds as a rock-cutting tool. Also a solid bit that drills a hole for blasting.

Dilution - Waste or low grade rock which in unavoidably removed with the ore.

Directional drilling (offset drilling) - The planned curving of a rotary drill hole to avoid an obstacle or to reach a special area. The course of the drill bit is controlled and directed.

Disseminated ore - Ore carrying small particles of valuable minerals, spread more or less uniformly through the gangue matter.

Dogs - Automatic braking device that prevents the cage from dropping down the shaft i.e., safety dogs.

Doghole - Any small opening driven into rock

Double jack - Sledge hammer.

Drag fold - Condition where rock has been folded or bent back on itself.

Dragline - A type of excavating equipment which casts a rope-hung bucket a considerable distance, collects the dug material by pulling the bucket towards itself on the ground with a second rope, elevates the bucket, and dumps the material on a spoil bank, in a hopper, or on a pile.

Draw down - The lowering of the water table by pumping; the differences between the static water level and the pumping water level. Also pulling ore from a shrinkage stope.

Draw point - Place from which ore is taken to dump into an ore pass.

Draw slate - A slate which covers a seam of coal. Usually a flat rock which may drop when the coal seam is removed.

Draw works - In rotary drilling, the part of the machine that functions as a hoist to raise or lower the drill pipe and transmit power to the rotary turntable.

Drift - Horizontal opening driven into rock - always on ore.

Drift mine - A mine that opens into a level or nearly level seam of coal.

Drifter - A rock drill used for boring horizontal holes for blasting.

Drill collar - A section of thick walled drill pipe used immediately above the rotary bit to provide extra strength and special threads for attachment of the drilling or coring bit.

Drill pipe - The sections of a rotary drilling string connecting the kelly with the drill collars and bit.

Drill string - In rotary drilling, the assemblage of drill rod (pipe), drill collars, core barrell or drill bit, rotating underground.

Drilling mud (drilling fluid) - An aqueous or oil suspension of bentonite or other clay minerals used in rotary drilling and pumped down the drill pipe to form a seal against the porous walls of the hole and to float and circulate the rock chips (cuttings) back to the surface of the ground.

Drophammer - A pile driving hammer lifted by cable and allowed to free fall.

Drop hose - A hose from the main source, e.g. compressed air, to the specific equipment being used, e.g. air drill.

Dry - Locker room for employees.

Dry well - A hole, filled or lined with rocks, constructed for the purpose of holding drain water until it soaks into the ground. Unsuccessful oil well.

Dummy hose - The short section of water hose on a jackleg or stoper.

Embankment - An artifical ridge of soil and rocks, such a a dike or railroad grade across a valley.

Entry - A haulage road, gangway or airway to the surface; a coal heading.

Escapeways - Passageways through the mine which are used in emergency.

Extractive metallurgy - The extraction of metals from their ores or from the naturally occurring aggregates of minerals by various mechanical and chemical methods. The major divisions of extractive metallurgy may be classified as mineral dressing, pyrometallurgy, hydrometallurgy and electrometallurgy.

Eye bolt - Piece of bolt with a loop on one end and thread on the other - used with an expanding shell to secure bolt into a drill hole.

Face - An area in a coal mine where coal is being extracted from its natural deposit in the earth; the solid surface of coal being mined; the working area.

Fast powder - Explosives having high speed detonation.

Fault - A fracture in the coal seam accompanied by displacement.

Faulting - The movement in the earth that produces relative displacement of adjacent rock masses along a fracture.

Fill - A structure or embankment made with soil or rock. Classified mill tailings used in backfilling.

Filter bed - A pervious fill made of soil that provides a drainage site for a septic field.

Fish plate (splice bars) - Flat piece of metal with holes used to secure pieces of rail together.

Fissure - An extensive crack, break, or fracture in the rocks.

Flame safety lamp - A lamp used for the detection of oxygen deficiency and the presence of methane.

Fleet angle (hoist) - Angle of cable with sheave and hoist drum centerline as the cable moves across the drum.

Flotation - The method of mineral separation in which a froth created in water by chemical reagents floats some of the crushed minerals and permits others to sink.

Fold - Any bending or wrinkling of a rock stratum.

Footer - Board placed under a post to keep it from sinking into soft ground (e.g. foot board).

Footwall - The wall or rock on the underside of a vein or ore structure.

Foul air duct - A suction line in a tunnel ventilation system.

Fracture - A break in the rock. The opening affords the opportunity for the entry of mineral bearing solutions.

Frog - Switch plate in railroad track used to assist rail equipment to change from one set of rails to another.

Front end loader - A tractor loader with a scoop or bucket which operates entirely at the front end of the tractor.

Frothing - The act of producing a collection of bubbles at the surface of a flotation medium for the purpose of separating a finely crushed suspension of minerals from one another by causing some of the minerals to float in a froth and others to sink.

Fuse or wick - Blasting safety fuse that has a waterproof covering over a black power train with a burning speed of 45 seconds per foot $\pm$ 10%.

Gamma rays - Electromagnetic waves forming a part of the radiation of a radioactive substance.

Gangue - The worthless minerals and rock associated with valuable minerals in an ore deposit.

Gas sample - An air or contaminated air volume taken underground for analysis.

Glory hole - A large open pit from which ore is extracted, especially where broken ore is passed to underground working before being hoisted.

Gob - Waste material left in coal mine. Also in metal mines, a dump for waste rock.

Gob area - Coal and other minerals in the mine that are not marketable. That part of the mine where minerals have been extracted and the resulting space, more or less, filled up by falled materials.

Gooseneck - The curved pipe on an air drill that the air hose is attached to.

Gouge - Fine, putty-like material composed of ground-up rock found along a fault.

Grizzly - A coarse screen or gill made of heavy steel bars, used to remove oversize pieces from run of mine ore or blasted rock.

Grizzly hook - A metal bar with a hook and a handle for moving rocks on a grizzly.

Ground wire - An electrical conductor which carries current to the ground. Used to prevent electric devices from producing shocks.

Gunite - A concrete like material sprayed on mines to keep ribs and back from crumbling.

Gyratory crusher - A primary crusher with a vertical spindle mounted in an eccentric bearing within a conical shell or chamber. The top of the spindle carries a conical crushing head which revolves eccentrically within the conical chamber.

Hammer mill - An ore crusher fitted with movable, loosely hung hammers mounted on a horizontal shaft which rotates in a lined casing. Rotation of the shaft permits the hammers to hit or flail the falling ore or rock which is fractured by the impact. (Also called an impact crusher).

Hanging wall - The wall or rock on the upper or top side of a vein or ore deposit.

Haulageway - Road or track used as a primary means of carrying ore from the mine.

Hazard - A potential source of danger to health or safety.

Header - The valves and fittings on the main air and water lines. Wood plank placed between roof or rock bolt plate and mine roof.

Heading - A tunnel excavation that is being advanced.

Headframe - The structure over the shaft that supports the hoist cable and skip.

Head room - The area above an overshot mucker.

Health - The well-being of the individual in terms of freedom from disease.

Health standard - A standard which states the amount of exposure to a potentially unhealthy condition which may be tolerated.

Highwall - The unexcavated face of exposed overburden and rock in a quarry or the uphill side of a strip or contour mine.

Hitch - A small hole carved out of rock into which timber is set.

Hoist - The power unit (motor and drums) that controls shaft conveyances (cage)

Hoist skip - A bucket attached to a hoist which is used primarily for carrying ore, sometimes miners are carried.

Hopcalite - A substance used in respiratory devices which serves as a catalyst for changing carbon monoxide into carbon dioxide.

Hopper - Device which is used for containing and transferring materials, usually open at top with a draw opening at bottom.

Hot - Refers to primed explosives or a lit fuse.

Hot fuse - Fuse that has been lit.

Hot wire (shot wire) - Wire carrying electrical energy also used to detonate electric caps.

Hydrogen - A gaseous element lighter than air which is colorless, odorless and tasteless. It is flammable over a wide range of concentrations and is released in the process of changing batteries

Hydrogen sulfide, H_2S - A colorless, toxic and flammable gas which is heavier than air and has an odor similar to rotton eggs. It is poisonous, and deadens the sense of smell quickly.

Igneous rocks - Rocks formed from molten material which originated within the earth.

Immediate roof - The roof immediately above the coal bed.

Impact crusher - See hammer mill.

Inby - Toward the working face or interior of the mine, away from the shaft or entrance.

Intake air - Air which is coming from the exterior of the mine toward the working area.

Ionizing radiation - Radiation capable of changing a neutral atom into an ion (an electrically charged atom).

Jack hammer - A percussion type of automatically rotated rock drill that is activated by compressed air.

Jackleg - Ingersoll Rand trade name for airleg plus jackhammer. Air driven rock drill mounted on an articulated air leg.

Jaw crusher - A rock or ore crushing machine consisting of a moving jaw, hinged at one end, which swings toward and away from a stationary jaw in a regular oscillating cycle.

Jig - An apparatus used in milling to concentrate ore on a screen submerged in water.

Jim crow - A railroad rail bender.

Jumbo - A track or tire drill mounted carrier.

Kelly - A square box tube fitted into a square opening in the turntable of a rotary drill, it is free to move up or down in the turntable while the turntable is rotating. The lower end of the kelly is treaded into the drill pipe and the upper end has a swivel connection for the attachment of the drilling fluid hose.

Kettle bottom - A smooth, rounded piece of rock, cylindrical in shape, which may drop out of the roof of a mine without warning.

Kick brace - a piece of timber going from the sill to a post.

Knee brace - A piece of timber going between two posts.

LHD - (Load, haul, dump) diesel equipment designed to load, haul and dump broken rock or soil.

Lagging - Boards placed along side each other as in a bulkhead.

Lamination - Process in roof bolting by which the bolts are used to bind different roof strata together under a certain amount of pressure, much like the manufacture of plywood.

Lamphouse - Place where lamp batteries for cap lights are kept, changed and dispensed to miners.

Lanyard - 6' safety rope with hooks on each end.

Leaching - A chemical process used in milling and/or mining for extracting ore. The natural process where by ground waters dissolve minerals and carry them away, thus depleting the mineral content.

Lens, lenticular - Term to describe shape of body of ore which has the form of a double convex lens.

Levels - Worked or working areas of a mine off the shaft or winze.

Levitation - In the mineral process of froth flotation, the act of lightening collector-coated particles by causing them to become attached to air bubbles.

Leyner - Air driven rock drill. Trade name of a drifter.

Lignite - A brownish black coal formed from peat.

Limestone - A bedded sedimentary deposit containing mostly calcium carbonate.

Liquid limit - The water content required for soil to pass from a plastic to a liquid state, the minimum moisture content which will cause a mass of soil to flow if jarred slightly.

Lock out - Procedure to be followed in maintenance and repair of equipment (especialy electrically powered) whereby the power source is turned off and locked in the off position to avoid inadvertant restart.

Longhole - A hole drilled into rock longer than 10' or requiring two or more lengths of drill steel.

Longwall mining - A system of mining on straight faces 80 yards or more in length. A method of working coal seams believed to have originated in England toward the end of the 17th century. The seam is removed in one operation by means of a long working face or wall advancing in a continuous line which may be several hundred yards long.

Main roof - Roof above the immediate top. It may vary in thickness from a few feet to several thousand feet depending on the depth of the coal.

Mandoor - Door in stopping or bulkhead for passage of miner.

Mantrip - Any device used for transporting miners in the mine. Also a trip on which miners are carried.

Manway - Any opening for the express purpose of allowing men to pass to and from any area.

Mast - Upright post to which drill, etc. is attached.

Matrix - The rock or gangue material containing ore minerals.

Matte - The product of a smelter, which is metal with some sulphur and impurities, requires further refining.

Mats - Long steel plates bolted to the rock for support.

Measuring pocket - A fixed container with doors at both ends that holds one skip of muck at a time. It is used to prevent overloading of a skip or car during drawing of material from a bunker or an ore pass.

Mesh - Wire used to hold areas of loose ground.

Messenger cable - A small diameter cable used to activate pull bottles and hang vent line on.

Methane, marsh gas, firedamp, Ch_4 - A flammable gas found in most coal mines, also known as marsh gas.

Mill - The physical structure and equipment used in beneficiation.

Mill heads - The average grade of ore fed into a mill.

Mill tailings - The rock waste remaining after removal of the mineral.

Mine door - Large hinged door used to completely close off a passage. They are hung so that ventilating air pressure will push them closed. Usually hung in pairs to form airlock.

Mine roof - The layer of hardened clay, limestone, sandstone, or other material that lies over the coal bed; rock or other material above the coal seam.

Mineral dressing - See beneficiation

Monkey heading - Return air passage in an anthracite mine.

Motor - A haulage engine used in mines, operated by by battery, compressed air, diesel or electricity.

Muck - Broken rock, ore or waste.

Mucker - Machine used to load or transport muck, i.e., Wagner, 12-B, Eimco 911.

Muck cars - Devices used to transport muck.

Muck stick - Shovel.

Mule barn - An area where battery banks are recharged and electric motors are kept when not in use.

Natural ore - Iron ore that contains moisture in contrast to "dry ore" that has been dried by not calcined.

Nip - An electrical connector used to connect trailing cables from various devices to a trolley wire.

Nipper - A gopher, one who runs errands, deliver supplies.

Nitrogen - The gas which is the major constituent of air. It is colorless, odorless and tasteless.

Nitrogen dioxide, NO_2 - An oxide of nitrogen which is an extreme irritant and toxic.

Nitrogen oxide, NO - An oxide of nitrogen. It is toxic but not as much so as NO_2

Non-ell - Primer cord type of explosive detonator.

Ore dressing - A process of mechanically separating the grains of ore minerals from the gangue minerals to produce a mineral concentrate and a discard of gauge minerals called tailings. (Ore dressing is also called milling, mineral dressing, or beneficiation).

Ore pass - An opening that is used to transport ore by gravity.

Oreshoot - The portion or length of the ore structure that carries sufficient valuable mineral to be profitable to mine.

Outby - A term indicating a relationship of being away from the face toward the entrance to the mine. That is, an object further from the face than a particular point is said to be outby that point.

Outcrop - The part of a coal seam or vein that appears at or near the surface.

Overbreak (backbreak) - Rock that is broken beyond the intended line of break by blasting.

Overburden - Soil or rock lying on top of bedrock or ore deposit.

Over cast - A device for carrying air over another air passage to avoid mixing of intake air.

Overspeed - Condition when hoist cable moves too rapidly. May be caused by incorrect load balance or by operator error.

Overwind - Condition when hoist cable is wound too far for location at which cage or skip is to stop. Usually implies damage to head shear due to contact with the cage or skip.

Oxygen-deficiency - An atmosphere with an oxygen concentration below that found in normal air.

Pass - A working cycle or trip of an excavating machine.

Pay formation - A layer or deposit of ore or rock that is valuable enough to mine or excavate.

Peat - A material formed in marshes and swanps from dead plants. It is yellowish-brown to brownish-black in color.

Percussion drill - A machine, usually pneumatic, producing a blow by an internal hammer, as it rotates a steel bit, i.e. stoper, drifter, jackhammer.

Permissible - Term applied to equipment e.g. self-rescurer which has been examined and certified by MSHA formally for use in gassy and dusty mines.

Pillar - A part of the natural rock or material being mined left to support the overlying strata in a mine; sometimes left permanently to support surface works or against old workings containing water.

Pin hole - Short drill hole - 2'.

Pinch point - Point at which two movable surfaces meet with possible trapping of hands, feet or limbs.

Plow - A long wall machine used to remove coal by the cutting action of a set of blades.

Plunge - The vertical angle an orebody makes between the horizontal plane and the direction along which it extends.

Pneumoconiosis - A chronic disease of the lung arising from breathing coal or other dusts.

Portal - The entrance to a tunnel or adit.

Post - An upright timber.

Pot - A rounded mass of roof slate resembling an iron pot. It is separated from the other slate by old mud cracks and is liable to fall without warning.

Pothead - Coupling used to connect trailing cables.

Powder - A term used for prill, dynamite, etc.

Power shovel - An excavating and loading machine consisting of a digging bucket at the end of an arm, suspended from a boom, which extends cranelike from that part of the machine which houses the power plant. When digging the bucket moves forward and upward so that the machine does not usually excavate below the level at which it stands.

Prill (prell) - An ammonium nitrate fuel oil blasting agent aka ANFO.

Prill gun - Device used to charge a hole with prill.

Prill pot - Pressurized device used to charge a hole with prill.

Primary crushing - Reduction of rocks to size of about 4 inches across.

Primary excavation - Digging in an undisturbed soil or rock formation.

Primer - Booster used to detonate prill, i.e., stick of powder and a cap.

Primer cord - High speed detonating fuse in cord form.

Process Metallurgy - Use of chemical, electrical and magnetic means to extract ore from the rock.

Puddle - Compaction of loose soil or fill material with water.

Pull bottle - An electric spring switch activated by pulling a cable or cord.

Pulp slime - A finely ground ore mixed with water and capable of flowing through suitably graded channels as a fluid.

Radioactivity - State of emitting ionized particles.

Radon - A radio active gas found chiefly in uranium mines.

Radon daughters - Radioactive elements produced in the disintegration of radon.

Raise - An opening driven upward through rock

Rake - Similar to plunge.

Ready line - Equipment line composed of vehicles that are ready to operate.

Refuge area - Self contained emergency area containing air, water, first aid supplies and stopping materials, where miners barricade themselves into in the event of a catastrophe.

Regulator - A hole placed in a bulkhead or stopping to affect the flow of air.

Relief holes - Holes drilled, but not loaded, along a predetermined line to weaken the rock so that it breaks when blasting charges are set off in other holes, or those holes drilled, loaded and blasted between the cut and trim holes.

Rem - A unit of radiation dosage.

Resuing - A method of stoping wherein the wall rock on one side of the vein has been blasted before the ore itself is broken. Used on narrow veins. Minimizes dilution.

Return air - Air which has passed the working face and is being exhausted.

Respirator - A device used to reduce the amount of dust or other foreign substances inhaled.

Respirable dust - Dust particles less than 10 microns in aerodynamic diameters. They are not visible to the unaided human eye. Particles smaller than 5 microns may be dangerous to the health because they can enter and be retrained in the low lungs.

Rib - The side of a pillar or the wall of an entry.

Ripper - A machine used to rip coal from the face.

Riprap - Heavy stones placed at the waters edge along earth fill embankments and lake shores to prevent erosion from wave action.

Rock (roof) bolt - A long steel bolt inserted in a drilled hole used to support mine roof; the unit consists of the bolt, steel bearing plate, and expansion shell.

Rock burst - The sudden failure of walls or pillars in a mine caused by the weight or pressure of the surrounding rock, accompanied by violent release of energy.

Rock dust - Dust crushed limestone used primarily in coal mines to cover coal faces and reduce the amount of coal dust in the air. May also be used to extinguish fires.

Rock hook - Device for manipulating rock in a crusher.

Rod mill - Similar to a ball mill but uses cylindrical steel rods for grinding.

Roll crusher - Crushes ore by cylinder rotating and pressing against the wall or another cylinder (double roll or triple roll).

Roof bolt - A long steel bolt inserted in a drilled hole used to support mine roof; the unit consists of the bolt, steel bearing plate, and expansion shell.

Roof bolter - A person who installs roof bolts. A machine used to install roof bolts.

Roof jack - A screw- or pump-type hydraulic extension post made of steel used as temporary roof support.

Roof trusses - A combination of steel rods anchored into the roof to create zones of compression and tension forces and provide better support of weak roof and roof over wide areas.

Room and pillar - A system of mining in which the distinguishing feature is the mining of 50 percent or more of the coal or ore in the first working. The coal or ore is mined in rooms separated by narrow ribs or pillars which are left to hold the roof. The rooms are driven parallel with one another and the room faces may be extended parallel, at right angles, or at an angle.

Rotary table - The geared rotating table that turns the kelly and drill string when drilling.

Safety - The maintainence of protection from objects which may cause injuries.

Safety fuse - "Safety fuse" means a train of powder enclosed in cotton, jute yarn, and water-proofing compounds, which burns at a uniform rate; used for firing a cap containing the detonating compound which in turn sets off the explosive charge. (30 CFR 77.2) See fuse.

Safety standard - Standard set for safe conditions.

Scab - A piece of short timber nailed to other timber for support of braces.

Scaling - Prying loose pieces of rock material from the roof and ribs of a tunnel or from the face of an open pit mine. See barring down.

Scalping screen - The screen or grizzly used to remove undesirable fines from broken ore, stone or gravel.

Screen - A mesh or bar surface used for separating pieces or particles of different sizes.

Screen, shaking - A screen that is vibrated to cause material to move along it and through the mesh.

Screening - Process of separating material by size. Undersize goes through and oversize passes over the screen.

Seam - A large deposit or layer of coal.

Secondary crushing - Reduction of ore to pieces about one inch across.

Section - A part of the working area of the mine.

Self-rescuer - A device used to protect a miner against carbon monoxide and smoke in case of a mine fire or explosion.

Semi-autogenous crusher - Uses metal balls to aid in crushing.

Service raise - An opening that is used for the passage of men and materials from one level to another.

Shaft mine - A mine in which the coal seam is reached by a vertical shaft.

Shale - A rock formed by consolidation of clay, mud, or silt; has a laminated structure composed of minerals essentially unaltered since deposition.

Shear - The deformation of rocks by lateral movement along parallel planes generally resulting from pressure and producing such metamorphic structures as cleavage.

Shearer - A long wall machine which shears coal from the face.

Shoring - Temporary bracing to keep excavation walls from caving.

Shot - Any explosive that is being or has been detonated.

Shotcrete - A form of concrete applied to the back and ribs of a mine to keep moisture out and reduce spalling (sloughing).

Shrinkage stoping - A method of stoping which utilizes part of the broken ore as a working platform and as support for the walls.

Shuttle car - A vehicle, usually powered by electric motors, used to transfer coal from the face area to the main transportation area.

Silica - An oxide of silicon, of which quartz is a common example.

Sill - A sheet of igneous rock of approximately uniform thickness and extending over a considerable lateral extent which has been intruded between level or gently sloping beds.

Silting - Filling of a water way with water-bone soil particles.

Single jack - Small sledge hammer - four lbs.

Sinter - The heat treatment of fine ore particles to produce larger pieces for blast furnace feed. Also the product of the treatment.

Skip - A large hoisting bucket primarily used for hoisting materials. Sometimes miners are transported in the skip.

Slate bar - The proper long handle tool used to pry down loose and hazardous material from roof, face, and ribs.

Slope mine - A mine with an inclined opening used to reach the coal seam.

Sloughing - The slow crumbling, of material from roof, face or rib.

Slurry - A combination of ore with liquid (usually water) for purposes of transportation or beneficiation or both.

Slusher - Winch like device used for moving broken rock.

Spad - A device attached to the roof of a mine to mark locations in the survey of the mine.

Spalling - The sloughing, slow crumbling, of material from roof, face or rib.

Spitter - Device used for lighting a fuse.

Spitting - The act of lighting a fuse.

Splice - A joining together of two pieces (usually electrical wires) to make a single unit.

Split - A specific segment of the airways in the mine serving a specific area of the mine.

Split set bolt - A specific type of rock bolt, i.e. slotted pipe.

Spoil - Dirt, rock, or overburden that has been removed from its original location.

Square set - An arrangement of timbers used for support. It consists of cap, girt, and post.

Square set stopeing - Method of removing ore using square sets as the support.

Squeeze - The roof settles without breaking and gradual upheaval of mine floor due to weight of mine roof.

Station - The area or room on each level at the shaft

Stemming - The inert material (clay; water) used to fill a hole after the explosive charge has been placed.

Stench gas - Emergency evacuation warning system - smells like rotten eggs.

Stope - A series of steps or benches made in the tunnel or crosscut area of a mine for the purpose of reaching an ore body. One of many opening configurations drilled upward to remove ore.

Stoper - An air drive rock drill

Stopping - A barrier erected in a passageway for the purpose of controlling air flow.

Stratum - A sheetlike layer of sedimentary rock.

String - In cable tool drilling (churn drill), the tools that are suspended on the drilling cable.

Stringer - A narrow vein or irregular filament of mineral traversing a rock mass.

Stripping - Excavating the surface layer of material for the purpose of strip mining the exposed ore formation.

Stull - A post used to support a weak spot in the back, roof or rib.

Sub level - An intermediate level in a mine opened between main working levels.

Sublevel blasting - Blasting done between levels of a mine. This may be done to follow to course of the seam.

Sulphur dioxide, SO_2 - Colorless gas or liquid with a suffocating odor.

Sump - An underground excavation for catching or storing water, usually at the bottom of a shaft.

Suspension - The act of hanging. Weaker strata hanging from stronger overlying strata by means of roof bolts.

Switch - That part of a railroad track that diverts a motor or car from one set of tracks to another.

Swivel head - The bevel gear that meshes with, and is driven by a matching gear on the drill motor shaft of hydraulic-feed, and/or some types of gear-feed, rotary drills.

Swivel coupling - A coupling where the water or mud hose is attached to the gooseneck of the kelly to permit pressure circulation of water or drilling mud through the drill string to the rotary bit at the bottom of the hole.

Syncline - A downarched fold in bedded or stratified rocks shaped like the trough of a wave.

Taconite - A siliceous iron formation containing magnetite and hematite which must be concentrated to make it useable. Formed mainly around the Mesabi range.

Tailings - The gangue or waste material separated from useful ore during mineral processing.

Tailpiece (conveyor) - Also known as foot section pulley. The pulley or roller in the tail or foot section of a belt conveyor around which the belt runs.

Talus - A heap of broken coarse rock found at the foot of a cliff or mountain.

Tension - Stretching applied to rock as a result of mining, or to a roof bolt or roof truss as a result of tightening.

Thoron - A radio active gas which breaks into thoron daughters.

Timber trucks - Trucks used for hauling timbers in the mine.

Timbering - The setting of timber supports in mine workings or shafts for protection against falls from roof, face, or rib.

TLV, Threshold Limit Value - The amount of contact allowable for a dangerous substance within a specific time period. An average (time-weighted) concentration of a substance to which an individual may be exposed 7 to 8 hours a day and 40 hours a week without adverse effects.

Trailing cable - Cable connecting a piece of mobile equipment to a power distribution center or other electrical source.

Tram - To move ore cars or other vehicles in the mine. An overhead materials handling system.

Treated timbers - Timber treated with chemicals such as creosote, zinc chloride, or by other methods to season and extend useful life and/or prevent fire.

Tugger - A small electric or air driven hoist.

Under cut - Area of the bank where the bottom has been removed and the top is overhanging.

Undercast - A passageway for the flow of air which allows the air current to flow beneath another air current without mixing the two.

Wagon drill - A pneumatic drill mounted on wheels; attached to a frame with a hydraulic drill control mechanism used to feed the drill into rock or retract it.

Wall rock - The country rock immediately adjoining mineral deposits.

Wetting agent - A chemical reagent used to reduce surface tension of water so that it will soak into porous material more readily.

Windrow - In road construction or strip mining, a term applied to a long ridge of loose dirt.

Winze - An opening driven downward in rock - opposite of a raise.

Working face - The area in which mining is currently being done.

Ventilation - The process of providing air to specific location in the mine.

Vug - A small cavity occurring in the midst of a vein or deposit. It is frequently lined with well-formed crystals.

Youngbuggy - A small dumptruck used to transport muck. Trade name.