Escape & Evacuation

A Miners' Education And Training Toolbox

Instructors' Handbook

PENNSTATE 1855

Miner Training Program

**Mark Radomsky,
Joseph Flick,
Joseph DeSalvo,
Larry Grayson &
Raja Ramani**

**Contents:
Demonstration videos,
Video user's guide,
Tool-box talk series,
and mine emergency scenarios**

**Funded by United States Department of Labor,
Mine Safety and Health Administration
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MINER TRAINING PROGRAM

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Preface

The history of safety in underground coal mines in the United States is a history of slow and steady progress. Safety should be thought of as a process of continual hazard identification and hazard control. A hazard is any condition or situation that causes or contributes to injuries and/or property damage. Over the last 50 years a formal, systematic approach to hazard identification and control has evolved and emerged. This approach—what we call modern safety management—includes many specific activities, such as examinations, communications, engineering controls, purchasing controls, analysis, administrative controls, group meetings, communications, personal protective equipment, and training, to name just a few. The passage and enforcement of laws, as well as company policies and standard operating procedures, engineering/technology applied to safety, and education and training are often referred to as the three Es of safety management, and are often understood as the three components of safety management that include all safety activities, such as those listed above. This module is an example of the education and training "E".

Mine emergencies, such as mine explosions, fires, and inundations have been all too common in underground coal mining. Too many miners have lost their lives over the years, and many more have suffered serious injuries doing the job that typically provides challenge, high wages, and good benefits.

Recent mine emergencies at Jim Walter Resources No. 5 Mine, Sago Mine, Aracoma Alma Mine No 1, and the Darby Mine No. 1 have reminded us that continuous safety and continuous safety improvement is our goal—a challenge to every miner. Our emphasis is always on prevention, but emergency preparedness has proven to be an important component of loss control.

Acknowledgements

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Very special thanks are extended to the many individuals who graciously shared time and talents in the making of the videos and preparation of the written materials associated with this project. Without their cooperation and assistance, these training materials could have been developed.

These materials are available now for a limited time at www.minerstownhall.org, and in the future may be available through the MSHA Academy at www.msha.gov.

Introduction

This training program is meant to supplement and support the training required under federal and state laws, the provisions of the MINER act of 2006, and the standards in Title 30 CFR, and related policies and guidelines issued by MSHA. Since training must be repeated often, there is a regular need for new training materials. This training program, titled *Escape and Evacuation: a Miners' Education and Training (E&T) Tool Box* includes two full length videos, a tool box talk series, and two emergency scenarios. The purpose of this handbook is to provide some suggestions regarding the planning and design of a mine emergency preparedness training program that uses the videos and the materials in this handbook. This handbook is organized into three parts. Part I includes a Video User's Guide for the two videos, titled *Mine Emergency: Demonstration of Evacuation Procedures*, and *Mine Emergency: Demonstration of an Escape*. Part II introduces the Tool Box Talk Series consisting of twenty tool box talks, and accompanying quizzes, and Part III includes two mine emergency scenarios.

Research has demonstrated that the most effective training uses content (information, materials, examples, etc.) that most closely mimic or reflect the real world. For mine emergency preparedness training, the goal is to improve or enhance the survivability of miners who may be in the mine when an emergency situation arises. Once a serious emergency (fire, explosion, or inundation) has been verified, and it has been determined that the hazards in the environment threaten the safety of the miners present, **the first priority is to evacuate/escape the mine.** If exiting the mine is not possible, miners should then seek refuge and wait to be rescued. A workforce well trained in all aspects of mine emergency preparedness makes a successful response to an emergency much more likely. As you plan your training sessions, ask yourself how you can design and tailor your training to take full advantage of the site-specific resources that you have at your disposal. A thorough knowledge of emergency related plans and evacuation procedures, including the steps to take regarding communication, readying a section and crew for evacuation, gathering equipment, knowing escapeways, etc., and proficient skills

in the use of SCSRs, directional lifelines, etc., can only be acquired through effective training and practice coupled with coaching and timely feedback, as needed.

The authors of this training tool-box, currently comprised of demonstration videos, tool-box talks and emergency scenarios, hope that you find these materials useful in your training efforts; we invite your comments, and suggestions for improvement of these materials, as well as the future development of materials and training programs.

We encourage you to help us improve this program. Please don't hesitate to contact us at 814.865.7472, or by contacting any of the authors (See Appendix A).

PART I

VIDEO USER'S GUIDE: *MINE EMERGENCY: DEMONSTRATION OF EVACUATION PROCEDURES*

The purpose of the video is to show how a crew of miners should respond to a serious mine emergency. Several important steps to a successful evacuation are demonstrated. It has been designed and developed for miners to enhance the goal of every emergency: take charge of the scene, reduce or eliminate the life-threatening effects of associated hazards, and preserve the lives of those involved in the emergency.

Primary and Secondary Target Audience

Miners who work on a production crew, responsible persons, and all miners working underground.

Objectives

At the conclusion of the video and the training program on emergency evacuation, the miners will be able to:

1. List the three major types of mine emergencies
2. Discuss the goal of mine emergency plans and preparations for an emergency
3. Define and discuss an evacuation
4. Compare and contrast an evacuation with an escape
5. Identify the responsible person on their shift
6. List at least four major objectives of a successful evacuation

Suggestions for Using This Video

Videos are an effective training tool. However, like any training material, they should not be misused; showing a video is only part of a curriculum. Therefore they should be used by the instructor to supplement and enhance the training. This video is intended to supplement a training lesson in mine emergency preparedness by elaborating on evacuation principles, and fundamentals, and acting out a realistic emergency scenario that demonstrates how a crew of mines work together to demonstrate a successful mine evacuation.

Effective training is rarely achieved without a significant investment in preparation. The first two steps of any training course or session involves analysis and design: analysis includes the needs assessment (defining and specifying the training content) and the design includes preparing training objectives, and selecting training methods and identifying training materials that will give the trainees the best opportunity to acquire the knowledge and skills intended by the training.

The final product of the design and development phase is the lesson plan, which often begins as a simple topical outline. A suggested outline for a lesson in escaping a mine appears below. The lesson plan can be thought of as the "road-map" or "blueprint" for the lesson. Although it is a personalized document, and often reflects the bias of the instructor, it represents a complete "script" that can be used by any instructor knowledgeable in the subject. As such it will include the training objectives, main points of the lesson, and the details of instruction, included suggested videos, case studies, examples, oral questions, etc. All training sessions should be carefully prepared and planned to include site-specific information, examples, and opportunities for discussion.

Suggested Outline

I. Introduction
II. Types of major emergencies
III. Types of emergencies at our mine, location, etc.
IV. Emergency response and emergency evacuation and firefighting plans
V. Policies, procedures, and emergency equipment
VI. Signs of an emergency
VII. Emergency reporting
VIII. Evacuation procedures
IX. Special problems…scenarios

VIDEO USER'S GUIDE: *MINE EMERGENCY: DEMONSTRATION OF AN ESCAPE*

The purpose of the video is to show how an outby miner, who is not aware of the ordered evacuation, is located by a supervisor, and subsequently the two of them successfully make their way out of the mine. After donning their SCSRs, the two miners proceed to exit the mine by first following the primary escapeway. However, along the way they encounter several obstacles that must be first overcome. This video has been designed and developed for miners to enhance the goal of every emergency response: take charge of the scene, reduce or eliminate the life-threatening effects of associated hazards, and preserve the lives of those involved. However, in situations where it has been determined that hazards cannot be controlled immediately, and a threat to the miners exists, all miners must attempt to evacuate or escape to the surface. Barricading, or entering a refuge chamber should always be the "decision of last resort."

Primary and Secondary Target Audience

Miners who work outby, responsible persons, and all miners working underground.

Objectives

At the conclusion of the video and the training program on emergency evacuation, the miners will be able to:

1. List the three types of major mine emergencies
2. Discuss the goal of mine emergency plans and preparations for an emergency
3. Define and discuss an escape
4. Compare and contrast an escape with an evacuation
5. Identify the responsible person on their shift
6. List at least four major objectives of a successful escape

Suggestions for Using This Video

Videos are an effective training tool. However, like any training material, they should be used by the instructor to supplement and enhance the training. This video is intended to supplement a training lesson in mine emergency preparedness. Effective training is rarely achieved without a significant investment in preparation. The first two steps of any training

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Part II

Mine Emergency Preparedness (MEP) Tool-Box-Talk Series

Introduction

Because of the potentially devastating consequences of mine fires, explosions and inundations, miners must be trained to recognize potential hazards, abate or control those hazards, and be prepared to react appropriately in the event of an actual emergency. The value of mine emergency preparedness (MEP) is rarely questioned, but our level of preparedness is sometimes taken for granted. Education and training, with an emphasis on practice and drills, is the best strategy to minimize loses—both human and property—in the aftermath of a mine emergency.

The purpose of the Mine Emergency Preparedness *Tool-Box-Talks* (TBT) is to provide a useful means of presenting MEP information related to mining emergencies. Tool box talks are brief learning opportunities. They are commonly used to present/review information on one topic or issue. Since they are short in length, the person conducting them must make efficient use of time. While the talk should be informal, the presentation needs to be structured and well organized to achieve the learning objective. Structure and organization is often aided by a good tool-box talk outline.

The twenty (20) tool-box-talks (TBT) in this series provide good outlines on several important topics; they can be used to instruct miners in emergency subjects in an efficient and effective manner. Some of the TBT address prevention, while others provide practical information on procedures and situations related to escape and/or evacuation. These TBT can be used throughout the year to help maintain a high level of awareness and skill in successfully implementing emergency plans and procedures to ensure the maximum protection of lives and property.

Advantages of Tool-Box-Talks

1. A supervisor or other knowledgeable person can conduct tool-box-talks.
2. Talks are short duration and typically last 10-30 minutes.
3. Training sessions do not need to be conducted in a classroom setting; they can be held in the locker room, a shop, or even in the mine itself.
4. Audiovisual equipment is not needed.
5. You can easily tailor the material to make the talk site specific.

Design of the Tool-Box-Talks

The consistent design is simple, and easy to use. It allows the user to become comfortable with the way the material is presented. The sections and supporting materials are explained below:

1. Purpose/Benefit:

This section states the goal of the talk. In other words, this section tells the miner why this material is important.

2. Learning Objective(s):

This section describes what it is that you want the miner to be able to do or know at the end of the training session.

3. Important Safety Points:

This section lists the most important points regarding the topic. Use what is provided or feel free to add additional information as it applies to your mine.

4. **What You Must Know and Do:**

This section focuses on what miners must know and do to avoid/address the hazards and/or to better ensure that the conditions are safe and/or procedures are followed.

5. Discussion:

This section allows you to tailor the information provided in the above sections to your mine, and provides time for miners to ask questions, seek clarifications, and make suggestions.

6. Instructor Reference Material:

This section provides the supervisor with supplemental study information on the topic. Reading over this material prior to giving the talk can provide some statistics, examples, policy/regulation references, subject details, etc., that can enhance the tool-box talk.

7. Quizzes and Exercises

The twenty (20) supplied quizzes and accompanying answer keys closely follow the twenty subjects of the tool-box-talk series. If time allows, you can administer the quizzes at the end of the session, or use them in other more formal training settings, such as Annual Refresher Training.

Suggestions for Delivering Tool-Box-Talks

1. Pick a time and place to have the meeting.

2. Pre-assess: ask the miners about their direct experience with the subject.

3. Tell the miners about how long the talk will last. Try to keep the meeting to less than fifteen minutes.

4. Be sure that all miners can see and hear you.

5. Because the tool-box-talk is only one-page, consider giving a bulleted handout to the miners that summarizes key information and responsibilities.

6. Review the tool-box–talk in advance of the meeting and become familiar with the contents.

7. Do not read the material to the miners, but use the information on the tool-box-talk as reference/talking points to cover, and stimulate discussion.

8. Use language and terms the miners know and understand.

9. Think in advance of any easy to use training aids that could reinforce the points of the talk such as a gas detector, mine map, SCSR, lifeline, etc.

10. Answer all questions honestly. It is okay not to know an answer to a question. It is NOT okay to speculate because of the serious nature of the subject material. If you do not know, say so and tell the miner you will find out—THEN DO IT!

11. Encourage group discussion, but do not let the meeting turn into a complaint session. Stick to the topic.

12. Be site-specific at every opportunity. Some material may be generic in nature, but the “Discussion” section of the tool-box-talk allows you to tailor your comments to the conditions at the mine.

13. At the end of the session, provide a brief summary or conclusion that captures the essence of the talk…key concepts, most important points, principle or lesson learned.

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #1	
Title	**Know the Dangers of Coal Mine Atmospheres**
Purpose/Benefit	To acquaint miners with the gases found in underground coal mine atmosphere and their effects on the health and safety of the miners
Learning Objective	The miner will describe the hazards posed by the various gases found in underground coal mines and the means to control these hazards.

Important Safety Points
o Mine atmosphere is different from normal atmosphere
o Minimum quality of mine air for miners to work safely is defined by regulations
o Mine ventilation is the principal method of controlling the mine atmospheric air quality and quantity
o Oxygen is the life sustaining gas. Oxygen-deficiency can occur in some areas of the mines due to excess methane, carbon dioxide or nitrogen. Miners must be very vigilant about these areas.
o Methane gas is commonly found in coal mines. It does not support life and is explosive under suitable concentrations [5% to 15%] in mine air.
o Carbon dioxide can also be found in coal mines in large concentrations. It does not support life.
o Toxic [or poisonous] gases in mines include Carbon Monoxide, Nitrogen Oxides, Sulfur Dioxide and Hydrogen Sulfide. All these gases affect different organs of the body [blood, lungs, etc] differently causing serious injury to the organ or even death.
o Before entering any area to work, ensure that the area is safe to work including air quality.

What You Must Know and Do
o Be aware of all the gases that occur in your mine and their health effects, and be familiar with the practices in the mine to control them.
o Verify that before entering a working place that it has been pre-shift examined to ensure that it is safe to enter.
o Do not disturb the ventilation controls so as ensure adequate fresh air flow according to the ventilation plan.
o If ventilation controls appear to be disturbed or broken down, report to get them fixed immediately or fix them as necessary.

Discussion
o The gases found in your mine are:
o The most common gas [other than oxygen, nitrogen and carbon dioxide] found in your working place is:
o What kind of alarms and warnings are provided in your mine when dangerous levels of mine gases are found?
o What actions will you take when methane concentration is greater than 1%?

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Instructor Reference Material

KNOW THE DANGERS OF COAL MINE ATMOSPHERES

How long can you live without air, water or food?

A general rule of threes for survival is that to stay alive you must:

- Breathe air within three minutes
- Drink water within three days
- Eat food within three weeks

In fact, if you are out doors in very cold weather, another good rule is to find shelter or warmth within three hours. Note that nothing is said about the condition of the air, water or food. It is assumed that they are all fit for consumption with no dangerous health effects. While these are very rough guidelines, it helps to appreciate the relative importance of life sustaining elements of the environment [air, water, food and weather].

Clearly, air is most important for sustaining life on the surface of the earth. The air in a mine is often different from the air in the atmosphere. If not properly understood and managed, mine air can be the source of lots of health and safety problems. These include **lack of oxygen, suffocations, poisoning, fires, ignitions and explosions of gases and dusts, and lung diseases such as black lung**.

This tool box talk is to make you aware of the dangers of coal mine atmospheres and discusses the following topics: [1] air quality in mines, [2] gases that are found in the mines, [3] descriptions of the major gases found in the mines and their health and safety properties, [4] detection of gases in mines and [5] control of gases in mining.

What is the Quality of Air in Mines?

Air is the mixture of gases forming the atmosphere that surrounds the earth. The essential function of air is to support life and combustion. Constituents of pure dry air are oxygen (O_2) 20.93%, nitrogen (N_2) 78.10%, carbon dioxide (CO_2) 0.03%, and argon (A) and other rare gases 0.94%. Atmospheric air would contain water vapor or moisture.

Mine air, while still a mixture of gases and water vapor, may contain gases that are not associated with the normal atmosphere. In addition to the commonly found gases in the atmosphere such as oxygen, nitrogen, carbon dioxide and water vapor, several other gases can be found in a coal mine. The most common of these is methane. Mine gases are present wherever coal is mined, transported, stored, or loaded. To have safe working conditions, the gases must be diluted, rendered harmless and carried away.

The quantity and quality of mine air where miners work or travel is specified in the laws and regulations of every mining country including the United States. All underground coal mines must be ventilated by means of a mechanical device [usually a fan] located on the surface. Mine air is often identified as intake air and return air.

Intake Air

The air that enters the mine from the atmosphere is called the intake air. It is the fresh air which:

1. has not passed through the last working place of a split or by the unsealed entrances to abandoned workings;
2. by analysis contains not less than 19.5% oxygen nor more than 0.5% carbon dioxide; and
3. does not contain any dangerous quantities of flammable gas or any harmful amounts of poisonous gas or dust.

Return Air

Return air is air that has ventilated the last working place on any split of any working section or any area whether pillared or non-pillared. There are locations in a mine (e.g. seals) which may be ventilated by return air.

Unsafe Mine Atmospheres

An unsafe mine atmosphere is one that contains a harmful amount of poisonous gas or a dangerous amount of flammable gas, or one which contains less than 19.5% oxygen and more than 0.5% carbon dioxide. These dangerous or injurious atmospheres are most likely to be found in unventilated, abandoned areas or idle working places in mines. Unsafe mine atmospheres also result from mine explosions and fires as these events produce large quantities of harmful and poisonous gases.

Before a worker goes into an abandoned or idle area for assigned work, the foreman should first have the place tested for ventilation, gases, roof conditions, and other aspects as required by pre-shift examinations. Workers should examine roof conditions and determine whether there is airflow and whether ventilation devices are installed before entering any area.

The air used to ventilate a mine can undergo changes. It may mix with methane, carbon dioxide, or other gases, lose oxygen by absorption or combustion, and either absorb or deposit moisture.

What are the various gases found in the mines?

The various gases found in the mines are as follows:

- Oxygen
- Methane
- Carbon Dioxide
- Carbon Monoxide
- Nitrogen
- Hydrogen Sulfide
- Nitrogen Dioxide
- Sulfur Dioxide
- Hydrogen
- Water Vapor

Some of the gases such as carbon monoxide and sulfur dioxide may be more common in mines using diesel engines. Hydrogen may be present near battery charging stations in mines using battery-powered equipment. Excess carbon dioxide and carbon monoxide may also be associated with heating, fires and explosions.

It is important to know the characteristics and sources of mine gases so that the appropriate steps can be taken to avoid associated hazards. One key concept that must be understood is specific gravity. Specific gravity (SG) is the ratio of the weight of a given volume of a substance to the weight of an equal volume of air. The specific gravity of air is 1.0. Therefore, gases with a SG less than 1.0 are lighter than air, and will typically rise and be found somewhere above the bottom, perhaps near the roof. It then follows that gasses with a SG greater than 1.0 are heavier than air, and would typically be found along the bottom, and at may concentrate in low areas.

What are health and safety aspects of each of the gases above?

Oxygen

Oxygen (O_2) is a tasteless, odorless, colorless gas that supports life and combustion. It is necessary to sustain life. About one-fifth (20.93%) of the earth's atmosphere is oxygen. The specific gravity of oxygen is 1.105. The minimum percentage of oxygen that can be present in mine air in active workings is 19.5%.

The body receives oxygen through the hemoglobin of the blood, which carries oxygen to all parts of the body. Oxygen combines chemically with the carbon contained in waste products in the body and forms carbon dioxide (CO_2).

When a person experiences an oxygen deficiency, breathing becomes faster and deeper as the deficiency increases. Dizziness, rapid heartbeat, and headache occur when air contains 16% oxygen. Atmospheres with less than 16% oxygen are dangerous and persons entering such atmospheres should enter only when wearing adequate protective equipment which supplies oxygen.

The amount of oxygen in mine air decreases as the air passes through a coal mine because it is absorbed by coal, breathed by workers, and consumed in the oxidation of other materials. In an atmosphere confined in the presence of coal, part of the oxygen combines with carbon to form carbon dioxide, but the greater part is absorbed by the coal.

In the mine, oxygen may be detected by the use of an oxygen detector, a flame safety lamp, or by chemical analysis. A safety lamp needs at least 16% oxygen in the atmosphere to support its flame. With less than 16% oxygen present, the flame will go out.

When abandoned mines or abandoned parts of active mines are penetrated, it is possible that explosive gases or an oxygen deficiency may be present. Therefore, the machinery shall be stopped and tests for oxygen deficiency and explosive gases shall be made by a person qualified to use the approved instruments. These tests shall be made at the mouth of the auger hole with an approved oxygen detector or an approved safety lamp. If the tests show oxygen deficiency or the presence of explosive gases, the equipment shall not be operated until the condition is corrected.

Methane

Methane (CH_4) is a potentially explosive gas that is naturally formed from the decay of matter. It is frequently encountered in coal mining operations. It is

composed of carbon and hydrogen and has a specific gravity of 0.555. In mines, methane is liberated from coal and adjoining roof and floor strata.

Methane can be found in all underground coal mines and may also be detected at some surface coal mines, as well as in enclosed areas such as silos, bins, hoppers, and reclaim tunnels. In underground mines, it is found along the roof, in high places, in the vicinity of working faces, in dead ends above falls, in sealed areas, and abandoned workings. "Fire damp" is an explosive mixture of methane and air. The approximate ignition temperature of methane is 1200°F. When methane is ignited, it expands from 17 to 34 times its normal volume, depending on the amount of coal dust present.

Methane is not explosive by itself. Oxygen is required to support combustion. The explosive range of methane is between 5% and 15% in mine air. Methane will not explode when its content is less than 5% because the heat, liberated by combustion, is dissipated into the surrounding air at a sufficiently rapid rate to prevent flame propagation. However, the explosive range of methane may be lower than 5% when coal dust is in suspension. Further, coal dust is more easily ignited in the presence of methane and the force of the resulting explosion is greater. There can be no explosion when the percentage of methane is greater than 15% because the amount of oxygen present is insufficient for rapid combustion to occur. No explosion of a methane-air mixture can occur when the percentage of oxygen is below 12%. There must be about 10% methane in order for maximum explosive force to be present. The amount of methane that is allowable in the U.S. in coal mine working areas to continue with production operations is less than one percent. When more methane is present (1% or more), all mechanized equipment must be shut down and arrangements made to decrease the concentration to below 1% for work to resume production.

Methane can be detected by use of methane detectors and testers, a flame safety lamp, or by chemical analysis. At surface mines and surface facilities other than auger holes, it is important to check for methane in reclaimed tunnels, under coal stockpiles, in coal bins, and in silos.
In a reclaimed tunnel underneath a coal stockpile, a methane check should be performed near the roof of the tunnel, especially at coal discharge and transfer points. In silos, a check should be made at the top and bottom of each silo. A methane check should be made before welding, cutting, or soldering is performed near auger holes. Methane is also encountered above pillar falls.

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Carbon Dioxide

Carbon dioxide (CO_2) is a heavy (specific gravity, 1.529), colorless, odorless gas formed by the chemical combination of carbon and oxygen. This gas is a product of complete combustion.

In a mine, carbon dioxide is formed by combustion, breathing of workers, decay of vegetable and animal matter, oxidation of coal, and chemical action of acid water on carbonates. The presence of carbon dioxide will displace oxygen, which will cause the flame of a safety lamp to be extinguished. The presence of carbon dioxide has an effect upon life, because it causes lung ventilation to increase. When 5% carbon dioxide is present, lung ventilation increases 300%, breathing becomes labored, and continued exposure is injurious.

In mines, accumulations of carbon dioxide might ordinarily be found near the floor, in dip workings, or in poorly ventilated places. It can be detected by the use of carbon dioxide detectors or by chemical analysis.

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, tasteless, combustible, poisonous gas, which is slightly lighter than air (specific gravity of .967), and extremely poisonous to living creatures. Carbon monoxide is poisonous because the blood absorbs carbon monoxide 300 times more readily than it does oxygen. Even small quantities of carbon monoxide are injurious because it accumulates in the blood. CO also poses a physical hazard: it is explosive at 12.5% to 74% with an ignition temperature of $1,100^0$.

Carbon monoxide is the product of incomplete combustion (combustion with an insufficient amount of oxygen). In underground mines, it is most likely to be found when there is a mine fire or after an explosion, or when it is produced in smaller quantities by diesel emissions. Internal combustion engines and explosives produce carbon monoxide. It can be detected by carbon monoxide detectors and by chemical analysis.

Carbon monoxide causes injury to life by combining with the hemoglobin of the blood to form carboxyhemoglobin [COHb] and excluding oxygen. The maximum amount of carbon monoxide that can be present in the mine atmosphere of active workings is .005% (50 ppm).

A concentration of carbon monoxide of 0.02% in the mine atmosphere (200 parts per million [ppm]) will produce symptoms in humans in several hours by reducing the capacity of the blood to carry sufficient oxygen. These symptoms include drowsiness, headache, imbalance, mental confusion, and burning eyes. Unconsciousness will be produced in 30 minutes at a carbon

monoxide concentration of 0.2% - 0.3% (2000-3000 ppm). Death will result when a saturation level of 60-70% COHb is present in the blood. With 0.1% of carbon monoxide present in the atmosphere, it is possible to have approximately 65% COHb saturation of the blood. With 0.2%, a COHb saturation of 80% is possible.

Nitrogen

Nitrogen (N_2) is a tasteless, odorless, colorless gas which will neither support life nor combustion. Nitrogen is non-combustible and has a specific gravity of 0.967. Nitrogen has no effect upon life, except when it replaces oxygen to the extent that there is a deficiency of oxygen in the atmosphere.

Hydrogen Sulfide

Hydrogen sulfide (H_2S) is a poisonous, combustible, colorless gas having a sweetish taste and an odor like rotten eggs. It is usually the product of the decomposition of sulfur compounds, such as the action of acid water on metallic sulfides or heating of sulfides in presence of moisture.

Hydrogen sulfide can be detected by its odor, by a hydrogen sulfide detector or by paper dipped in acetate of lead, which will turn black immediately on exposure to hydrogen sulfide

The specific gravity of hydrogen sulfide is 1.191. Its explosive range is 4.3% - 46.0%, and its most violent explosive point is 14%. The ignition temperature of hydrogen sulfide is 655^{o} F.

Hydrogen sulfide is extremely poisonous, in quantities as little as 0.05%. It is also very injurious to the eyes. It is easily detected, as it has a very offensive smell similar to rotten eggs. Anyone smelling this odor should retire to fresh air or out of the smell without delay, because very small percentages will destroy the senses of taste and smell which might cause failure to recognize increasing concentrations and lead to death. Concentrations as low as .07% (700 ppm) will cause rapid unconsciousness, stoppage of breathing, and death.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is an extremely poisonous, heavy (specific gravity, 1.589) gas. Nitrogen dioxide is non-combustible, but it is a by-product of burning caused by high explosives containing nitroglycerin and nitro-substitution compounds. It is also formed in small amounts by diesel equipment. Extremely low concentrations of nitrogen dioxide (approximately 0.01% or 100 ppm) will be fatal, even after apparent recovery from the

symptoms. The first effects of nitrogen dioxide will be extreme irritation of the nostrils and eyes.

The safe limit for nitrogen dioxide in the mine air of active workings is .003% (3 ppm). Traces of nitrogen dioxide may be detected by a NO2 detector, chemical analysis, or by using a paper soaked in a solution of starch and potassium iodide, which will turn blue when exposed to nitrogen dioxide.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a colorless, suffocating, irritating, and poisonous gas, even in small amounts. . The first effects of exposure are that it is extremely irritating and suffocating and is intolerable to breathe. The specific gravity of SO_2 is 2.263.

Sulfur dioxide is formed in a mine by burning coal containing pyrites or by diesel exhaust emissions, although it will not burn or explode. It can be detected by the sense of smell and its effect on the air passages or by chemical analysis. Death can result from exposures of 0.05%. The safe limit for sulfur dioxide is 10 ppm.

Hydrogen

Hydrogen (H_2) is a colorless, odorless, tasteless gas. It is the lightest of all gases, with a specific gravity of 0.070. Hydrogen is explosive over a wide range, from 4.1% to 74.0%. The ignition temperature of hydrogen is 935^{o}F. It is formed by mine fires, explosions, or by charging batteries and can be detected by detectors or by chemical analysis.

Water Vapor (H_2O)

Water vapor (H_2O) is water is a gaseous state. It is found in all mine air and has a specific gravity of 0.625. The common measure for water vapor in air is the humidity, which is the degree to which the air is saturated with moisture. The addition of moisture causes air to become lighter, since water vapor is lighter than the constituents of air which it displaces. The most important condition affecting the humidity of air is temperature. As the air grows hotter, it will hold increasingly more moisture.

The human body regulates the body temperature by sweating and the sweat is carried away by the flowing air. When air is saturated with moisture (100% humidity) at any temperature, high or low, it has no capacity to carry any

more moisture. Miners working under such conditions will experience heat build up problems as the body will not be able to cool down.

How to do we detect gases?

Gas Detection:

There are numerous gas detection devices available, the selection of which is based on a variety of factors such as cost, availability, ease of maintenance and use, and the circumstances in which they are to be used. Manufacturers of the various gas detectors provide instruction manuals and other training aids that relate to the specific instruments.

All detectors are based on one of the following principles: catalytic oxidation for combustible gases (e.g. methane, carbon monoxide), electrochemical sensing (oxygen, carbon monoxide, hydrogen sulfide, and nitrogen oxides), light absorption and index of refraction (methane), electrical conductivity using semiconductors, and reactive properties of gases and chemicals (stain tubes for several gases).

Portable gas detectors for detecting either a single gas or a number of gases are available and certified for mine use. These detectors come with easily readable displays. Modern gas detection devices are accurate only when properly calibrated and used by trained personnel.

The flame safety lamp is useful as a methane detector and a detector for oxygen deficient atmospheres. In recent years, the flame safety lamp has been excluded from mines by laws in some countries, suffered loss of prestige among some mine safety experts and, in some cases, may not even be issued to foremen; foremen should still be trained in its use, care, limitations and dangers. The flame safety lamp, when properly assembled and used by a properly trained, competent person, can be a reliable detection device for the presence of methane or the absence of oxygen.

It may be necessary to collect air samples in special syringes, evacuated bottles or gas or liquid displacement containers. These samples are then sent to a laboratory to perform a chemical analysis for the various gases that may be present. The samples can also be collected by a remotely operated system (tube bundle system) and analyzed immediately in the event of a fire or explosion.

Automatic monitoring systems for gases are available for continuously monitoring the gas concentrations in selected mine locations such as mining faces, machine locations, etc. The data collected by a sensor is transmitted and displayed on the surface or any other chosen location.

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How do we control the gases in mines?

Principles of Gas Control:

The maximum allowable level for each contaminant of the mine atmosphere, which is based on the toxicity and explosibility of the contaminant, is established by the mining laws and regulations. These limits can vary from country to country. The control of these contaminants to below their maximum allowable levels is important.

There are certain engineering principles that are fundamental to the control of contaminants. These principles in order of preference are as follows:

1. Prevention
2. Removal
3. Suppression
4. Containment
5. Dilution

Prevention is applicable in cases where the production of contaminant gases, such as those that arise during blasting and use of diesel engines, can be reduced by the proper choice of explosives and correct design of blasting rounds, and the correct choice of engine, fuel, and fuel air ratios, respectively. Removal is applicable where the contaminant gases can be safely removed before mining commences with practices such as coal bed methane drainage. Suppression of gases is achieved by capturing the gas through such devices as diesel engine exhaust condition or wetting with water all the surfaces before and after blasting to dissolve the toxic gases. Containment is a method where the gas is contained behind a barrier such as a sealed area which does not allow the gas to enter the mine atmosphere. Also, by properly directing or containing the contaminated ventilating air away from the workers, the miners will not be exposed to the contaminants. Dilution is often the most common method used in coal mining to control the contaminant gas. In dilution, the aim is to dilute the contaminant gas to below its maximum allowable limit through the use of the ventilating air. However, methods based on the other four principles are used, as applicable, to decrease the amount of gas handled by the ventilation system.

Mine ventilation is one of the most important health and safety components of a mine plan, design and operation. The quantity and the quality of mine air is fully determined by the proper planning, operation and maintenance of the mine ventilation system. Every miner must familiarize himself or herself with the mine ventilation system including the intakes, returns, face ventilation system, escapeways, and refuge chambers.

Safety Quiz

TRUE OR FALSE?

1. ___ In working areas, mine air must contain at least 21% Oxygen.
2. ___ Carbon Dioxide is heavier than air and accumulates from floor upwards.
3. ___ Methane is explosive in the range 1% to 4%.
4. ___ Carbon Monoxide affects the capacity of blood to absorb oxygen.
5. ___ Nitrogen is a poisonous gas and supports combustion.

FILL IN THE BLANK

6. The maximum amount of carbon dioxide in mine atmosphere is _____ %
7. The methane sensors on the continuous miner will sound an alarm when _____% of methane is discovered.
8. The methane concentrations from ____ % to ____ % in mine atmospheres is explosive.
9. The amount of time a person can be alive without breathing air is about _____ minutes.
10. The principal method of removing gases and dusts in the working areas of the mine is achieved by _____.

Answer Key

1. False (19.5%)
2. True
3. False (5%-15%)
4. True
5. False
6. 0.5%
7. 1%
8. 5%-15%
9. 3
10. ventilation

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #2	
Title	**Prevention of Mine Fires and Explosions**
Purpose/Benefit	To refresh miners with basic principles and practices to prevent fires and explosions.
Learning Objective	The miner will describe basic practices to reduce the chance of a fire or explosion at the mine.

Important Safety Points
o We must follow the regulations-regulations are the starting point.
o Compliance is not enough. In many instances we must go beyond compliance.
o We must follow all plans in effect at our mine.
o Face equipment must be maintained (e.g. maintaining good bits on the miner)
o Float dust must be removed and all areas well rock-dusted.

What You Must Know and Do
o We must take the time to make required gas and ventilation checks.
o Take required Ch_4 readings at the proper time intervals.
o Follow the cleanup plans in effect at the mine.
o Maintain equipment according to regulations.

Discussion
o Is it easy to become complacent regarding the dangers of methane?
o How consistent are we about taking methane exams and air readings prior to moving equipment in-by, checking our water pressure and flow rates and cleaning our sprays and maintaining the scrubber?
o What is the required number of operating water sprays and where must they be located?
o **IF SCRUBBER MINERS ARE USED**: How well are we keeping up on scrubber maintenance? What are the number of sprays required on a scrubber miner, and what air flow (cfm's) must be maintained for your scrubber miner?
o CFM required in the face ventilation plan?
o Are we keeping up with our cleanup and rockdusting at the face, along runways and at the dumping point?
o Do we maintain our ventilation controls adequately?
o Where is our fire fighting equipment located? What are each section crew member's duties if a fire breaks out in the area?
o Where is our emergency meeting point in the section?

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Instructor Reference Material

PREVENTION OF MINE FIRE'S AND EXPLOSIONS

Fire and Explosion Basics

There are three necessary elements which must occur simultaneously to cause a fire: fuel, heat, and oxygen.

These elements form the three legs of the fire triangle. By removing any one of these elements, a fire becomes impossible. For example, if there were very little or no oxygen present, a fire could not occur regardless of the quantities of fuel and heat that were present. Likewise, if insufficient heat were available, no concentrations of fuel and oxygen could result in a fire.

For an explosion to occur, there are five necessary elements which must occur simultaneously: fuel, heat, oxygen, suspension, and confinement. These form the five sides of the explosion pentagon. Like the fire triangle, removing any one of these requirements would prevent an explosion from propagating.

For example, if fuel, heat, oxygen, and confinement occurred together in proper quantities, an explosion would still not be possible without the suspension of the fuel. However, in this case, a fire could occur. If the burning fuel were then placed in suspension by a sudden blast of air, all five sides of the explosion pentagon would be satisfied and an explosion would be imminent.

Most preventive measures concentrate on the fuel or heat sides of the fire triangle. Some ways to eliminate or minimize the fuel side of the fire triangle include:

- Maintaining adequate ventilation
- Frequent testing for methane
- Maintaining bleeder systems
- Maintaining seals
- Maintaining water sprays and dust collectors (if used)
- Using extra precautions when mining near or into inaccessible areas
- Keeping mine surfaces wet (especially in areas less than 40 feet from the face)
- Cleaning up loose coal, coal dust, and other combustible material and
- Applying liberal amounts of rock dust

Maintain Adequate Ventilation

Ample ventilation in all unsealed areas of a mine is the first line of defense against an explosion.

All open parts of a mine must be ventilated by a current of air that will dilute, render harmless, and carry away flammable, explosive, noxious, and harmful gases, dust, smoke, and fumes.

Sometimes there are sudden outbursts of unusually high quantities of gas in active mining areas. Under such circumstances, additional quantities of air must be supplied to maintain a margin of safety against unexpectedly high methane liberation rates.

Proper maintenance of the mine's ventilation system is important at all times but especially during the winter alert period. Some ventilation factors requiring attention include:

- Proper installation of ventilation controls
- Prompt repair of damaged ventilation controls
- Proper authorization when making changes in regulators and doors
- Prompt cleanup of roof falls
- Removal of obstructions to ventilation
- Keeping line brattice or tubing close to the face
- Maintaining required air quantities
- Frequent and thorough monitoring of air quantities flowing through the mine

Maintaining Water Sprays and Dust Collectors

Water sprays and dust collectors reduce the fuel available for a potential fire or explosion by:

- Removing some of the dust cloud from the air near the point where the dust is generated.
- Reducing the amount of float coal dust deposited some distance away from where the dust is generated.

Water sprays also add moisture to mine surfaces, which reduces the risk of the dust found on these surfaces being dispersed into the air. Water sprays and dust collections must be properly maintained in order to be effective.

Methane

Methane (CH_4) is a potentially explosive gas that is naturally formed from the decay of matter. It is frequently encountered in coal mining operations. It is composed of carbon and hydrogen and has a specific gravity of 0.555.

In mines, methane is liberated from coal and adjoining roof and floor strata.

Methane can be found in all underground coal mines and may also be detected at some surface coal mines, as well as in enclosed areas such as silos, bins, hoppers, and reclaim tunnels. In underground mines, it is found along the roof, in high places, in the vicinity of working faces, in dead ends above falls, in sealed areas, and abandoned workings.

"Fire damp" is an explosive mixture of methane and air. The approximate ignition temperature of methane is 1200°F. When methane is ignited, it expands from 17 to 34 times its normal volume, depending on the amount of coal dust present.

Methane is not explosive by itself. Oxygen is required to support combustion. The normal explosive range of methane is between 5% and 15% in mine air. Methane will not explode when its content is less than 5% because the heat, liberated by combustion, is dissipated into the surrounding air at a sufficiently rapid rate to prevent flame propagation.

However, the explosive range of methane may be lower than 5% when coal dust is in suspension.

There can be no explosion when the percentage of methane is greater than 15% because the amount of oxygen present is insufficient for rapid combustion to occur.

No explosion of a methane-air mixture can occur when the percentage of oxygen is below 12%.

There must be about 10% methane in order for maximum explosive force to be present.

The amount of methane that is allowable in the U.S. in coal mine working areas to continue with production operations is less than one percent.

When more methane is present (1% or more), all mechanized equipment in the 1% atmosphere must be shut down and arrangements made to decrease the concentration to below 1% to resume production. At a concentration of 1.5%, the section must be de-energized.

Coal Dust

Coal dust is more easily ignited in the presence of methane and the force of the resulting explosion is greater.

Another important requirement of the fuel is related to particle size. Experiments have shown that bituminous coal particles passing through a U.S. standard 20-mesh sieve can participate in a coal dust explosion. A 20-mesh sieve allows particles up to 841 microns or about 0.03 inch to pass and these are the largest particles that contribute to a coal dust explosion. As the particle size is reduced even further, a more severe explosion hazard is realized.

Rock Dust

The regulations state that rock dust shall be distributed upon the top, floor, and sides of all underground areas of a coal mine in such quantities that the incombustible content of the combined coal dust, rock dust, and other dust shall not be less than 65%, and the incombustible content in the return air courses (where the dust is expected to be finer) shall be no less than 80% (30 CFR 75.403). Each mine has a rockdust plan. Follow the plan.

These incombustible concentrations assume that the coal and rock dust are not layered, but are intimately mixed. Float coal dust is a serious explosion hazard if it accumulates on top of the rock dust and is not mixed thoroughly with the rock dust.

The heat to ignite the combustible mixture can come from sparks, electrical arcs, detonation of explosives, etc. Oxygen sufficient to support combustion is generally present throughout unsealed areas. Fires and explosions can be prevented by eliminating any one element of the fire triangle.

Generous applications of rock dust can prevent the propagation of coal dust explosions. The law requires that all areas of a coal mine that can be safely traveled must be kept adequately rock dusted to within 40 feet of all working faces.

Testing for Methane

During the winter months, gas tests should be made more frequently than required by law, especially in gassier mines, on retreat mining sections, and in places near abandoned areas. Thorough methane testing is particularly important in areas where miners may only occasionally be required to work, such as in idle sections.

Maintaining Effective Bleeder Systems and Seals

Because of the barometric pressure drops that accompany storm fronts, the condition of systems used to ventilate or seal abandoned areas are especially critical during the winter months. Tests for proper airflow, methane, and oxygen deficiency, in and around such areas can often detect malfunctioning bleeders or seals and warn of dangerous accumulations of explosive or noxious gases.

Use Special Precautions When Mining Near or Into Inaccessible Areas

Mining near or into inaccessible areas can give rise to several dangerous situations. Chief among these include methane, oxygen deficient air, and possible inundations of water. Take special precautions if mining near potentially hazardous inaccessible areas. It is especially important to drill test holes to prevent accidental mining into these areas.

Clean Up

Fuel is an element of the fire triangle. The possibility of a fire or explosion can be diminished by reducing the fuel supply.

Loose coal and coal dust should be frequently cleaned up. Each mine has a clean-up plan. Review and follow the plan.

Paper, rock dust bags, scrap wood, and oily waste should be removed. Loose coal, coal dust, and other combustible materials must not be permitted to accumulate either on mine surfaces or on electrical equipment.

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Safety Quiz

TRUE OR FALSE?

1. ____ A fire needs heat, fuel and oxygen in order to burn, and an explosion needs heat, fuel, oxygen, suspension and confinement to explode.

2. ____ Keeping mine surfaces wet, especially when within 40 feet of the face can minimize the fuel side of the fire triangle.

3. ____ Adequate ventilation can help dilute methane concentrations.

4. ____ Water sprays help reduce the amount of methane in the mine air.

5. ____ The explosive range of methane is 5% to 15% in fresh air.

6. ____ The lower explosive level of methane can be lower than 5% when coal dust is in suspension.

7. ____ Maintaining bits on cutting machines can help prevent an explosion.

8. ____ As the size of coal dust gets smaller, the explosion hazard is reduced.

9. ____ The incombustible content of the combined mine dusts in return air courses shall be at least 65%.

10. ____ Loose coal and coal dust must be frequently cleaned up.

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Answer Key

1. True
2. True
3. True
4. False
5. True
6. True
7. True
8. False
9. False
10. True

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #3	
Title	**Sometimes Water is not Harmless**
Purpose/Benefit	To acquaint miners with the sources of water in mines, hazards from these waters, and means to avoid the hazards.
Learning Objective	The miner will describe the sources of and hazards from water while working in underground mines. They will also explain the means to avoid these hazards.

Important Safety Points
o Inundation is a sudden and unexpected in-rush of water, gases, or both. Inundations are surprisingly very common in mines. An average of 22 inundations occur each year.
o Water sources are surface streams, river, impoundments, ponds, etc; pools of water in abandoned workings in seams above or in the same seam, and in abandoned or active adjacent mines; aquifers above the seam being mined; heavy rains.
o Underground mines are always under threat from water from higher ground. An inundation can occur in surface mines as the pit is lower than surrounding areas.
o In the Quecreek [water] incident, eighteen miners could have been killed. Nine escaped and nine were rescued. In the Moss #3 mine disaster, a CM crew cut into old workings and five miners were killed by carbon dioxide inundation.
o Miners must be aware of the inundation hazards in their mines and the operational practices [e.g. advanced drilling, mine maps] to locate water pools, abandoned workings and the emergency response plan for water or inundation hazards.
o Water accumulations in mine airways/roadways can increase resistance to air flow, block entries to travel, slow or stop transportation and affect heat and humidity.

What You Must Know and Do
o Understand [1] the mine emergency response plan for inundation and [2] actions to be taken [communication, escapeways] in the event of an inundation emergency.
o Understand [1] the sources of inundation [water, gases, other liquids] near the mine working areas, [2] the precautions to be taken when approaching these sources and [3] the signs of increased water flow in the workings.
o Understand the effects of atmospheric pressure on breathing of gobs and sealed areas. In times of changing from high to low pressure, gob air may enter the mine workings.
Discussion
o What are the sources for large quantities of water suddenly entering your mine workings?
o What are the sources for large quantities of gas or other liquids [not water] suddenly entering your mine workings?
o What are operational practices in your mine when workings are approaching the zones which can be the source of inundation hazards?

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Instructor Reference Materials

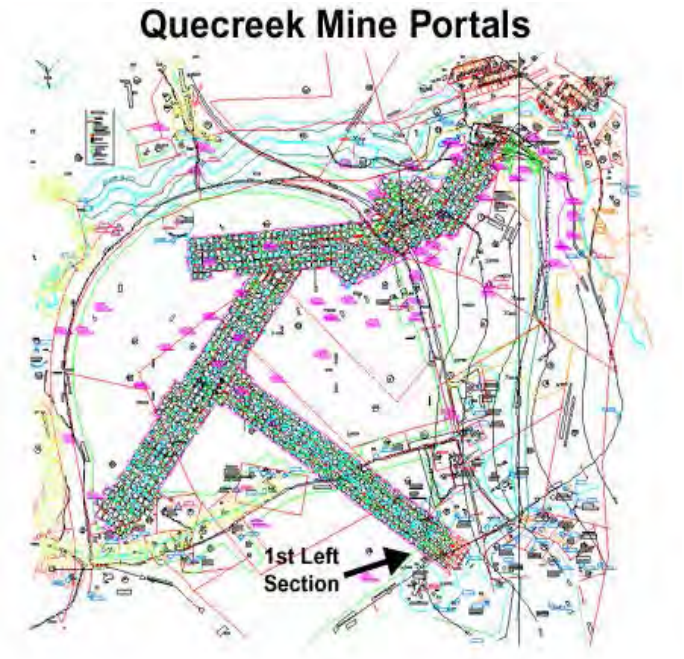
SOMETIMES WATER IS NOT HARMLESS

An underground coal mine consists of shafts, slopes, and roadways connecting slopes and shafts and each other. The depths where coal is being mined is determined by the depth of the coal seam and the dip of the coal seam. Anybody who has been in a coal mine can attest to the fact that water is often present in the roadways. In some mines, there is more water than in other mines. In some cases, water can be seen dripping from the roof and sides, and accumulations of water in the floor. Water is used in mines to suppress coal dust. It is also kept in storage tanks to fight fire. Normally, water is pumped out of the mine without causing much harm. But sometimes water is not harmless. The purpose of this toolbox talk is to illustrate this point and provide the miners with the knowledge to avoid the dangers of mine water.

What happened at the Quecreek Mine on July 24, 2002?

On July 24, 2002, at about 8:45 p.m., a sudden in-rush of water into the No. 1 Left section of the active Quecreek Mine from the adjoining abandoned and water-filled Harrison No. 2 Mine endangered the lives of 18 miners.

- Nine of the miners were working in the No. 1 Left section [see Figure]
- The other nine were working in the No. 2 Left section [Not shown]



Mine Emergency Preparedness
Tool Box Talk Series

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Sometimes Water is Not Harmless

1. ***The No. 1 Left section foreman made a quick decision to telephone the miners in the No.2 Left section with message of the incident and the need for them to evacuate immediately to the surface—<u>the importance of this decision cannot be overemphasized</u>!***

2. As a result of this timely action, the nine miners who were working in the deeper part of the mine escaped by themselves from the in-rushing water and exited the mine around 9:15 p.m.

3. The miners in the No 1 Left section, who were working on the rise side of the mine, were not able to escape despite several efforts to out run the water due to the rapid accumulation of the water in the dip workings of the mine.

4. The nine miners retreated towards the working section, progressively on to higher elevations.

5. It is estimated that approximately 75 million gallons of water emptied into the Quecreek Mine from the abandoned Harrison No. 2 Mine pools.

With regard to the trapped miners, several actions were initiated by the emergency management team consisting of state and federal mine health and safety agencies and the mining company to rescue the miners. The inundation had destroyed the normal telephone communication link and the rising water in the mine cut off all contacts with the miners after an initial contact when a drill hole intersected the workings where the miners were trapped. The drilling of holes, installing of pumps to drain the water from the mine, drilling of rescue shafts, etc were started and continued. On July 28, at about 1:00 a.m., the first miner was raised in the MSHA capsule. The last miner was raised at 2:45 a.m.

While this serious mine inundation incident had a successful ending in that no lives were lost, there was extensive property damage. The potential for the loss of 18 lives should be recognized and all future efforts should be made to eliminate the hazards of mine inundation.

Mine Emergency Preparedness
Tool Box Talk Series

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Sometimes Water is Not Harmless

Are mine inundations incidents common?

Inundations occur at surprising frequency in mines in the United States. Inundations occur in surface and underground mines. Because most inundations do not involve loss of property or life, we do not hear much about them.

While the Quecreek mine inundation is an inundation of water, inundation is a large scale sudden inrush of water or gases which floods the entire mine or a large section of the workings.

Mines have been inundated with water and with gases such as carbon dioxide, methane, nitrogen, hydrogen sulfide, etc. For example, cutting into an old working which contains no water but large quantities of carbon dioxide can result in sudden inrush of this gas which does not support life.

In the U.S., on the average, there have been about 22 inundations per year (Kendorski, 2004). Most do not result in death or loss of property. Inundations in India and China have resulted in major loss of lives.

This large number of non-fatal inundation incidents reveals the need to understand the potential for inundations in mines, identify the sources of water and take preventative measures to control the flow of water or gas.

What are the sources of water?

When mines are below water level, the potential for flooding of mines from pools of water must be recognized. Inundations can come from any of the following sources:

1. Water in coal seams or workings in a coal seam above or adjacent to the coal seam being mined.
2. Underground aquifers (reservoirs of water trapped in rock formations).
3. Geological problems such as faults connected to water-bearing strata.
4. Overlying strata can contain water and, when an opening is created in the mine, the roof can crack allowing water to flow into the workings.
5. Surface impoundments or other waters, including lakes, rivers, creeks and rainwater, can enter the coal seam through mine openings or cracks in overlying strata.
6. The mined coal seam itself can contain water. When openings are created, water can flow into the workings.

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Sometimes Water is Not Harmless

The sources of water that constitute the greatest inundation hazards are: [a] abandoned mines, [b] worked-out areas of the current mine, [c] underground aquifers and [d] surface impoundments, streams or bodies of water

What are the other safety issues with water in a mine?

While inundations pose threats to life and property, even smaller quantities of water in a mine can:

1. Block or increase resistance in ventilation airways
2. Block entries to travel
3. Stop or slow transportation
4. Affect the working conditions and safety of miners [e.g. humidity]

What lessons can be learned from the Quecreek Mine inundation incident?

There are several important lessons that are evident.

1. Good planning and effective control are the keys to successful outcomes in any endeavor.

2. Planning and control must go hand in hand for effective management of any hazard. Inundation hazards from inadequate planning [e.g. using inadequate data, wrong data, uncertain data, improper design, and poor operational practices] cannot be avoided even by the implementation of good controls. Similarly, even with good planning, inundation hazards from using inadequate controls [e.g. no measurement, wrong measurement, and unsafe acts] may occur.

Key requirements for enhancing safety of the mine from inundation hazards through a systems safety approach included:

1. Establishing the quality and reliability of data used in planning, design, analysis, permitting and operational phases of a mine that will be adjoining an abandoned mine.

2. Identifying the critical points or zones in the mine, improving the safety conditions around these points or zones, and preventing them from becoming major sources of hazards by providing alternative means to escape and egress from areas of mines affected by these points or zones.

3. Developing effective emergency response for all contingencies including inundation.

4. Creating a workforce that is knowledgeable on inundation hazards and their control including the operational, monitoring and mine emergency provisions.

Reference

Kendorski, F. (2004). *Problems in "void" detection in coal mine water hazards*. 23rd International conference on Ground Control in Mining (Morgantown, WV, August 3-5, 2004

Mine Emergency Preparedness
Tool Box Talk Series

Sometimes Water is Not Harmless

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Safety Quiz

SOMETIMES WATER IS NOT HARMLESS

TRUE OR FALSE?

1. ____ The average number of inundations per year in the last five years in the U.S. is more than 20.

2. ____ A miner trapped in an inundation incident can live without food for more than two weeks.

3. ____ The source of water in the Quecreek mine non-fatal inundation incident was water from an abandoned mine in the same seam.

4. ____ Inundation is not a hazard in surface mines.

5. ____ All mines have to develop an emergency response plan for inundation emergencies.

FILL IN THE BLANK

6. The number of miners working underground in Queecreek mine during the inundation incident was _____.

7. When working or cutting near old workings that are sealed and do not contain water, inundation hazards can come from several gases. Name two of them:

   1. _____ 2. _____

8. Water accumulations in mine airways/mine travel ways can cause several hazards. Name three of them:

   1. _____ 2. _____ 3. _____

9. According the PA Safety Laws for underground bituminous coal mines, what is the minimum setback distance to start a test drilling plan in active mines from the boundary of an adjacent mine? _____ ft.

10. When atmospheric pressure drops rapidly, what happens to the air in sealed off areas of the mines?

Mine Emergency Preparedness
Tool Box Talk Series

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Sometimes Water is Not Harmless

Answer Key

1. True
2. True
3. True
4. False
5. True
6. 18
7. Carbon Dioxide, Nitrogen, Methane, Hydrogen Sulfide
8. Block or increase resistance in ventilation airways, also:
    - Block entries to travel
    - Stop or slow transportation
    - Affect the working conditions and safety of miners [e.g. humidity]
9. 500 feet
10. air blows from sealed off areas into the mine or, air blows from the mine into the sealed-off areas

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Mine Safety Grant

Tool Box Talk #4	
Title	**How You Communicate a Mine Emergency Matters**
Purpose/Benefit	To instruct miners regarding best practices for communicating an emergency
Learning Objective	The miner will explain best practices for communicating a mine emergency

Important Safety Points

- Accurate communication from inside the mine can greatly enhance getting the necessary help from outside to the miners inside
- The emergency communication triangle is a good way to remember what to communicate in an emergency
  - Who—a credibility issue
  - Where—often missed…leads to serious consequences
  - What—not always communicated…leads to serious consequences
  - Critical information that must be communicated in response to an emergency:
    - Is anyone in danger?
    - How serious is the problem?
    - What is being done?
    - What resources are on the scene?
- When reporting an emergency, it is better to err to the side of "more serious" than "less serious."

What You Must Know and Do

- Review how and what to communicate during an emergency
- Know the location of the mine pager phones or communication system throughout the mine
- Don't take communication for granted
- Know the designated responsible person on your work shift
- If you hear a fire sensor alarm, or sense any sign of an emergency, notify your foreman

Site-specific Discussion

- Mine phones in my work location are…..
- The way the mine phone works is….
- If you were here (at specific locations on a mine map), where would you go to access the nearest phone?
- In an emergency, when you call outside, what would you say…

Developed under The 2008 MSHA Brookwood-Sago Mine Safety Grant

Instructor Reference Material

HOW YOU COMMUNICATE A MINE EMERGENCY MATTERS

Any **miner may be the first person to detect or learn of an emergency.** Preceding practically every emergency/accident event is a series of events/conditions that lead up to a more significant energy release. A wire in an electrical switch may slowly get hotter and hotter until melting… causing an arc, followed by a fire that gradually escalates. A roof fall may disrupt a ventilation control, leading to a gradual accumulation of methane, which then ignites. Of course, early detection of anything unusual (perhaps a sign of an imminent release of energy (fire, inundation, explosion) is most desirable. That is why monitoring systems for fires and explosive gases are so important. As important as they are, to have any effect on the timeliness of the response, or the potential for loss control, the warning must be seen, heard, etc., and acted on. You may hear or see an alarm, smell or see smoke, detect an accumulation of water or gas. Once you identify or learn of an emergency, notify your foreman at once.

All communication has a purpose…to inform, entertain, persuade, etc. Communication is much more than sending a message, listening, or reading. We tend to take communication for granted. Sometimes when we communicate we assume that we have achieved our purpose. For communication to take place, a sharing of understanding between a sender and a receiver must occur.

Emergency communication is unique. Its purpose is to inform, report, warn, or notify. If we are caught up in an emergency situation, there is a chance that we will be under a certain amount of stress. Our training and experience go a long way to give us the confidence and calmness to act.

Remember that the purpose of emergency communication is to facilitate a successful emergency response. Be familiar with your mine communication system. Miners need to know how to operate their mine communication system. In addition, miners must also have the ability to use non-verbal and other ways to communicate in cases where we can't speak (e.g., wearing an SCSR).

Effective communication is essential to a successful evacuation or escape. Wrong or inaccurate information delays an evacuation or escape. What you intend to be communicated will lead to good decisions—another essential factor in successful emergency response.

Developed under The 2008 MSHA Brookwood-Sago Mine Safety Grant

Safety Quiz

HOW YOU COMMUNICATE A MINE EMERGENCY MATTERS

TRUE OR FALSE?

1. ____ Misunderstandings due to poor communications are rare.
2. ____ When reporting an emergency it is not necessary to identify yourself.
3. ____ The communication triangle includes a "Where" leg.
4. ____ Everyone is a designated responsible person under the MINER Act of 2006.
5. ____ If in doubt about the seriousness of an emergency, it's better to assume it is serious rather than communicate it as non-serious.

FILL IN THE BLANK

6. Who, Where and _____are the three legs of the "Communication Triangle."
7. If you hear a fire sensor alarm, or sense any sign of an emergency, notify _____
8. All communication has a _____.
9. For communication to take place, a sharing of _____ between a sender and a receiver must occur.
10. Communicating accurate information during an emergency will lead to good _____ making—an essential factor in successful emergency response.

Mine Emergency Preparedness
Tool Box Talk Series

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How you Communicate a Mine Emergency Matters

Answer Key

1. False
2. False
3. True
4. False
5. True
6. what
7. your foreman
8. purpose
9. understanding
10. decision

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
Miner Training Program
Penn State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk Number #5	
Title	**What Would You Rather Do - Escape or Seek Refuge?**
Purpose/Benefit	To acquaint miners with the various strategies of mine response and to assist them make an informed decision in an emergency among the various responses, particularly escaping or seeking refuge.
Learning Objective	The miner will describe the strategies of response in an emergency and the rationale for decision-making

Important Safety Points
o Every mine has to define the kinds of emergencies that the mine may encounter
o Certain mine emergencies like fires and explosions destroy the mine atmosphere
o There are six stages in an emergency response - hazard control, evacuation, escape, survival, rescue and recovery.
o Miners have practiced barricading in the past when they have been trapped underground in an emergency. MINER Act 2006 requires refuge chambers in underground mines.
o Refuge chambers are barricades that are already built, assembled and maintained in underground mines to sustain the lives of persons trapped underground.
o The mine emergency plan is the most important document that explains actions to be taken by everyone in the event of an emergency.
o Familiarity through practice is the best way to make it a habit to perform safely in the event of an emergency.

What You Must Know and Do
o Be aware of all the emergencies that occur in a mine, their effects on mine health and safety systems (e.g. ventilation), and be familiar with the practices to control them.
o Be familiar with the mine emergency response plan and systems, the role and location of escapeways and refuge chambers, and the roles of miners in an emergency.
o Be familiar with self-rescuers, their performance, switching, escape and survival
o The safest place in an emergency is the surface of the mine, escape if at all possible
Discussion
o What are the emergencies that can occur in your mine?
o What are the purposes of a refuge chamber in a mine?
o Why should one try to escape at all times rather than seek refuge in an emergency?
o In our mine, refuge chambers are currently located….
o What actions are likely to follow both outside and inside the refuge chamber if miners seek refuge in a chamber?

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Instructor Reference Material

WHAT WOULD YOU RATHER DO - ESCAPE OR SEEK REFUGE?

The progress made in the reduction of number of mine disasters as well as of fatalities from a particular disaster is a testimony to the effectiveness of the introduction of improved equipment, procedures and practices. Yet the continued occurrences of disasters and accidents with disaster potential point to the need for an even more rigorous search to eliminate the causes of disasters and to increase the chances of survival in the event of a disaster.

Investigations of mine disasters and emergencies result in the identification of the causes of their occurrence and recommendations for eliminating the causes. Such recommendations often include new operating procedures, new design, new personal protective equipment, changes in training programs and practices, new approval and certification requirements, changes in health and safety standards, and in some cases, new laws and regulations.

What are the distinct stages to a disaster response?

These are **six stages** to a disaster response:

1. **Hazard control** which refers to immediate actions to eliminate the hazard, e.g. in the event of a fire hazard, all actions taken to gain control over the fire and to extinguish the fire. If the hazard cannot be controlled, then all miners must be moved to safe location.

2. **Evacuation** is the orderly exit of miners from the mine using predetermined procedures and under the supervision of responsible person

3. **Escape** refers to the safe exit by individual miners using their knowledge of the mine escapeways and the hazards that they are likely to encounter along the way.

4. **Survival** becomes essential when evacuation and escape fails. In simple terms, the miners are trapped and must find a safe location or build a barricade and wait for assistance to arrive.

5. **Rescue** efforts are mounted from the outside to locate the miners who are trapped and bring them to safe locations that are established by the rescue teams.

6. **Recovery** is the last stage of a disaster response when all efforts are directed towards recovery of the victims and restoration of the conditions inside the mine.

While elimination of accidents is the ultimate goal, the pursuit to enhance the escape, post-disaster survival and rescue of miners has continued to be relentless. Major accomplishments have been made to enhance performance in these areas including the development of SCSRs, intake escapeways, lifelines, rescue apparatus, emergency response plans, and specialized training.

The explosions at the Sago Mine on January 2, 2006, and the Darby Mine No. 1 on May 20, 2006, are relevant to the discussion above.

1. The explosion at the Sago Mine killed one miner instantly and destroyed seals and filled portions of the mine with toxic levels of carbon monoxide.

2. The remaining 12 miners barricaded themselves on the section when their attempts to evacuate were unsuccessful.

3. The barricade was constructed in an area with high concentrations of carbon monoxide.

4. Eleven miners died before they could be rescued. One miner was rescued, but was severely injured.

The force of the explosion at the Darby Mine No. 1 killed two miners.

1. Four other miners encountered thick smoke and donned their SCSRs while attempting to evacuate.

2. The miners eventually became separated and three died from carbon monoxide poisoning.

These tragic events resulted in the requirements for installing or building refuge chambers in coal mines in which miners can seek refuge in the event of an emergency.

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What Would You Rather Do-Escape or Seek Refuge?

What are the two components of the MINER Act of 2006 with regard to an "accident response plan?"

According to the MINER Act of 2006, an accident response plan shall

> (i) provide for the evacuation of all individuals endangered by an emergency; and
>
> (ii) provide for the maintenance of individuals trapped underground in the event that miners are not able to evacuate the mine.

Each operator must draft a plan which is mine specific and offers miners the best possible chance of effectively escaping to the surface from a potentially life threatening situation underground. Further, each operator's plan must include provisions that increase the survivability of miners ("maintenance of individuals") who are unable to escape an emergency situation. In fact, the MINER Act of 2006 had directed NIOSH to conduct research, including field tests, concerning the utility, practicality, survivability, and cost of various refuge alternatives ***for maintenance of individuals*** in an underground coal mine environment, including commercially-available portable refuge chambers.

It is important to understand the background for these provisions in the MINER Act of 2006. Tragedies at the Sago Mine, and the Darby Mine No. 1 in early 2006 raised serious concerns about emergency response and preparedness.

As a result of the investigations, major gaps were identified in several areas such as:

1. the location and tracking of miners
2. mine communications
3. escape
4. rescue
5. survival.

One of the major outcomes of the enquiries following these disasters was the passage of the **MINER Act of 2006** at the federal government level. Several states also passed mine specific health and safety legislation. An important aspect of the legislation was the attention given to enhancing the chances of miners' escape and survival following a disaster by requiring the development of the accident response plan.

Mine Emergency Preparedness
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What Would You Rather Do-Escape or Seek Refuge?

According to MSHA, how many lives could have been saved if refuge chambers were available from 1900?

In developing the final rule for refuge chambers, MSHA reviewed a number of underground coal mine accident reports and evaluated its accident and injury data from 1900 through 2006.

During that period, 264 miners, who were alive after a mine accident, died later during rescue or escape. MSHA has estimated that recent MSHA standards could have saved the lives of 43 of these miners. **Thus, for purposes of estimating benefits, this final rule could potentially have saved the lives of 221 miners over the 107 year period.**

If refuge alternatives had been available, MSHA estimates that the range of lives saved would have been between a low of 25 percent and a high of 75 percent. Using these estimates, the final rule potentially could save an average of from one to three lives every two years.

What would you do in the event of an emergency?

Every miner should have been trained in the Mine's Emergency Plan. If the miner becomes aware of an emergency, the miner must follow the sequence of procedures that are described in the plan and that are part of the mine emergency drills. While one cannot be very specific about the sequence of operations, in general, it includes the following:

- know who the responsible person is
- if you detect the emergency, communicate - immediately and clearly - the emergency to the responsible person and other miners
- assemble at the designated location in the section
- follow the instructions of the responsible person
- responsible person or his designee would direct all operations as needed
- if not needed to stay behind to assist with the emergency, exit the mine
- use the knowledge and training that were imparted to you during mine emergency drills about escapeways, equipment, and procedures to exit the mine. Remember that hazard control, evacuation and escape are the most important three first steps.
- **Only when exit (evacuation or escape) is not possible at all, then enter the refuge chamber**

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What Would You Rather Do-Escape or Seek Refuge?

Why is it suggested that if at all possible, escape rather than seek refuge?

The provisions of the MINER Act 2006 are to improve mine emergency response through several means such as more effective procedures and provisions than that existed prior to passage of the Act for mine evacuation, maintenance of individuals, communication and location, rescue teams, and so forth.

The important point that is to be emphasized is that when a miner's life is threatened, the immediate action must be to get to a place where the threat is non-existent or minimum. In almost all cases, that place is the surface of the mine. Reaching the surface of the mine then must be the immediate action. Thus, evacuation or escaping from the mine should have a higher preference to any other action including seeking refuge.

It is also important to emphasize that refuge chambers are designed to provide a safe environment for a specified period of time. However, when a miner enters the refuge chamber then the miner has to await rescue by outside personnel. Clearly, rescue teams cannot enter the mine until the conditions are safe for them to do so. Among these conditions are the following:

1. the hazard is under control
2. there is no danger of the hazard flaring-up
3. the mine atmospheric conditions (heat, levels of toxic gases, etc) are close to normal
4. the whole operation can be conducted safely without any threat to the rescue team members, etc.

Clearly, any delay in mounting a rescue due to any adverse conditions in the mine can pose a threat to the "maintenance" of the miners in the chamber. Miners should be aware of the fact that mine rescue team members have lost their lives while mounting a rescue and that rescue operations have been suspended due to the inability to control the hazard underground. Thus, while refuge chambers provide a safer atmosphere and better opportunities for survival than barricades that were built by miners in the past, there is always an element of risk that timely rescue may not occur.

The threat to the rescue chambers in coal mines from being in the environment with coal all around should also be recognized.

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Tool Box Talk Series

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What Would You Rather Do-Escape or Seek Refuge?

The MINER Act of 2006 has several provisions to make better the chances of escaping or evacuating from underground in the event of an emergency. Among these are:

- supplemental SCSRs
- added life lines to guide miners
- more frequent evacuation drills
- greater amount of training, etc.

In summary, because of the better and safer aspects of surface of a mine (compared to the refuge chamber), because of the issues with ability to mount a successful rescue in a timely manner, and because of the improved provisions for escape and evacuation, **it is always advisable that miners should attempt to evacuate and escape rather than seek refuge**. **Refuge chambers are there to ensure that when miners cannot evacuate or escape and therefore, are trapped, the refuge chambers afford safety from the evolving hazards from the emergency**.

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What Would You Rather Do-Escape or Seek Refuge?

Safety Quiz

TRUE OR FALSE?

1. ___ In a mine fire, all escapeways are destroyed.

2. ___ Mine explosions can destroy the air quality in the section where the explosion occurs.

3. ___ As a miner, my first action in the event of an emergency is to control the hazard causing the emergency.

4. ___ Refuge chambers are the first line of defense against loss of lives in the event of an emergency.

5. ___ There must be at least two escapeways from each working place.

FILL IN THE BLANK

6. According to MSHA, how many lives could have been saved every year from 1900 if refuge chambers were available? _____

7. Every mine must assign one person to be in-charge of emergency operations every shift when miners are working. His title is _____

8. In the Sago mine disaster, _____ miners survived the initial explosion and _____ miners finally survived.

9. According to the MINER Act of 2006, there are two components of an "accident response plan." One component is to provide for evacuation. What is the second component? _____

10. How many times in a year should mine emergency drills must be conducted? _____

Mine Emergency Preparedness
Tool Box Talk Series

What Would You Rather Do-Escape or Seek Refuge?

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Answer Key

1. False
2. True
3. True
4. False
5. True
6. 221
7. Responsible Person
8. 12, 1
9. maintenance
10. 4

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #6	
Title	**SCSRs: What You Should Know**
Purpose/Benefit	To acquaint the miner with the basic function, use and care of the SCSR.
Learning Objective	The miner will describe the basic function, use and care of the SCSR.

Important Safety Points
o The SCSR is designed to provide you with one hour of oxygen during an emergency.
o When worn properly, the SCSR isolates you from breathing toxic mine air.
o Before going underground, you must visually inspect your SCSR daily
o The SCSR is either a chemical type or direct oxygen type.
o The SCSR must be carried with you at all times.
o The SCSR must be donned at the first sign of fire. Do not wait to see smoke.
o There are extra supplies (caches) of SCSRs located not more than a half-hour walk.
o The SCSRs are visually inspected by the company every 90 days; a "shake test" may also be part of the inspection.

What You Must Know and Do
o Be absolutely 100% positive that you know how to don the SCSR.
o Be absolutely 100% positive that you know how to switch SCSRs at the cache site.
o Check your SCSR BEFORE going underground every shift: Look for dents, secure straps, proper seating of the top and bottom sections, check the heat and moisture indicators if so equipped (e.g., CSE SR-100), oxygen gauge on direct oxygen units, steel ball under the latch (e.g. Ocenco M-20). Follow the manufacturer's exact directives for inspecting the unit.
o NEVER take an SCSR underground unless you have checked it and are satisfied that it is in proper working condition… Keep your SCSR unit clean!
o Do not toss or throw the SCSR unit.
o NEVER attempt to repair an SCSR unit.
o Do not store SCSRs on power centers
o This talk does not replace your "hands-on" training sessions on donning your SCSR

Discussion
o The SCSR used for daily use at this mine is:
o This is how to perform a daily visual inspection:
o The locations of SCSRs in this section are:
o The types of SCSRs in the cache are:
o The SCSR unit will be inspected and weighed by the company every 90 days.
o The things that can cause a SCSR to be removed from service are:

Instructor Reference Material

SCSR's: WHAT YOU SHOULD KNOW

Background

SCSRs are used by approximately 50,000 underground mine employees. Training in care, maintenance and inspection is essential to ensure that the SCSR works properly when donned by a miner in response to a mine emergency.

According to NIOSH "*Expectations Training for Miners Using Self-Contained Self-Rescuers in Escapes from Underground Coal Mines*":

- Self-contained self-rescuers (SCSRs) provide the wearer with a 1-hr oxygen supply. SCSRs were developed in the late 1970s and deployed in U.S. mines in the early 1980s for use by coal miners during emergencies, such as fires, explosions, or gas inundations in which the ambient atmosphere becomes toxic. As their name implies,

- SCSRs are meant to serve one purpose—to allow a miner to self-rescue by escaping the mine. They are not intended to be used for other purposes, such as fire fighting.

- There are two types of SCSRs produced and sold. Both are closed-circuit breathing apparatuses; that is, the units do not exhaust CO_2 but remove it from the breathing circuit internally. One type of SCSR stores O_2 as a compressed gas and uses a chemical bed of lithium hydroxide (LiOH) to absorb CO_2 as the miner exhales. It is started by opening a valve on the oxygen cylinder that fills a breathing bag. The other type uses potassium superoxide (KO_2, a solid chemical that reacts with moisture in the breath) to generate O_2, with LiOH used to remove much of the CO_2 from the breathing circuit.

Inspection

The type of inspection you must perform depends on how your unit is used. If your SCSR is carried daily, it must be inspected daily. If it is stored according to an approved MSHA storage plan, it is to be inspected every 90 days.

Daily Visual Inspection

- Check Top and Bottom Covers
- Security Band
- Seals
- Moisture and Heat Indicators
- Case, etc. (aside from overall condition, what you check differs by model).

SCSR's that do not pass inspection will be taken out of service.

MSHA Regulations

- There must be at least one additional SCSR, which provides protection for a period of one hour or longer, for each person at a fixed underground work location.
- Additional SCSRs along the normal travel routes for pumpers, examiners, and other persons who do not have a fixed work location to be stored at a distance an average miner could walk in 30 minutes.
- If a mantrip or mobile equipment is used to enter or exit the mine, at least one additional SCSR, which provides protection for a period of one hour or longer, shall be available for each person who uses such transportation from portal to portal.
- When each person underground cannot safely evacuate the mine within 30 minutes, the mine operator shall provide additional SCSRs stored in each required escapeway.
- Different cone configurations on lifelines help miners find additional SCSRs (e.g., double cone=branch line, 4 cone "diamonds"=SCSR cache.
- Each storage location shall contain at least one SCSR, which provides protection for a period of one hour or longer, for every person who will be inby that location.
- Storage locations shall be spaced along each escapeway at 30-minute travel distances
- As an alternative to providing SCSR storage locations in each escapeway, the mine operator may store SCSRs in a hardened room located between adjacent escapeways.
- All SCSRs required under this section shall be stored according to the manufacturers' instructions, in conspicuous locations readily accessible by each person in the mine.
- A sign made of reflective material with the words "SCSRs'' or "SELF-RESCUERS'' shall be conspicuously posted at each storage location. Direction signs made of a reflective material shall be posted leading to each storage location.

SCSRs: What You Should Know

When To Don The Rescuer?

- At the first indication of smoke or fire
- When notified

When To Remove The Rescuer?

- Only when you are in known fresh air, or on the surface

Miscellaneous Information

- SCSR's must be stored according to the manufacturer's directives.
- Do not store on power centers as heat can affect the unit.
- The SCSR is rugged, but not meant to be thrown, tossed, banged or slammed.
- SCSRs should not be allowed to get wet

Mine Emergency Preparedness
Tool Box Talk Series

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SCSRs: What You Should Know

Safety Quiz

TRUE OR FALSE?

1. ____ Federal regulations require the SCSR to provide 1 hour of oxygen.
2. ____ Dents in SCSR cases rarely affect their reliability.
3. ____ The SCSR filters toxic gases from the air.
4. ____ All SCSR units have a portable oxygen tank.
5. ____ Extreme temperatures can affect the function of the SCSR.
6. ____ Daily visual inspections of the SCSR can mean the difference between life and death.
7. ____ Because of the various number of types and manufacturers of SCSRs, it is critically important to follow the exact directives for your specific unit.
8. ____ Heat from a power center can affect the functioning of a SCSR.
9. ____ A properly worn SCSR will isolate your breathing from toxic mine air.
10. ____ An SCSR is so rugged that it can easily withstand being thrown and tossed.

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SCSRs: What You Should Know

Answer Key

1. True
2. False
3. False
4. False
5. True
6. True
7. True
8. True
9. True
10. False

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
Penn State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #7	
Title	**What are the Purposes of Lifelines?**
Purpose/Benefit	To refresh the miner in the use and care of lifelines.
Learning Objective	The miner will describe/demonstrate the proper use and care of lifelines.

Important Safety Points
o Lifelines help guide miners in poor visibility toward evacuation routes and SCSR caches
o Lifeline cords must be MSHA approved as flame resistant.
o Lifeline cords do not have to be steel cable.
o All cone-type directional indicators must comply with the convention of the tapered end of the cone pointing **INBY**.
o Care must be taken when lifelines are installed in escape ways that are also travelways.
o While lifelines must be protected from damage they must be readily available to miners during emergencies.
o Branch lines—which typically lead a miner to a SCSR cache or a refuge alternative—are required off of the main lifeline.
o Main and branch lines must be equipped with indicators (e.g., cones, balls, spiral coil) appropriately.
o Escaping miners must be able to easily locate the stored SCSR's.

What You Must Know and Do
o Know and understand the logic of the cones pointing inby.
o Run your hand over the cones to get the feel of them so there is no confusion if it is necessary to use the lifeline.
o Know the location of where they start in your section, and be able to find them in smoke.
o Report any damage to lifelines in travel/haulageways.
o Know what the indicator for a SCSR storage box is along your lifeline
o Lifelines are a great help in limited visibility but you still must know your escapeways.
o A thorough knowledge of your escapeway is one of the keys that will enable you to get outside safely during limited visibility, escape or evacuation.

Discussion
o Where do the lifelines begin at your work location?
o How do the cones point when you are traveling outby?
o The identification system of additional indicators/taglines at this mine is:
o The locations of the primary and secondary escapeways are:
o The locations of overcasts or undercasts along your escapeways are:
o The location of doors where to switch escapeways are:
o Other unique escapeway conditions are:

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What is the Purpose of Lifelines

Instructor Reference Material

WHAT IS THE PURPOSE OF LIFELINES?

Miners working underground when a mine accident occurs must be able to rapidly find lifesaving devices and use those devices to help them prevent injury, evacuate the mine quickly, and save their lives. Access to these devices and techniques for survival (including storage locations of supplemental SCSRs and more frequent training in their use, lifelines, and proper training in mine evacuations) is essential when a miner is underground and a mine fire, explosion, or other type of mine emergency happens.

Lifelines help guide miners in poor visibility conditions toward evacuation routes and SCSR storage locations.

The location and use of directional lifelines or equivalent devices will be part of quarterly required training

Be sure lifelines are connected. Repair or report any deficient lifelines.

Do not secure lifelines in a manner that they cannot be pulled down.

Summary of Applicable MSHA Regulations-Bituminous and Lignite Mines

Provided with a continuous, durable directional lifeline or equivalent device that shall be installed and maintained throughout the entire length of each escapeway.

Flame-resistant

Marked with a reflective material every 25 feet.

Located in such a manner for miners to use effectively to escape.

Equipped with directional indicators, signifying the route of escape, placed at intervals not exceeding 100 feet. When cones are used as directional indicators, they shall be installed so that the tapered section points inby; and

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What is the Purpose of Lifelines

Equipped with one directional indicator cone securely attached to the lifeline, signifying the route of escape, placed at intervals not exceeding 100 feet.

Cones shall be installed so that the tapered section points inby.

Securely attached to and marked to provide tactile feedback indicating the location of any SCSR storage locations in the escapeways.

Equipped with one sphere securely attached to the lifeline at each intersection where personnel doors are installed in adjacent crosscuts;

Equipped with two securely attached cones, installed consecutively with the tapered section pointing inby, to signify an attached branch line is immediately ahead. (A) A branch line leading from the lifeline to an SCSR cache will be marked with four cones with the base sections in contact to form two diamond shapes. The cones must be placed within reach of the lifeline. (B) A branch line leading from the lifeline to a refuge alternative will be marked with a rigid spiraled coil at least eight inches in length. The spiraled coil must be placed within reach of the lifeline (see Illustration 1 below).

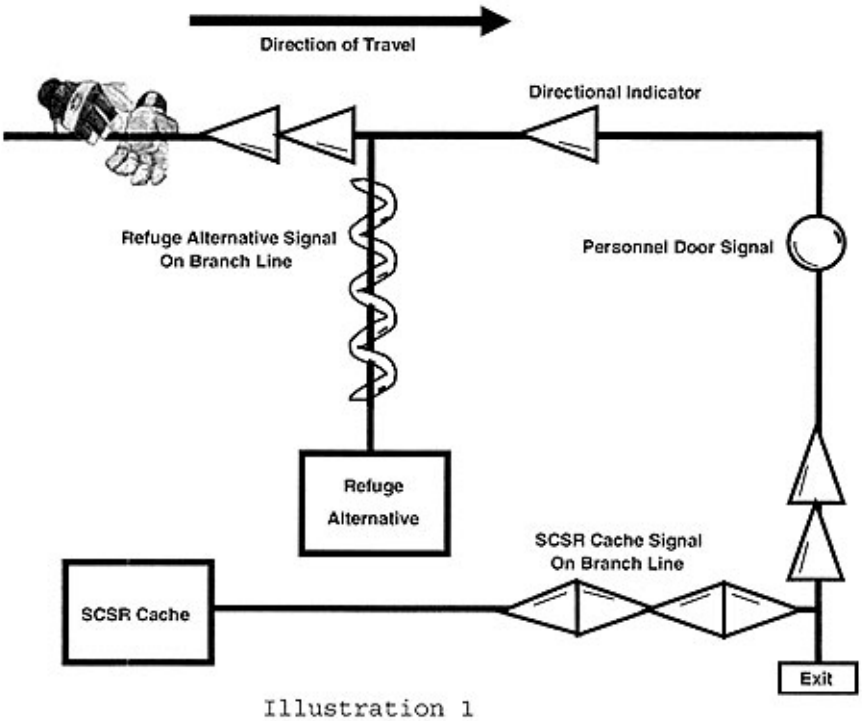

Illustration 1

Mine Emergency Preparedness
Tool Box Talk Series

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What is the Purpose of Lifelines

Summary of Applicable MSHA Regulations-Bituminous and Lignite Mines

A continuous, durable directional lifeline or equivalent device that shall be--

Installed and maintained throughout the entire length of each escapeway.

Flame-resistant in accordance with the requirements of Part 18 (Title 30 CFR) upon replacement of existing lifelines; but in no case later than June 15, 2009;

Marked with a reflective material every 25 feet;

Located in such a manner for miners to use effectively to escape;

Equipped with directional indicators, signifying the route of escape, placed at intervals not exceeding 100 feet.

When cones are used as directional indicators, they shall be installed so that the tapered section points inby.

Securely attached to and marked to provide tactile feedback indicating the location of any SCSR storage locations in the escapeways.

Cones shall be installed so that the tapered section points inby.

Equipped with one sphere securely attached to the lifeline at each intersection where personnel doors are installed in adjacent crosscuts;

Equipped with two securely attached cones, installed consecutively with the tapered section pointing inby, to signify an attached branch line is immediately ahead.

A branch line leading from the lifeline to an SCSR cache will be marked with four cones with the base sections in contact to form two diamond shapes. The cones must be placed within reach of the lifeline.

A branch line leading from the lifeline to a refuge alternative will be marked with a rigid spiraled coil at least eight inches in length. The spiraled coil must be placed within reach of the lifeline.

Mine Emergency Preparedness
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What is the Purpose of Lifelines

Safety Quiz

TRUE OR FALSE?

1. ____ Lifelines only lead miners to the outside of the mine.
2. ____ The point of the cone on the lifeline must always point outby.
3. ____ It is permissible to securely tape a lifeline to a roof bolt, if it frequently falls down.
4. ____ Lifelines must be marked with reflective tape every 25 feet.
5. ____ When cones are used as signal indicators, they must be placed at least every 100 feet.
6. ____ A branch line leading from a lifeline to an SCSR cache will be marked with 2 cones with the base sections attached.
7. ____ A branch line leading from a lifeline to a refuge alternative will be marked with a spiraled coil at least 8 inches in length.
8. ____ A ball on a lifeline indicates a crosscut that has a mandoor.
9. ____ Training on lifelines during quarterly training is optional if all miners know how the lifeline system works.
10. ____ If you disregard a fallen part of a lifeline, you might be endangering the safety of yourself and everybody in the mine.

Mine Emergency Preparedness
Tool Box Talk Series

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What is the Purpose of Lifelines

Answer Key

1. False
2. False
3. False
4. True
5. True
6. False (4)
7. True
8. True
9. False
10. True

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008/2009 MSHA Brookwood-Sago Mine Safety Grant

Tool Box Talk #8	
Title	**Know Your Emergency Response Plan**
Purpose/Benefit	To review the importance of the ERP as a means to achieving a successful evacuation/escape from a mine, or successful rescue.
Learning Objective	The miner will discuss the benefit of understanding the mine's ERP, and list and explain the primary elements of the plan.

Important Safety Points
o The purpose of the ERP is two-fold: 1) provide for evacuation, and/or 2) maintenance of trapped miners.
o Plans must be approved by MSHA and reviewed at least every 6 months.
o Plan is evaluated on input from miners, and the following four questions: 1) safety consistent with current standards? 2) reflect current research/improvements in mine safety? 3) include latest technology? and, 4) responsive to characteristics of mine?
o Plans must be periodically updated to reflect changes in mining operations, technology
o Provides for post-accident communications.
o Provides for post-accident tracking .
o Provides for post-accident breathable air:
o Self-Rescuer storage locations designed and maintained (30 CFR 75.1714-4)
o Caches of rescuers will be established in primary and secondary escapeways
o The appropriate distance between self-rescuers caches must be maintained
o Cache locations must be clearly marked (30 CFR 75.1714-2);
o Locations of caches in the mine are indicated on all escapeway and ventilation maps.
o Provides for lifelines, training, additional provisions for trapped mines (safe havens and portable refuge chambers), and local coordination.

What You Must Know and Do
o You will receive training on implementing the ERP "expectations training" on your SCSR and use of refuge alternatives.
o Know your mine's emergency communication system.
o Know your mine's tracking system.
o Know how to take full advantage of the post-accident breathable air (SCSR for escape and evacuation, and breathable air, barricading, refuge chambers for extended use).
o Check your SCSR daily.
o Check your escape and ventilation map daily.
o Always think about what you must do in a mine emergency to first evacuate/escape.

Discussion
o Specific questions or unique features of your ERP.

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Instructor Reference Material

KNOW YOUR EMERGENCY RESPONSE PLAN

How many times have we heard the saying, "if you fail to plan, then plan to fail." A plan is a blueprint that gives everyone a better opportunity to do what needs to be done to achieve a goal.

A plan is a practical activity—a realistic attempt to control the future. In a mine emergency, we are talking about life and death issues. And when a fire, explosion, or inundation occurs, we must act efficiency and effectively to preserve life and property.

To achieve this goal, we must have a plan that indicates a standardized set of policies, procedures, emergency tasks, emergency resources available, etc. Yet there is nothing standard about an emergency. They are unique, and the hazards that they introduce must be recognized and addressed. Even when we have a good plan, things don't always turn out the way we planned. Imagine the potential for loss if we have a poor plan…or no plan at all! Know your plan!

How does an ERP plan help? An ERP is a written document that establishes how miners will respond, how mine management will track miners underground, and provide emergency assistance to miners that are evacuating, escaping, or who are unable to exit the mine.

It is mandatory (Section 2 of the MINER Act of 2006) that mines (with input from miners) develop a mine specific ERP that adequately describes the procedures in effect at the mine for evacuation. ERPs must be approved by MSHA, and MSHA will consider the comments of miners regarding the plans.

If miners cannot evacuate or escape, they must be sustained or maintained. The ERP details the specific procedures to sustain and maintain trapped miners until they are rescued.

At a minimum, approved plans shall provide miners a level of safety consistent with current standards, reflect current research and current improvement in mine safety, incorporate the latest proven technology, and account for the specific physical characteristics of the mine.

Mines are dynamic work places (changes in layout, escapeways, etc.) and technology advances at a consistently rapid pace. The ERP is a living document, and as such must reflect the changes that are relevant to emergency response. Changes in the ERP must be approved by MSHA. On a regular basis, MSHA inspectors will evaluate the mine for compliance with the ERP.

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Know Your Emergency Response Plan

Once it is determined that the emergency threatens the lives of miners, and the hazards cannot be eliminated or reduced sufficiently, miners must attempt to evacuate or escape. The ERP plays an important role in implementing an escape or evacuation. A successful escape or evacuation depends on knowing what to do, how to do it, and having the required resources at one's disposal. In other words, effective training (e.g., evacuation and firefighting), and resources, (e.g., lifelines, tethers, SCSRs, communication systems), and additional provisions for maintaining and sustaining miners who cannot escape or evacuate the mine are essential.

The ERP also provides for a redundant means of communication between persons underground and the surface (post-accident communication), and for above ground personnel to determine the current, or immediately pre-accident location of all underground personnel.

In addition, underground coal mines have filed plans with MSHA that provide for a post-accident communication system between persons on the surface and miners working underground via a wireless two-way medium, and an electronic tracking system that permits surface personnel to determine the location of any persons trapped underground.

What does redundant mean? Redundant means two communication systems. And these systems, in order to provide a system if one is inoperable, must be located in separate entries or bore holes.

What is more precious than breathable air? The ERP describes (by reference to 30 CFR 75.1714-4) storage locations of SCSRs, and provides detailed information regarding their placement in caches, their number, how they are to be maintained, and that SCSR locations and number of SCSRs shall be noted on the mine escape and ventilation maps.

The ERP must also provide for sufficient post-accident breathable air for miners trapped underground, post-accident lifelines, training, and local emergency coordination.

Post accident breathable air will be provided within 1,000 feet of the closest working face of each active working section. There are several acceptable methods of providing the required 96 hour supply of breathable air for each miner. These methods include, but are not limited to, boreholes, airlines, and compressed air cylinders; in addition, provisions for Co_2 scrubbing must be described if oxygen cylinder systems are used.

Aptly named, lifelines are directional, i.e., small end/tip of the cones on the line points in-by and therefore indicates a direction [opposite the tip] that is away from the face. Miners must be trained on evacuation procedures, escapeways,

and donning and switching SCSR; at least one such session shall be in "smoke." ; all miners must participate in mine evacuation drills each quarter; expectations training shall be held once per year for all miners; SCSR units that simulate breathing resistance and heat shall be used. Many additional provisions are described in the ERP, such as two inflatable stoppings, or other quick deployable barricade units, as well as a sufficient materials to build a safe haven, and use of portable refuge chambers.

Additional Resources:

*Your mine's ERP for details and/or
MSHA PROGRAM POLICY LETTER NO. P06-V-10

PROGRAM POLICY LETTER NO. P09-V-01
Guidance for Compliance with Post-Accident Two-Way Communications and Electronic Tracking Requirements of the Mine Improvement and New Emergency Response Act (MINER Act)

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Know Your Emergency Response Plan

Safety Quiz

TRUE OR FALSE?

1. ____ If an ERP includes the necessary information, MSHA considers it approved.

2. ____ An ERP must be revised annually.

3. ____ Mines of less than 10 miners can use their evacuation plan in lieu of an ERP.

4. ____ Changes in ERPs must be approved by a majority of miners before being submitted to MSHA.

5. ____ At least two of the four annual "Expectation Training" sessions must be held in "smoke" or the equivalent.

6. ____ Current ERPs provide for a wireless post-accident communication system that allows miners underground to communicate with persons on the surface.

FILL IN THE BLANK

7. I can find the _____of caches of SCSRs on the escapeway and ventilation map.

8. When referring to emergency communication systems, redundant means _____communication systems.

9. ERPs provides for lifelines, training, additional provisions for trapped mines (safe havens and portable refuge chambers), and local emergency _____.

10. According to law, mines must develop a mine specific ERP that is responsive to the _____of the mine in which the miner works.

Mine Emergency Preparedness
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Know Your Emergency Response Plan

Answer Key

1. False
2. False
3. False
4. False
5. False
6. True
7. Location
8. Two
9. Coordination
10. Characteristics

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #9	
Title	**Knowledge of Escapeway Map Saves Time and Lives**
Purpose/Benefit	To acquaint miners with the benefits of knowledge about mine maps, especially during an emergency.
Learning Objective	The miner will describe the benefits of knowing their mine maps during an emergency.

Important Safety Points
o A copy of the mine escapeway map readily accessible to miners is located in each working section, areas where equipment is being installed/removed, and on the surface where miners congregate.
o Primary & alternate escape ways from the working section or work station to the surface or to the exits at the bottom of the shaft or slope are shown on the map
o Information on self-contained self-rescuer storage locations is shown on the map
o Locations of refuge alternatives are shown on the map
o Locations of doors accessible in the escape ways are shown on the map
o Directions of airflows in escape ways are shown on the map
o Each escapeway map must be kept current, and any change in route of travel, location of doors, location of refuge alternatives, or direction of airflow must be shown on the maps by the end of the shift on which the change is made
o Miners underground on a shift when any previously mentioned change is made must be notified immediately of the change
o Other affected miners must be informed of any previously mentioned change before entering the underground areas of the mine

What You Must Know and Do
o Know the location of the escapeway map in your section
o Know the location of the primary & alternate escapeway in your working section or work station
o Know how to find self-contained self-rescuer storage locations, refuge alternatives, and accessible doors in each escape way
o Be aware of the direction of airflow in each escape way
o On every shift take particular note of any changes to the route of travel, location of doors, location of refuge alternatives, or direction of airflow associated with either escape way; during an escape or evacuation take the escapeway map with you

Discussion
o Purpose/benefit of: refuge alternatives, knowledge of direction of airflow, man doors, etc.

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Instructor Reference Material

KNOWLEDGE OF ESCAPEWAY MAP SAVES TIME AND LIVES

30 CFR § 75.1505

Escapeway maps.

(a) Content and accessibility. An escapeway map shall show the designated escapeways from the working sections or the miners' work stations to the surface or the exits at the bottom of the shaft or slope, refuge alternatives, and SCSR storage locations. The escapeway map shall be posted or readily accessible for all miners--

(1) In each working section;

(2) In each area where mechanized mining equipment is being installed or removed;

(3) At the refuge alternative; and

(4) At a surface location of the mine where miners congregate, such as at the mine bulletin board, bathhouse, or waiting room.

(b) Keeping maps current. All maps shall be kept up-to-date and any change in route of travel, location of doors, or direction of airflow shall be shown on the maps by the end of the shift on which the change is made.

(c) Informing affected miners. Miners underground on a shift when any such change is made shall be notified immediately of the change and other affected miners shall be informed of the change before entering the underground areas of the mine.

VENTILATION, MINE, AND ESCAPEWAY MAPS

92. When do the ventilation maps, mine maps, and escapeway maps have to be updated? The ventilation map update (§ 75.372(b) (11)) should be submitted with the next required ventilation map submission (§ 75.372(a) (1)). The mine map (§ 75.1200-1(n)) and escapeway map (§ 75.1505) revisions were required by March 2, 2009 and must be kept current through temporary notations.

93. In what locations are escapeway maps required under § 75.1505(a)? The escapeway map must be posted or readily accessible for all miners — (1) In each working section; (2) In each area where mechanized mining equipment is being installed or removed; (3) At the refuge alternative; and (4) At a surface location of the mine where miners congregate, such as at the mine bulletin board, bathhouse, or waiting room.

94. If the escapeway map is posted at the working section does it also need to be posted at the refuge alternative for that section? Yes.

Selections from *Questions & Answers: MSHA's final rule on refuge alternatives* (http://www.msha.gov/REGS/COMPLIAN/GUIDES/RefugeAlternatives.pdf)

Mine Emergency Preparedness
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Knowledge of the Excapeway Map Saves Time and Lives

Safety Quiz

TRUE OR FALSE?

1. ___ An escapeway map must be updated on a weekly basis when changes occur.

2. ___ Changes to the location of a refuge alternative need not be noted on a section's escape way map.

3. ___ Locations of accessible doors in escapeways must be indicated on the escape way map.

4. ___ Directions of airflows in escape ways do not matter in an emergency.

5. ___ It is a good idea to take the escapeway map with you during an evacuation.

6. ___ When a roof fall occurs in an escape way, it could constitute a change to the route of travel.

FILL IN THE BLANK

7. There must be _____ escapeways from a working section to the surface or the exits at the bottom of the shaft or slope.

8. A copy of the _____ _____ _____must be readily accessible to miners on a working section.

9. An escape way map must show the escapeway routes from the _____ or _____ to the surface or to the exits at the bottom of the shaft or slope.

10. Describe how a change in direction of airflow might indicate trouble during an evacuation.
    _____

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Knowledge of the Excapeway Map Saves Time and Lives

Answer Key

1. False
2. False
3. True
4. False
5. True
6. True
7. two
8. mine escape way map
9. working section or work station
10. This could indicate damage to ventilation controls and altered escape routes.

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #10	
Title	**Donning the CSE SR-100 SCSR***
Purpose/Benefit	To acquaint the miner with the fundamental steps of donning a SCSR.
Learning Objective	The miner will describe how to correctly don the SCSR.

Important Safety Points
o Your SCSR can save your life. It can provide you with the life-sustaining oxygen you need to escape from the mine. Treat it with care and respect. The only way the SCSR can help you is if it is used correctly.
o The SCSR provides 1 hour of oxygen while isolating your lungs from toxic mine air.
o Be absolutely 100% positive that you know how to use the SCSR.
o Be absolutely 100% positive that you know how to use the SCSRs at the cache site.
o This talk does not replace the required hands-on training on donning your SCSR

What You Must Know and Do
o Remember the 3 + 3 Method. After placing neck strap, three steps up, then 3 steps down. UP: 1. Activate 2. Mouth piece 3. Nose clip. DOWN: 1. Goggles 2. Neck strap 3. Waist strap.
o Remove the SCSR from your belt.
o Drop to your knees.
o Take your hard hat off and shine your light toward the SCSR in front of you
o Open the SCSR according to manufacturer's directives.
o Place the neck strap around your neck.
o Activate the SCSR by pulling cord (chemical units)
o Place the mouthpiece in your mouth and bite firmly on the bite lugs.
o Exhale into the breathing tube, and then begin breathing normally.
o Place nose clips on your nose.
o Put on goggles. If you wear glasses, place the glasses on over the goggles.
o Tighten neck strap. Be sure the SCSR is riding high up on your chest.
o Tighten waist strap.
o Place hardhat back on.

Discussion
o The SCSR used for daily use at this mine is:
o This is how to correctly don this type of SCSR:
o The types of SCSRs in the cache are:
o This is how to properly don the SCSRs stored in the cache.

***Note: If other SCSR models are in use, the mine's safety/training department should prepare a TBT for the appropriate model (See Instructor Reference Material)**

Mine Emergency Preparedness
Tool Box Talk Series

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Donning the CSE-100 SCSR

Instructor Reference Material

DONNING THE CSE SR-100 SCSR

From CSE Corporation: http://www.csecorporation.com/index.html

The SR-100 weighs less than 6 lbs. and is designed to be worn on the belt, or kept within arm's reach of workers exposed to dangerous hazards.

In emergencies, the user should position themselves kneeling on the ground removing the unit from the belt.

Open the unit by lifting the latch on top, removing both top and bottom covers.

Loop the neck strap over the head and begin the 3+3 donning procedure.

3 Primary Steps:

1. Pull orange actuator tag down to activate oxygen.
2. Remove plug and insert mouthpiece.
3. Pull apart nose pads and affix to nose so that both nostrils are completely closed.

3 Secondary Steps:

4. Put on safety goggles.
5. Adjust neck strap so that the SR-100 unit rests on chest. Fasten waist strap around waist.
6. Replace hard hat if removed and move out.

By following these steps written by MSHA/ NIOSH, the SR-100 can be donned in less than 20 seconds when worn on the worker's belt.

Keeping the SR-100 within arm's reach ensures minimal donning time, and maximizes worker protection in emergency situations.

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Donning the CSE-100 SCSR

Additional Information

The degree of training and familiarity can affect the duration.

The more training and experience the subject has with an SCSR, the more their breathing will be calm and controlled.

If a subject is familiar with a particular escape way, it may improve the mechanics of their escape.

The greater the training and familiarity, the greater the duration.

By minimizing talking and swallowing your saliva, the greater the duration of the SCSR.

SR-100s generate oxygen by chemical reaction, and produce oxygen at a certain rate. Miners should be reminded that when wearing a self rescuer, it is to their advantage to breathe at a slow rate. If it seems as though the rescuer is not keeping up, slow down.

Warning: Before donning SR-100 remove any foreign matter from your mouth such as chewing tobacco or gum.

Warning: Breathing through the SR-100 differs from breathing ambient air; temperature and resistance will be slightly higher. This is normal during use and never warrants removal of the mouthpiece.

Warning: The user should be familiar with operational primary escape ways, secondary escape ways and SR-100 cache locations.

Warning; Never remove the mouthpiece unless you have reached fresh air or you are replacing the unit you are wearing with a reserve unit.

Warning: Do not attempt to talk while wearing SR-100, maintain a tight seal on mouthpiece and nose clip. Try to communicate via hand signals or writing.

Warning: Remove the SR-100 from service if any of the following conditions exist:

1. top or bottom moisture indicator is not blue,
2. the security seal is broken,
3. the unit was exposed to temperatures above 130^0 F as indicated by the temperature indicator being red if your unit is provided with this indicator,

4. shows indications of physical abuse(crushed, burnt, visible puncture holes, substantial crack dents, or any other visible signs of trauma.)

Warning: The unit must temporarily be removed from service if the internal temperature of the unit drops below 32^0F. Once the internal temperature rises above 32^0F the unit may be returned to service.

Warning: Never attempt to use a damaged SR-100, unit already removed from service or that does not meet inspection criteria.

Warning: The SR-100 is intended as a one-time use only product, once the unit is opened it is considered spent and should be disposed of properly.

Warning: Avoid direct contact between the breathing bag and open flames or chemicals during use.

Warning: The SR-100 and carrying pouch should be kept clean. Do not submerge the SR-100 in water or use petroleum solvents to clean.

Warning: The SR-100 is approved with the SR-100 carrying pouch, any modification or substitution of this pouch should be removed immediately and replaced with an approved SR-100 pouch.

Warning: The user should perform the daily inspection of the CSE SR-100 prior to carrying the unit.

Warning: Only a trained and qualified individual may perform the 90 day inspection of the CSE SR-100.

Warning: Do not introduce petroleum based liquids or flammable liquids into the unit. The chemical (potassium super oxide) in this unit is not combustible but it can ignite flammable liquids when they come in contact.

The amount of work required to escape affects the duration.

Running, walking bent over, crawling or climbing a ladder for example will increase the work required to escape. Less work results in greater duration.

The physical condition or fitness of the user affects the duration. A high heart rate, age and percent of body fat suggest inferior levels of fitness. The more fit the user, the more efficient utilization of oxygen, permitting higher work rates or longer durations. The user's fitness, weight, response to inspired carbon dioxide and tolerance to breathing resistance all affect the amount of

oxygen required by the user. The more fit and the less weight, the greater the duration.

The user's breathing rate affects the duration. The rate can be increased by excitement and fear. The lower the breathing rate, the greater the duration.

MANUAL START PROCEDURES

The user can easily confirm that the oxygen starter system has released oxygen into the breathing bag by two observations.

Once the Oxygen Actuator has been pulled the user will hear a faint hiss of the oxygen being released from the bottle into the unit for a few seconds.

Second and more noticeable indication, the user will see the breathing bag fill as long as the mouthpiece plug is still inserted into the mouthpiece.

In the event the compressed oxygen starter does not activate or the oxygen vents through the mouthpiece because the plug is left out of the mouthpiece during activation, the user should manually start the unit.
Remove the Mouthpiece from your mouth. The nose piece should remain attached to the nose.

1. Inhale ambient air through the mouth.
2. Exhale into the mouthpiece to begin inflating the breathing bag.
3. Repeat this process 3 to 6 times until the breathing bag is full.
4. Continue with the 3+3 Donning Procedure.
5. Begin the egress by moving at a moderate work rate, allowing the breathing bag to inflate with the excess oxygen.

Once the bag is full, you can then increase your egress to a more normal rate.

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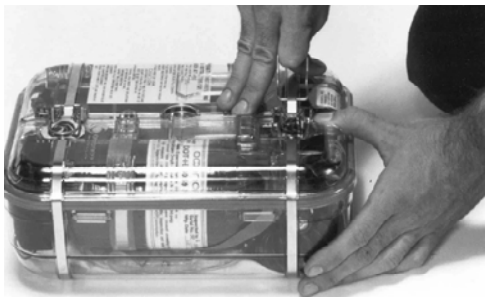
DONNING THE OCENCO EBA 6.5 SCSR

(Excerpted from *Instruction Manual for Ocenco Incorporated EBA 6.5 60 Minute Self-Contained Self-Rescuer* (Manual Number: NH13747, Revision A, ECN 2384, Se ptember 7, 2001)

INSTRUCTIONS FOR USE

(1) Pull latch release rod.

(2) Lift and pull each latch ring to release bands.



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(3) Remove cover from base. Grab the two handle straps and pull case apart, discard cover and rubber seal.

(4) Open oxygen valve fully counterclockwise, in direction of arrow

(5) Place neck strap over head

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(6) Pull mouthpiece toward face. The mouthpiece plug will automatically be removed from the mouthpiece. Insert mouthpiece and breathe through mouth only. Use head strap for additional support of mouthpiece, if required

(7) Apply noseclips to nose. Do not attempt to inhale or exhale through your nose

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(8) Purge bag with oxygen to eliminate nitrogen: exhale, hold breath and deflate bag by pressing on the bag. Inhale deeply through the mouthpiece, then breathe normally (oxygen will be supplied from the demand regulator).

(9) Adjust neck strap for comfort.

(10) Wrap waist harness around waist, clip and adjust for fit by pulling on strap end.

(11) Place goggles over eyes to prevent irritation from smoke or other irritants.

(12) ESCAPE

Note: Proper handling, maintenance, and other information as supplied in this manual are essential to the effective use of the EBA 6.5. The user should be familiar with Instructions for Use 1-12 before attempting to use the EBA 6.5.

Mine Emergency Preparedness
Tool Box Talk Series

Donning the CSE-100 SCSR

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Safety Quiz

TRUE OR FALSE?

1. ____ The first step in donning the SCSR is to activate the oxygen.
2. ____ Wearing the SCSR high on your chest puts less strain on the air hose and mouth piece.
3. ____ The goggles can prevent toxic gases from being absorbed by the eyes.
4. ____ A common way to remember the donning steps for the SCSR is "3+3."
5. ____ Keeping the waist strap tight will be a big help if you have to switch SCSRs.
6. ____ All SCSRs function exactly the same way.
7. ____ If the SCSR does not activate properly, you must know the proper steps to manually activate the SCSR.
8. ____ You must not allow the breathing hose to kink; this can obstruct air flow.
9. ____ If the air bag (on some units) tears, and you are able, roll the bag up around the hole to seal the leak.
10. ____ In order for the SCSR to give you the required protection, it must be worn correctly and your lungs must be isolated from mine air.

Mine Emergency Preparedness
Tool Box Talk Series

Donning the CSE-100 SCSR

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Answer Key

1. False
2. True
3. True
4. True
5. True
6. False
7. True
8. True
9. True
10. True

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #11	
Title	**Switching the CSE SR-100 SCSR**
Purpose/Benefit	To increase the miner's awareness of the proper procedures to follow when switching SCSR's.
Learning Objective	The miner will describe/demonstrate the proper procedures to be followed for switching SCSRs.

Important Safety Points
o Maintaining isolation while switching is the primary goal.
o Making sure the waist strap on the unit is tight will make it easier to switch mouthpieces.
o Even though a new unit has been in storage, do an inspection before switching.
o Lay everything out before attempting the switch. You don't want to find yourself holding your breath while untwisting a hose.
o Don't be concerned about length of straps until you are isolated.
o You must know your escapeways and the location of the SCSR storage units.
o Team work is involved in traveling the escapeway.
o Mentally review the steps for donning and switching on a daily basis. This will definitely help with your comfort level if and when it gets to the point where you must put these procedures to use.
o This talk is not a substitute for actual hands-on training specific to our mine.

What You Must Know and Do
o Kneel and shine your light on the unit.
o Lay the unit out to help ensure that the switch will go smoothly.
o Remove the neck strap of the unit you are using-make sure you have a firm grip on the mouthpiece.
o Loop the neckstrap of the new unit around your neck. Activate the unit, take a deep breath hold it and switch mouthpieces and then noseclips.
o Release the waist band on the old unit and adjust the neck and waist straps on the new unit. If you need to switch goggles that can also be done at this time.
o After replacing your hard hat, prepare to continue out the escapeway.

Discussion
o Where are the storage units along the primary and secondary escapeways?
o Who will hand out the units when you arrive at the cache?
o How will you deal with someone on the crew that has a problem switching?
o What situations could occur that would affect which escape route to use?

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Switching the CSE SR-100 SCSR

Instructor Reference Material

SWITCHING THE CSE SR-100 SCSR

Emphasize that after about a 30-minute walk, the miners will find another supply of SCSRs.

It is important to switch to a fresh unit at this time.

Always follow the exact instructions for donning and switching SCSRs.

Kneel and put the replacement SCSR on the bottom, remove your hat and shine your light on it as before.

Prepare the rescuer to be put on by opening it and by unfolding the bag and laying out the straps

Remove the neck strap on the rescuer you are wearing, allowing it to hang by the waist strap.

Loop the neck strap of the replacement unit around your neck.

Activate the replacement unit.

Take a deep breath from the unit you are using and hold your breath.

Put the mouthpiece in your mouth from the replacement unit and exhale into the mouthpiece.

Put the nose clips on.

Remove the waist band from the first rescuer and adjust the straps on the replacement unit

NOTE: THE FOLLOWING SUMMARIZES NIOSH RESEARCH ON A GENERIC SWITCHING PROCEDURE AND EXPECTATIONS TRAINING. IT IS NOT SPECIFIC TO THE CSE SR-100.

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Tool Box Talk Series

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Switching the CSE SR-100 SCSR

The following information describes a recent NIOSH research project that explored the adoption of a generic SCSR switching procedure.

Ongoing Research Project related to Mine Disasters

SCSR Switchover Procedure and Expectations Training

Miner switching from one SCSR to another

STRATEGIC GOALS:
Mine disasters; Surveillance and training

KEYWORDS:
Self-contained self-rescuers, underground mining, SCSR, training, traumatic incident stress, expectations training

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PURPOSE: To enhance miners´ ability to switch from one self-contained self-rescuer (SCSR) to another if needed during escape from an underground mine, and to provide expectations training on what it is like to wear an SCSR.

RESEARCH SUMMARY: According to section 2(3)(b)(2)(E)(iii)(IV) of the MINER Act of 2006, each underground coal miner must be trained in the proper procedures for donning self-rescuers, switching from one unit to another, and ensuring a proper fit. At the time the Mine Safety and Health Administration (MSHA) promulgated the final rule on emergency mine evacuation, there was no procedure for switching from one SCSR to another. NIOSH, in partnership with MSHA and original equipment manufacturers, undertook the task to develop such a procedure. This effort also included development of expectations training for teaching miners 1) what to expect from the SCSR unit during an emergency and 2) what to expect from themselves and fellow miners during escape.

The goal of this project was to develop a procedure for switching from one SCSR to another, minimizing the amount of time a miner would have to hold his or her breath. Researchers investigated various potential procedures in NIOSH laboratories with the goal of developing a universal donning sequence that would work equally well for all apparatus while isolating the miner´s lungs quickly. The procedure developed involved working back and forth between the two devices in order to complete the necessary steps to change out the units. Using this procedure, the critical steps of activating the oxygen and swapping out the mouthpiece and noseclips can be accomplished in less than 10 seconds. The procedure is as follows:

1. kneel
2. prepare the second SCSR
3. swap neck straps
4. activate the oxygen

5. swap mouthpieces and noseclips
6. swap waist strap
7. swap goggles, and
8. replace cap and move out

In addition to developing the switchover procedure, NIOSH developed an expectations training program for miners. Researchers collected data through interviews with miners who had worn apparatus either in training or during an escape, with manufacturers, and with other NIOSH researchers. Studies on human behavior in escape and responses in previous mine emergencies were reviewed. Potential physical and psychological consequences of donning an SCSR were determined. The key areas that might lead to a miner thinking his/her SCSR was not working included:

- starting the unit
- unit heat
- induction of coughing
- unit taste
- difficulty in breathing while wearing the unit
- quality of the air supplied
- nose clips
- goggles, and
- the behavior of the breathing bag

NIOSH researchers next consulted with MSHA on the development of training modules for each SCSR on the market. As part of the development process, the procedure was demonstrated several times to a cross-section of stakeholders including SCSR manufacturers, industry and labor representatives, and enforcement personnel whose input helped shape the training modules. Each module consists of a video DVD that illustrates the procedure being performed, an instructor´s guide that covers inspection, storage, care and maintenance, donning procedures, transfer procedures, and an expectations component. An information circular detailing how to clean and disinfect SCSR training equipment is also included. These resources were compiled by MSHA into the training modules "A Comprehensive Guide to the Inspection, Care and Use of Self-Contained Self-Rescuers", MSHA Training Product Catalog No. Cat No: DVD 013, available from the National Mine Health and Safety Academy in Beckley, WV (http://www.msha.gov/TRAINING/prodintr.htm) . The expectations training study was published in the Journal of Occupational and Environmental Hygiene, October, 2008.

Mine Emergency Preparedness
Tool Box Talk Series

Switching the CSE SR-100 SCSR

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Safety Quiz

SWITCHING THE CSE SR-100 SCSR

TRUE OR FALSE?

1. ___ You might be doing yourself a huge favor to review the SCSR switching process on a very regular basis.
2. ___ You will find a cache of replacement SCSR's after about a 30 minute walk.
3. ___ You should replace your existing SCSR at every other cache station.
4. ___ It is vitally important to maintain isolation of your lungs from the mine air when switching SCSR's
5. ___ Laying the replacement SCSR out before beginning the switch is an easy way to get messed up during the switch.
6. ___ The first step in the switching process is to remove the neck strap from the unit you are wearing.
7. ___ Placing your hard hat on the ground with the light shining on the replacement unit can help you see better to open the replacement unit.
8. ___ You must hold your breath while switching mouthpieces.
9. ___ If you do not exhale into the replacement unit, you might get a lung-full of powder.
10. ___ If you see a fellow miner struggling with the switch, you should delay putting your unit on and help them first.

Mine Emergency Preparedness
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Switching the CSE SR-100 SCSR

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Answer Key

1. True
2. True
3. False
4. True
5. False
6. True
7. True
8. True
9. True
10. False

Mine Emergency Preparedness
Tool Box Talk Series

Developed under The 2008 MSHA Brookwood-Sago Mine Safety Grant

Tool Box Talk #12	
Title	**Responsibilities of Each Miner During a Fire or Fire Drill**
Purpose/Benefit	To instruct miners regarding their responsibilities during a mine fire and/or fire drill
Learning Objective	The miner will identify who has special responsibilities during an emergency, and discuss their responsibilities during a fire/fire drill

Important Safety Points
o Once the responsible person has sufficient knowledge of the emergency, he/she will order a complete evacuation or organize miners to address the fire and order the remaining miners to evacuate.
o Miners will be instructed where to assemble in the event of an emergency.
o CO monitoring systems and belt fire monitors (fire sensor alarm) will give an audible and visual (CO monitor) or visual (fire warning) alarm.
o UG electrical installation and belt heads are provided with rock dust and extinguishers.
o Emergency drills are conducted every 90 days.
o If the person in authority so orders, selected miners will be responsible to fight the fire: o One SC operator stays in contact with surface; another relays info on fire o Bolter gets the fire hose from tailpiece; one hooks up; another approaches fire, etc. o Outby miners have different responsibilities (e.g., shut down belt, tec.)
o Carbon monoxide is a colorless, odorless and tasteless gas that is always present following a fire or explosion.
o Anyone can and should report/warn others of an emergency.

What You Must Know and Do
o Know who the designated responsible person is on your work shift (posted on BB)
o Know the location of the pager phones or communication system throughout the mine
o Know your mine's evacuation and fire fighting program
o Know the location of the assembly point for emergency evacuations
o Notify your foreman if you hear a fire sensor alarm
o Know how to de-energize equipment on the section
o Know the names of the persons at your mine who are trained and qualified to respond to an emergency
o Know how to recognize and fight A, B, or C type fires
o Know how to use a fire extinguisher (demonstrate skill) & rock dust to suppress a fire.
o Know the location of water lines, fire valves, fire hose and fire suppression equipment
o Know how to use a fire hose

Discussion
o Specific information/questions about your fire fighting program and fire drills

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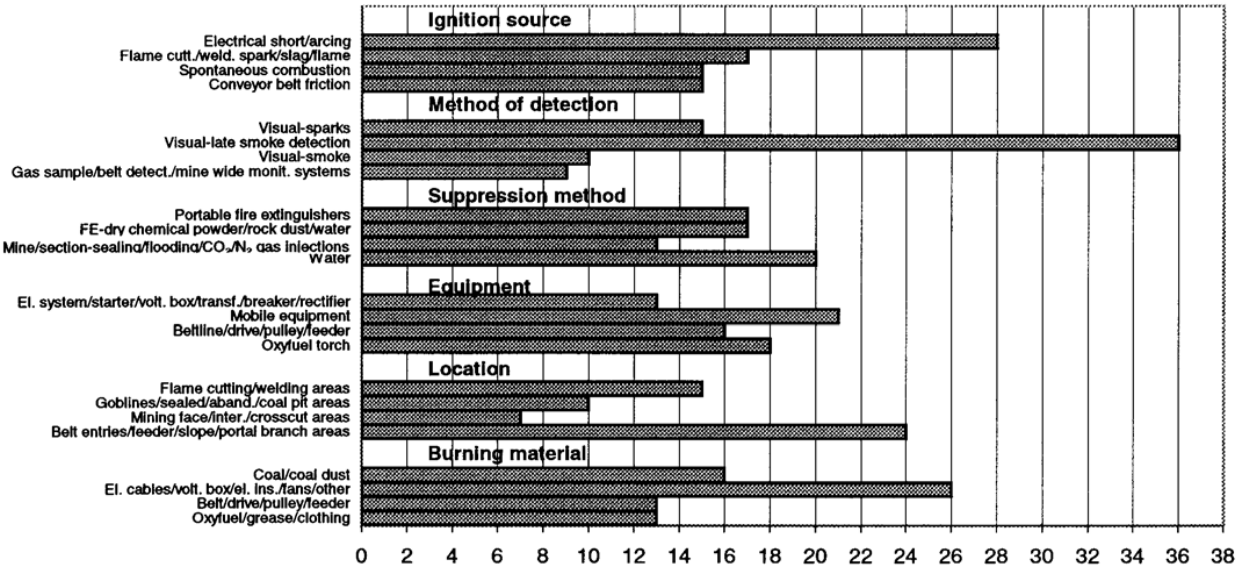
Instructor Reference Material

RESPONSIBILITIES OF EACH MINER DURING A FIRE/FIRE DRILL

A mine fire is a unique emergency. Unlike an explosion, or inundation of water or gas, a fire usually takes time to develop. If mine fires are detected while they are still small, they can be extinguished. An appropriate response or successful control of a mine fire depends on several factors:

1. An adequate mine emergency evacuation and fire fighting program
2. A trained workforce who can demonstrate competencies in understanding/identification of UG mine fires, good decision-making, and fire fighting skills
3. Adequate fire prevention policies and practices
4. Water supplies (water lines, valves, hose, etc.), fire extinguishers, fire suppression equipment.
5. Adequate fire drills

Of the 458 coal mine fires that occurred during the period 1990-1999, 85 (19%) occurred underground. According to recent experience, the most likely location of underground fires is belt entries, the ignition source is electrical shorts, and the suppression method is water, followed by portable fire extinguishers.



Underground coal mine fires 1990-1999

Reference:
De Rosa, M. (2004). Analysis of mine fires for all U.S. underground and surface coal mining categories: 1990-1999. (DHHS (NIOSH) Publication No. 2004–167).

Mine Emergency Preparedness
Tool Box Talk Series

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Responsibilities of Each Miner During a Fire/Fire Drill

Safety Quiz

TRUE OR FALSE?

1. ____ If you hear a fire alarm, contact your foreman.
2. ____ Most mine fires usually occur at the face.
3. ____ Only the responsible person can notify others of an emergency.
4. ____ Emergency drills are conducted every 120 days.
5. ____ Water is best for "A" type fires.
6. ____ Underground electrical installations and belt heads are provided with rock dust and one or more fire extinguishers.

FILL IN THE BLANK

7. Who are the responsible persons at your mine?_____.
8. Report any _____ with the mine communication system to your foreman.
9. Anyone can and should _____ others of an emergency.
10. Know how to recognize and fight _____,_____,_____ type fires

Mine Emergency Preparedness
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Responsibilities of Each Miner During a Fire/Fire Drill

Answer Key

1. True
2. False
3. False
4. False
5. True
6. True
7. Foreman
8. Problems
9. Warn
10. A, B, C

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #13	
Title	**Primary and Secondary Escapeways**
Purpose/Benefit	To acquaint miners with key information regarding primary and secondary escapeways.
Learning Objective	The miner will describe the major regulatory requirements and the locations of primary and secondary escapeways leading from the working section or work station.

Important Safety Points
o Two escapeways are required from every working section and work station
o The escapeways must generally be separate and distinct, and safely and continuously travelable to the surface or to the escape shaft or slope facilities to the surface
o The primary and secondary escapeways must not end at a common shaft, slope, or drift opening (an exception may be approved for certain multiple compartment facilities)
o The primary escapeway must be ventilated with intake air
o The escape ways must be clearly marked to show the route and direction of travel, and be equipped with a continuous, durable, flame-resistant lifeline marked with reflective material every 25 feet
o The lifeline "communicates" critical information by an arrangement of cones, spheres, and coils… o Cones indicate direction (tapered end=inby); sphere = personnel door; pair of attached cones = a branch line; four cones in shape of 2 diamonds = a SCSR cache, and a spiral coil indicates a refuge alternative

What You Must Know and Do
o Know where your escapeway map is in your working section or work station
o Know where your primary escapeway and secondary escapeway begin in your section
o Know that the primary escapeway is definitely ventilated with intake air
o Know what cone arrangements mean
o Personnel carriers may be used in the primary escapeway under approved conditions

Discussion
o Escapeways are important in time of an emergency because …
o The primary escapeway is the preferred route of travel because …
o The secondary escapeway could be the best option for evacuation when …
o The location of SCSR caches along the escapeway are indicated by …
o The location of refuge alternatives along the escapeway are indicated by …
o The location of mine doors along the escapeway are indicated by …
o Requirements regarding mechanical escape facilities at bottom of shaft or slope

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Instructor Reference Material

PRIMARY AND SECONDARY ESCAPEWAYS

Program Policy Manual—Vol. 5 Coal Mines

75.380 Escape ways; Bituminous and Lignite Mines
"The most direct, safe and practical route," as used in paragraph (d)(5) will be determined on a mine-by-mine basis. If the inspector believes that a particular escapeway is not the most direct, safe, and practical route, he or she must specifically inform the operator that another route is more direct, safe, and practical. This should be done by the inspector at the time of issuing a citation by orally notifying the operator of the preferred escapeway route and by noting in both the citation and inspector's notes, the escapeway route which the inspector believes to be more direct, safe, and practical.

Serious consideration should be given to the inherent hazards related to rehabilitation of fallen areas. In addition to the hazards of exposure related to such rehabilitation, other factors affecting whether the operator has set out the most direct, safe and practical route include roof conditions, traveling height, fan location, physical dimensions of a mine opening, and similar factors.

For example, if bad roof conditions are present along the shortest direct route and those roof conditions are beyond reasonable control, then an alternate safest route, as designated by the mine operator, may be acceptable. The presence of roof falls does not necessarily indicate that the passageway would not be suitable for evacuation.

Where coal seam thickness varies to the extreme, the shortest route may be through lower coal, making travel relatively slow and difficult, whereas an alternate route through a high passageway may permit faster and easier travel. Such an alternate route, although longer, may be acceptable. Similarly, an old mine shaft may not be safe for travel because of badly deteriorated shaft lining, timbers, etc., even though it is still suitable for mine ventilation purposes.

Standard development projections will not have to be altered to drive additional rooms, entries, or crosscuts for the sole purpose of providing a passageway to the nearest mine opening. However, the construction of ventilation controls such as stoppings, overcasts, and under casts, or installation of an escape facility, may be required to provide the most safe, direct, and practical escapeway.

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Tool Box Talk Series

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Primary and Secondary Escapeways

Safety Quiz

TRUE OR FALSE?

1. ____ The secondary escapeway must be ventilated by intake air.
2. ____ Four cones on a lifeline shaped into two diamonds indicates the location of an SCSR cache.
3. ____ A directional indicator on a lifeline has the tapered section pointing outby.
4. ____ A sphere on a lifeline indicates the location of a mine door.
5. ____ An escapeway map must be provided on a working section.
6. ____ Generally, two escapeways leading from a working section must not end at a common shaft, slope, or drift.

FILL IN THE BLANK

7. Escapeways leading from a working section to the surface must be _____ and _____.
8. Escapeways leading from a working section to the surface must also be _____ and _____.
9. Personnel carriers may be used in the _____ escapeway under approved conditions.
10. Describe the time requirement for availability of mechanical escape facilities following surface notification of an emergency requiring evacuation.

Mine Emergency Preparedness
Tool Box Talk Series

Primary and Secondary Escapeways

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Answer Key

1. False
2. True
3. False
4. True
5. True
6. True
7. separate and distinct
8. safely and continuously travelable
9. primary
10. Operational within 30 minutes of notification of the surface of an emergency requiring an evacuation.

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

Tool Box Talk #14	
Title	**Care and Transport of Injured Miners**
Purpose/Benefit	To acquaint the miner with fundamental principles for caring for and transporting injured miners.
Learning Objective	The miner will describe basic principles to stabilize and transport injured miners.

Important Safety Points
o The care you provide in the early minutes following an injury can have a great effect on the outcome of the patient's recovery.
o Always evaluate the safety of an accident site before rushing in; it has been said that, "…the second victim is often the first rescuer…"
o Call for help at the very first opportunity.
o Treat first for life-threatening conditions…Remember…**A**irway, **B**reathing, **C**irculation
o First aid supplies are located in every section (within 500 ft. of the face, in the dispatcher's office, and at the bottom of the shaft or slope).
o Do not move an injured miner unless the environment is dangerous to you or the injured miner.
o A mode of transportation for transporting injured miners to the outside is available in every section.
o EMTs and miners with advanced first aid skills will need to stabilize the injured miner's neck and spine and place and secure the miner on a rigid backboard before taking the injured miner outside.

What You Must Know and Do
o Look for and control life-threatening problems such as evaluating breathing, pulse, controlling bleeding and treating for shock until better-trained miners arrive.
o If there is any doubt about neck or back injuries, it is best not to move a victim unless the environment is life threatening to you or the injured miner.
o Use supplies from the first aid kit, or in crisis conditions, use your clothing until better supplies arrive.
o Continue providing care for the injured miner until an EMT or miner with advanced first aid training arrives and takes over care. Offer to help the EMT and follow their directions.

Discussion
o The first aid supplies in this section are located:
o The EMTs on this shift are:
o Importance of informing the surface regarding the nature of injury/injuries, and what transportation arrangements need to be made.
o The way an injured miner would be transported out of this section is:
o The supplies that an EMT has that are different from the first aid box are:

Mine Emergency Preparedness
Tool Box Talk Series

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The Care and Transport of Injured Miners

Instructor Reference Material

THE CARE AND TRANSPORT OF INJURED MINERS

The care and transport of injured miners is a broad topic. It goes well beyond the scope of a tool-box talk. However, some specific principles of first aid are so important that they should be repeated on a regular basis. One such principle is SCENE SAFETY. When responding to an emergency—especially if the victim is a friend or relative—we have a tendency to focus primarily on the victim. The result may be a lack of awareness of imminent dangers. This paradoxical state of mind where there is focus and a lack of awareness may be referred to as "tunnel vision." Tunnel vision is an extreme form of selective perception. To overcome tunnel vision when responding to a victim, the rescuer needs to stop and do a risk assessment before checking the victim. There are many hazards in an underground coal mine that may pose a threat to the safety of the rescuer. So, before approaching a victim, the rescuer must first stop, and look and check for:

1. **UNSTABLE ROOF/RIBS**
2. **SOURCES OF ELECTRICITY**
3. **UNSTABLE MATERIALS/EQUIPMENT**
4. **WATER**
5. **LACK OF O_2**
6. **METHANE**
7. **OTHER GASES**
8. **ANY OTHER HAZARDS**

Once the rescuer is satisfied that imminent dangers are not present, he/she can proceed with rendering emergency care to the injured miner(s).

One other principle that should be repeated often is that rescues should never move an injured person until the person's injuries have been treated.

The following information is excerpted from First Aid (Safety Manual No. 3, reprinted 1997), and may be helpful in preparing to give a tool-box talk on the care and transport of injured miners.

Developed under The 2008 MSHA Brookwood-Sago Funding Grant

The Care and Transport of Injured Miners

TRANSPORTATION

After receiving first aid, an injured person often requires transportation to a medical facility. Under special circumstances like those in mining accidents, the patient must be transported to a place accessible to ambulance personnel. It is the responsibility of the first aider to see that the patient is transported in such a manner as to prevent further injury, pain, or discomfort. Improper handling and careless transportation often add to the original injuries, increase shock, and endanger life.

Under normal circumstances, do not move an injured person until a thorough examination has been made and first aid has been given. Move a seriously injured person in a position that is least likely to aggravate injuries. Various methods for carrying a patient can be used in emergencies, but the stretcher is the preferred method of transportation. When a stretcher is not available or impractical, employ other means of transportation.

When the life of a person is in danger and the person **must** be pulled or dragged to safety, pull the body by the shoulders, not sideways. Avoid bending or twisting the neck or trunk. Carry in the arms, over the back, or use the two-person carry when you know that no injury will be aggravated by such handling of the patient.

Two-Person Seat Carry

The two-person seat carry (Figure 16) is a technique for transporting the patient in a seat fashioned from the rescuers' arms. Use this carry when moving the patient through narrow passageways. Do not use this carry when injury to the spinal column is suspected.

Figure 16 - Two-Person Seat Carry.

Three-Person Lift and Carry

Use the three-person lift and carry (Figure 17) to move an injured person a short distance, through a narrow passageway, or when a stretcher is not available. Also use this carry when an injured person is placed on or removed from a stretcher.

Three persons are required for this lift and a fourth is desirable. (A fourth person to hold the head is necessary if a spinal injury is suspected.) Proper lifting must be done by commands of a leader, usually the bearer at the patient's head.

PENNSTATE 1855

The Care and Transport of Injured Miners

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Figure 17 - Three-Person Lift and Carry.

- Each of the three bearers kneel on the knee nearest the patient's feet and on the least injured side, if possible.
- One bearer, opposite the patient's shoulders, supports the patient's neck and shoulders.
- Another bearer, opposite the patient's hips, supports patient's thighs and small of back.
- The third bearer, opposite the patient's knees, supports the patient's knees and ankles.
- On command, the bearers slowly lift the patient to rest on their knees.
- On command, the bearers slowly turn the patient on his/her side so the patient rests in the bend of their elbows close to their chests.
- On command, all bearers rise in unison.
- The bearers can then, when commanded, move the patient.

Four-Person Log Roll

This technique for moving a patient with spinal injuries requires four persons, one who acts as captain. To perform the four-person log roll, proceed as follows:

- One rescuer (who acts as captain) stabilizes the neck and head as he/she opens the airway by using the modified jaw-thrust maneuver. One rescuer places spine board parallel to the patient.
- Three rescuers (one rescuer at shoulder, one at waist, one at knee) kneel at the patient's side opposite spine board, leaving room to roll patient toward them while the captain keeps the neck and head stabilized.
- The captain commands the shoulder level rescuer to extend patient's arm over the head on the side on which the patient will be rolled.
- The rescuer at the shoulder places one hand under patient's shoulder and the other hand under patient's upper arm.
- The rescuer at the waist places one hand on the patient's waist and the other hand under patient's buttocks.
- The rescuer at the knees places one hand under the patient's knees and the other hand under the mid-calf.
- On command, roll patient in unison on side toward the rescuers.
- On command, waist level rescuer or bystander pulls spine board into position against patient.
- Roll patient as a unit onto board, on command.
- Place rolled blankets beside head and neck for additional protection and secure head to board with cravat bandages.
- Secure patient to the splint or stretcher so the entire body is immobilized (Figure 18).

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The Care and Transport of Injured Miners

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Figure 18 - Four-Person Log Roll.

Straddle Slide

Another technique for moving a patient with a spinal injury onto a long board is the straddle slide. Three persons handle the patient and the fourth person slides the board into place. To perform the straddle slide, proceed as follows:

- One rescuer maintains an open airway with the modified jaw-thrust and applies traction.
- The second rescuer faces and straddles the patient. Bending at the waist, the rescuer grips the patient's arms, just below the shoulders.
- A third rescuer also faces and straddles the patient. Bending at the waist, the rescuer places his/her hands on the sides of the patient's waist. (The long board must pass between the legs of the three rescuers).
- The fourth rescuer positions the board at the patient's head in line with the patient's body.
- On signal from the commanding rescuer, the rescuers lift the patient just high enough to allow the fourth rescuer to slide the board under the patient.
- On command, the rescuers gently lower the patient onto the board. Support is maintained until patient is secured (Figure 19).

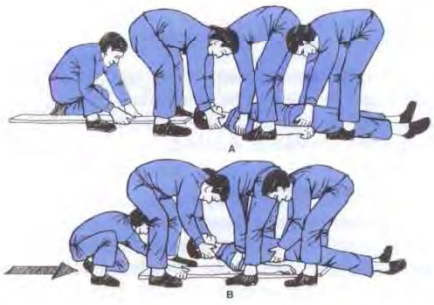

Figure 19 - Straddle Slide.

Stretcher Transportation

It is recommended that stretchers be tested before placing a patient on it. Ask a person who is about the same weight as the patient to lie face down on the stretcher, and proceed to lift the "test patient."

Mine Emergency Preparedness
Tool Box Talk Series

The Care and Transport of Injured Miners

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Safety Quiz

TRUE OR FALSE?

1. ____ The care provided to an injured miner in the early minutes following an injury can have a great impact on his/her recovery.

2. ____ A stretcher is the preferred mode of carrying an injured person.

3. ____ When you either witness an accident or come upon an injured miner, you should immediately rush to them to start providing care.

4. ____ Extreme care should be used if you think an injured miner has head, neck or spinal injuries.

5. ____ You should only move an injured miner if the environment is life-threatening to either the miner or you.

6. ____ EMT's must support and stabilize the neck and spine of an injured miner before transporting them outside.

7. ____ You should call for help at the earliest opportunity.

8. ____ You should look for fractures and sprains very early in your assessment of an injured miner.

9. ____ In a crisis, and without first aid supplies, you can use your clothing for makeshift bandages until a first aid kit arrives.

10. ____ You can quit providing care to an injured miner when you hear that the EMT will be there in 5 minutes.

Mine Emergency Preparedness
Tool Box Talk Series

The Care and Transport of Injured Miners

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Answer Key

1. True
2. True
3. False
4. True
5. True
6. True
7. True
8. False
9. True
10. False

Mine Emergency Preparedness
Tool Box Talk Series
Developed by
The Miner Training Program
The Pennsylvania State University

Developed under The 2008 MSHA Brookwood-Sago Mine Safety Grant

Tool Box Talk #15	
Title	**Zones & Communication**
Purpose/Benefit	To instruct miners regarding the use of zones for communication and miner tracking
Learning Objective	The miner will define zones for communication, and what their responsibilities are when moving from zone to zone

Important Safety Points

- Zones refer to predetermined areas of the mine and are used to determine the relative location of miners underground.
- Mines are divided into zones to enhance miner tracking (i.e., determining the location of miners at any given time)
- Miner Act pre June 15th, 2009:
  - Above ground personnel must be able to determine the current or immediately pre-accident location of all underground personnel.
  - The mine is divided into zones (e.g., 1, 2, 3, 4, etc.), and mines use a check-in/check-out system to communicate to surface personnel their movement from zone to zone
  - Any system so utilized shall be functional, reliable, and calculated to remain serviceable in a post-accident setting.
- Post accident communication between underground and surface personnel via a wireless two-way medium is mandated by the MINER Act—effective June 15, 2009
- An electronic tracking system must be provided that permits surface personnel to determine the location of any persons trapped underground.
- Mine operators can use an alternative approach or system to provide two-way communication or electronic tracking, if the approach or system satisfies the requirements of applicable statutes and regulations.

What You Must Know and Do

- How your emergency communication and tracking system works
- Communicate your movement from zone to zone with surface personnel
- Check daily the name of the responsible person on your shift

Discussion

- This mine has _____zones. What are the zones?
- Section _____ is in zone _____.
- Other site-specific issues regarding zones and miner tracking:
  - Leaky Feeder
  - Personal Emergency Device (on-way texting)
  - Hand-held two-way radios
  - Mine pager phones, etc.

Developed under The 2008 MSHA Brookwood-Sago Mine Safety Grant

Zones & Communication

Instructor Reference Material

ZONES & COMMUNICATION

MINER ACT of 2006

Not later than 3 years after the date of enactment of the Mine Improvement and New Emergency Response Act of 2006, a plan shall, to be approved, provide for post accident communication between underground and surface personnel via a wireless two-way medium, and provide for an electronic tracking system permitting surface personnel to determine the location of any persons trapped underground or set forth within the plan the reasons such provisions cannot be adopted. Where such plan sets forth the reasons such provisions cannot be adopted, the plan shall also set forth the operator's alternative means of compliance. Such alternative shall approximate, as closely as possible, the degree of functional utility and safety protection provided by the wireless two-way medium and tracking system referred to in this subpart.

PROGRAM POLICY LETTER NO. P09-V-01
Guidance for Compliance with Post-Accident Two-Way Communications and Electronic Tracking Requirements of the Mine Improvement and New Emergency Response Act (MINER Act)

Mine Emergency Preparedness
Tool Box Talk Series

Developed under The 2008 MSHA Brookwood-Sago Mine Safety Grant

Zones & Communication

Safety Quiz

TRUE OR FALSE?

1. ____After June 15, 2009, the method of tracking miners by reporting zone locations is obsolete.

2. ____Miners should report their location to the surface every few hours.

3. ____ You should find out the name of the responsible person before you enter the mine.

4. ____If the system of zone location is working well, the mine is exempt from implementing a two-way wireless communication system.

5. ____Zones are areas of the mine where communication systems exist.

6. ____ Mine operators can use an alternative approach or system to provide two-way communication or electronic tracking, if the approach or system satisfies the requirements of applicable statutes and regulations.

7. ____Tracking systems must be examined every three months for functionality.

FILL IN THE BLANK

8. Miners are required to communicate their _____from zone to zone with surface personnel.

9. Mines are divided into zones to enhance miner _____.

10. An electronic tracking system must be provided that permits surface personnel to determine the_____ of any persons trapped underground.

Mine Emergency Preparedness
Tool Box Talk Series

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Zones & Communication

Answer Key

1. False
2. False
3. True
4. False
5. False
6. True
7. False
8. Movement
9. Tracking
10. Location

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The Pennsylvania State University

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Tool Box Talk #16	
Title	**Responsible Person**
Purpose/Benefit	To acquaint miners with the duties and responsibilities of the "Responsible Person."
Learning Objective	The miner will describe his [or her] understanding of the role of the responsible person in the event of an emergency.

Important Safety Points
o Management has to define the kinds of emergencies that the mine may encounter.
o A person must be designated by the mine operator as a responsible person to take charge during emergencies for each shift that miners work underground.
o The responsible person will cease all other duties during an emergency to concentrate on managing the emergency.
o The responsible person must undergo specific training on a number of subjects every year.
o The responsible person has specific things to do in the event of an emergency.
o The mine emergency plan is the most important document that explains actions to be taken by everyone in the event of an emergency, including the miner.
o Familiarity through practice is the best way to make it a habit to perform safely in the event of an emergency.

What You Must Know and Do
o Be aware of all the emergencies that occur in a mine, their effects on mine health and safety systems [e.g. ventilation], and be familiar with the practices to control them.
o Be familiar with the mine emergency response plan and systems, the responsible person on the shift
o Be familiar with the role of the miner in an emergency and his duties and responsibilities to the responsible person
o The importance of communication to other miners and the responsible person in the event a miner discovers the hazard or emergency
Discussion
o The emergencies that can occur in your mine are:
o The responsible persons in your mine in order are: 1. _____ 2. _____ 3. _____
o What are your responsibilities to the responsible person? 1. _____ 2. _____ 3. _____ 4. OTHER: _____

Instructor Reference Material

RESPONSIBLE PERSON

According to Webster's dictionary, the meanings of the word "responsible" are 1. answerable or accountable, 2. able to satisfy any reasonable claim or demand, or 3. involving important work or trust. It will be fair to interpret a responsible person as one who is answerable or accountable, is able to satisfy any reasonable demand and is involved in important work. All three characteristics are important aspects of a miner who is identified as a responsible person in the mine emergency plan. The purpose of this presentation is to provide a brief background on mine emergencies, mine emergency plan and the responsible person.

What is a mine emergency?

An emergency can be defined as "a serious situation or occurrence that happens unexpectedly and demands immediate attention." An emergency has also been defined as "a sudden crisis usually involving dangers to humans and property that requires immediate attention." For the purposes of the discussion here, a mine emergency is an unplanned event that has serious impacts on the health and safety of the miners. Examples of mine emergencies are fires, explosions, inundations of gases and water, massive collapse of roof strata, outbursts of coal, rock and gas, coal bumps, etc. Mine emergencies also include unplanned events that affect the health, safety and general welfare of the mining community and the environment such as failures of impoundments and release of toxic effluents.

What is a mine emergency plan?

According to ASSE [2001], an emergency plan is "a comprehensive document to guide managers on actions to be taken under various emergency conditions. [It] includes

- Responsibilities of individuals and departments
- Organization resources available for use
- Sources of aid outside the organization
- General methods or procedures to follow
- Authority to make decisions
- Requirements for implementing procedures within departments
- Training and practice of emergency procedures, communications and reports

Mine Emergency Preparedness
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Responsible Person

The Mine Safety and Health Administration (MSHA) requires mine management to prepare and submit an emergency response plan (ERP) and an evacuation and firefighting plan; both must be approved by MSHA. These plans are generally prepared to address emergencies that are likely to be encountered in the mine. Further, the contents of these plan must be covered in miner training programs.

A mine emergency plan is an essential guide for the effective management of an emergency at a mine. Another purpose for which it is useful is for training miners to heighten the awareness to emergencies, to raise the level of readiness to control the emergencies, and to increase the reliability of the emergency response.

There are some common elements in all mine emergency plans. One of these elements, for example, is the notification procedures. There are however several mine specific details such as escapeways, exits, underground assembly points, and designated responsible persons.

Who is a responsible person?

According to 30 CFR Part 75. 1501, a person must be designated by the owner as the responsible person to take charge during emergencies. Specifically, the regulation states that:

"each shift that miners work underground, there shall be in attendance a responsible person designated by the mine operator to take charge during mine emergencies involving a fire, explosion, or gas or water inundation."

The regulation does not require the responsible person to be in a particular place at the mine, either on the surface or underground. The mine operator must identify the responsible person to all of the miners and must let them know before the start of the shift if the designated responsible person changes.

Even though the operator is required to designate one person as a responsible person, the rule specifically states that nothing in the regulation should be read to prevent anyone else from warning miners if there is an imminent danger that requires evacuation.

What are some of the specific things that the responsible person must know about the mine and miners?

The responsible person shall have current knowledge of the following things:

- the assigned location and expected movements of miners underground,

- the operation of the mine ventilation system,
- the locations of the mine escapeways and refuge alternatives,
- the mine communications system,
- any mine monitoring system if used,
- locations of firefighting equipment,
- the mine's Emergency Response Plan,
- the Mine Rescue Notification Plan, and
- the Mine Emergency Evacuation and Firefighting Program of Instruction.

What are some of the specific training requirements that a responsible person must undergo?

The responsible person shall be trained ***annually*** in a course of instruction in mine emergency response, as prescribed by MSHA's Office of Educational Policy and Development.

The course will include topics such as the following:

- Organizing a command center
- Coordinating firefighting personnel
- Deploying firefighting equipment
- Coordinating mine rescue personnel
- Establishing fresh air base
- Deploying mine rescue teams
- Providing for mine gas sampling and analysis
- Establishing security
- Initiating an emergency mine evacuation
- Contacting emergency personnel and
- Communicating appropriate information related to the emergency.

The operator shall certify by signature and date after each responsible person has completed the training and keep the certification at the mine for 1 year.

Details of the MSHA training program are available in the following publication:

> *Responding to a Mine Emergency*: Training Responsible Persons at Underground Coal Mines, U.S. Department of Labor, Mine Safety and Health Administration. Instruction Guide Series, IG 110, 2008

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Responsible Person

What are some of the things that a responsible person should do in the event of an emergency?

The responsible person must initiate and carry out an immediate mine evacuation if there is an emergency which presents an imminent danger to miners from fire, explosion or gas or water inundation.

If there is an emergency, only properly trained and equipped personnel are allowed to remain underground.

In the case of a false alarm or if for some reason the emergency comes under control quickly, the responsible person is also authorized to interrupt the evacuation.

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Tool Box Talk Series

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Responsible Person

Safety Quiz

RESPONSIBLE PERSON

TRUE OR FALSE?

1. ___ The responsible person for a mine shift must be underground.

2. ___ The responsible person is the only person who can inform all miners of emergencies.

3. ___ As a miner, you must know who the responsible person of your shift is.

4. ___ The course of instruction for the training of the responsible person has been prescribed by MSHA.

5. ___ All miners not needed to aid the responsible person in an emergency to address the problems should evacuate the mine.

FILL IN THE BLANK

6. Number of times in a year the responsible person should be trained in the duties and responsibilities of the responsible person : _____

7. Name three topics on which a responsible person must be trained.
   1. _____ 2. _____ 3. _____

8. Name three specific things about which the responsible person must know about the mine:
   1. _____ 2. _____ 3. _____

9. How can a responsible person know where all the miners for whom he or she is responsible are during a shift?
   _____

10. What are the two qualifications of a miner who should be asked to stay behind to assist in the event of an emergency?

    1. _____
    2. _____

Mine Emergency Preparedness
Tool Box Talk Series

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Responsible Person

Answer Key

1. False
2. False
3. True
4. True
5. True
6. One (annually)
7. Organizing a command center, and:
   - Coordinating firefighting personnel
   - Deploying firefighting equipment
   - Coordinating mine rescue personnel
   - Establishing fresh air base
   - Deploying mine rescue teams
   - Providing for mine gas sampling and analysis
   - Establishing security
   - Initiating an emergency mine evacuation
   - Contacting emergency personnel and

8. The assigned location and expected movements of miners underground, and:
   - the operation of the mine ventilation system,
   - the locations of the mine escapeways and refuge alternatives,
   - the mine communications system,
   - any mine monitoring system if used,
   - locations of firefighting equipment,
   - the mine's Emergency Response Plan,
   - the Mine Rescue Notification Plan, and
   - the Mine Emergency Evacuation and Firefighting Program of Instruction.
9. Through tracking and communication systems
10. Properly trained and properly equipped

Mine Emergency Preparedness
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Tool Box Talk #17	
Title	**Tethers: Why and How**
Purpose/Benefit	To refresh the miner in the concept of teamwork to get out of the mine safely.
Learning Objective	The miner will describe/demonstrate the purpose and function of tethers.

Important Safety Points
o Using tethers requires team work.
o Miners are used to working as a team. This type of team work is no different.
o Chances are greatly improved when working together as a group when obstacles are encountered.
o New or inexperienced miners should be placed in the middle of the tag line.
o Using the combined knowledge of the group increases your chances of making the right decisions.
o It is important that each member of the group take upon themselves the responsibility of knowing their escapeways.

What You Must Know and Do
o Practice moving through the mine on a tether.
o You may have to adjust your "walking speed" while tethered together: o Older miners or "out of shape" miners may need to travel at a slower speed.
o Pick positions on the tag line for each crew member. Talk over how you will deal with various obstacles that you could encounter and how they will be dealt with as a group.
o Will the miner in the lead hand out the SCSR's for a switch at the SCSR storage?
o Will you be switching at every storage station?
o How will you communicate with your SCSR's on?
o Practice!

Discussion
o Who will lead?
o Who will be taking gas checks?
o How will you communicate while wearing the SCSR's?
o How will you find the SCSR storage when visibility is poor?

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Instructor Reference Material

TETHERS: WHY AND HOW

Miners working underground when a mine accident occurs must be able to rapidly find lifesaving devices and use those devices to help them prevent injury, evacuate the mine quickly, and save their lives.

There are no specific requirements for the tethers other than a performance requirement that they be durable and permit the members of a mine crew to link together during a mine evacuation.

Different mine heights and other conditions may dictate spacing of clips and other parameters.

Some mines have expressed an interest in individual tethers that will be worn by each miner and clipped together for evacuation. These are acceptable in lieu of having all such tethers stored.

At least one individual tether must be stored with the SCSRs. Additional caution is needed to keep these worn tethers from becoming entangled in moving equipment and belts.

At least one tether, which is a durable rope or equivalent material designed to permit members of a mine crew to link together while evacuating the mine during an emergency, shall be provided and stored with the additional SCSRs on the fixed work location and on the mobile equipment.

Mine Emergency Preparedness
Tool Box Talk Series

Tethers: Why and How

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Safety Quiz

TRUE OR FALSE?

1. ____ New or experienced miners should always be placed at the beginning of the tether line.
2. ____ Using tethers requires team work and practice.
3. ____ When tethered, older miners may need to travel at a slower pace
4. ____ Your mine crew should tether together at the first SCSR cache.
5. ____ Tethers are required to be provided on the work section, at additional SCSR's and on mobile equipment.
6. ____ You can walk as fast as you want while tethered, regardless of how fast the person in front and behind you walks.
7. ____ You must have a system in effect to communicate with each other while tethered together.
8. ____ A mandoor is a great place to have a pileup if you don't practice with the tether.
9. ____ The person in the lead can communicate obstacles to workers behind him/her.
10. ____ You do not have to have a system in effect so that all miners clip the tethers in a standardized fashion.

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Tool Box Talk Series

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Tethers: Why and How

Answer Key

1. False (in the middle)
2. True
3. True
4. True
5. True
6. False
7. True
8. True
9. True
10. False

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Tool Box Talk #18	
Title	**Fire Extinguishers**
Purpose/Benefit	To acquaint the miner with the basic locations, use and care of portable fire extinguishers.
Learning Objective	The miner will describe where fire extinguishers are required, how to operate the extinguisher, and how to examine the fire extinguisher.

Important Safety Points
o Fire extinguishers are made to put out small fires; they are not a fire brigade.
o Fire extinguishers will only last a few seconds when held on full open (10-20 seconds).
o Extinguishers must be at least 5 lbs. in weight.
o Extinguishers are required on all transportation, at least two extinguishers in each mining section, at electric stations, at wooden doors and at all oil storage and battery charging locations.
o Extinguishers must be examined and dated at least every six months.
o The most common type of extinguisher is the A-B-C multi-purpose dry chemical extinguisher. It is effective on common combustibles, liquids and electrical fires.
o Report all fires, even fires that have been extinguished.
o The safety of miners is the highest priority in all fire situations.

What You Must Know and Do
o A clear understanding of when it isn't safe to fight a fire
o Use the extinguisher via the "P-A-S-S" method: P=Pull pin; A=Aim nozzle; S=Squeeze handle, and S=Sweep agent over the base of the fire.
o Stay back 6-10 feet from the fire before discharging the extinguisher.
o Never turn your back on a fire.
o When inspecting a fire extinguisher look at: the gauge for adequate pressure, the condition of the canister, the condition of the hose, the pin is adequately seated and secured, and that the nozzle is not obstructed.
o Remove any fire extinguisher that is not functional from service and replace it.

Discussion
o The type of extinguisher used at this mine is:
o Fire extinguishers at this mine are located:
o Demonstrate the basic steps of the "P-A-S-S" method.
o Demonstrate the basic steps of examining the fire extinguisher.
o The procedure at this mine for removing extinguishers from service is:
o The procedure at this mine for choosing to fight a fire is:

Note: Hands-on training in putting out a small fire can be conducted in lieu of giving a tool-box talk on fire extinguishers.

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Instructor Reference Material

FIRE EXTINGUISHERS

To understand how fire extinguishers work, you need to understand a little about fire. Fire is a very rapid chemical reaction between oxygen and a combustible material, which results in the release of heat, light, flames, and smoke.

For fire to exist, the following four elements must be present at the same time:

1. Enough **oxygen** to sustain combustion,
2. Enough **heat** to raise the material to its ignition temperature,
3. Some sort of **fuel** or combustible material, and
4. The chemical reaction that is fire.

How a fire extinguisher works

Portable fire extinguishers apply an extinguishing agent that will either cool burning fuel, displace or remove oxygen, or stop the chemical reaction so a fire cannot continue to burn. When the handle of an extinguisher is compressed, agent is expelled out the nozzle. A fire extinguisher works much like a can of hair spray.

All portable fire extinguishers must be approved by a nationally recognized testing laboratory to verify compliance with applicable standards. Equipment that passes the laboratory's tests are labeled and given an alpha-numeric classification based on the type and size of fire it will extinguish.

Examples of Fire Extinguisher Ratings

1-A:10-BC

The letters (A, B, and C) represent the type(s) of fire for which the extinguisher has been approved.

The number in front of the A rating indicates how much water the extinguisher is equal to and represents 1.25 gallons of water for every unit of one. For example, a 4-A rated extinguisher would be equal to five (4 x 1.25) gallons of water.

The number in front of the B rating represents the area in square feet of a class B fire that a non-expert user should be able to extinguish. Using the above example, a non-expert user should be able to put out a flammable

liquid fire that is as large as 10 square feet.

Portable fire extinguishers are classified to indicate their ability to handle specific classes and sizes of fires. Labels on extinguishers indicate the class and relative size of fire that they can be expected to handle.

Class A extinguishers are used on fires involving ordinary combustibles, such as wood, cloth, and paper.

Class B extinguishers are used on fires involving liquids, greases, and gases.

Class C extinguishers are used on fires involving energized electrical equipment.

Class D extinguishers are used on fires involving metals such as magnesium, titanium, zirconium, sodium, and potassium.

Letter-shaped symbol markings are also used to indicate extinguisher suitability according to class of fire.

Extinguishers suitable for Class A fires should be identified by a triangle containing the letter "A." If colored, the triangle should be green.

Extinguishers suitable for Class B fires should be identified by a square containing the letter "B." If colored, the square shall be colored red.

Extinguishers suitable for Class C fires should be identified by a circle containing the letter "C." If colored, the circle should be colored blue.

Extinguishers suitable for fires involving metals should be identified by a five-pointed star containing the letter "D." If colored, the star shall be colored yellow.

Extinguishers suitable for more than one class of fire should be identified by multiple symbols placed in a horizontal sequence.

Multi-purpose - Dry chemical extinguishers

Dry chemical extinguishers put out fires by coating the fuel with a thin layer of fire retardant powder, separating the fuel from the oxygen. The powder also works to interrupt the chemical reaction, which makes these extinguishers extremely effective.

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Fire Extinguishers

Dry chemical extinguishers are usually rated for class B and C fires and may be marked multiple purpose for use in A, B, and C fires. They contain an extinguishing agent and use a compressed, non-flammable gas as a propellant.

ABC fire extinguishers are red in color, and range in size from five pounds to 20 pounds.

Using the P-A-S-S Technique

Most fire extinguishers operate using the following P.A.S.S. technique:

- **PULL** Pull the pin. This will also break the tamper seal.
- **AIM** Aim low, pointing the extinguisher nozzle (or its horn or hose) at the base of the fire.
- **SQUEEZE** the handle to release the extinguishing agent.
- **SWEEP** Sweep from side to side at the base of the fire until it appears to be out.

Inspecting Fire Extinguishers

Fire extinguishers must be visually examined at least every six months.

A tag must be attached to the fire extinguisher indicating the date of inspection.

- Common items to look for when inspecting a fire extinguisher include:
- The pressure indicator is in the normal range.
- The canister does not have dents or cracks or appear to be damaged beyond normal cosmetic blemishes.
- The pin is inserted and secured.
- The hose does not have cuts, bends or deformities.
- The nozzle is not obstructed.

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Fire Extinguishers

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Safety Quiz

TRUE OR FALSE?

1. ___ Laying on the ground before you discharge a fire extinguisher is a good way to make sure you are hitting the base of the fire.

2. ___ The CO_2 fire extinguisher is the most common in underground mines.

3. ___ There must be at least one fire extinguisher in all mining sections.

4. ___ Fire extinguishers are only required at oil storage areas if there is less than 6,000 cfm of air passing through.

5. ___ Fire extinguishers must be examined and dated every seven months.

6. ___ You must report all fires, even if it was a small fire that you extinguished.

7. ___ It is best to get within 4 feet of the fire before discharging the extinguisher.

8. ___ Fire extinguishers will usually provide about 1-2 minutes of agent when held on "full-auto."

FILL IN THE BLANK

9. Describe what the "P-A-S-S" method means when using a fire extinguisher.
   P _____ A _____ S _____ S _____

10. List four things to check when inspecting a fire extinguisher.

    I. _____

    II. _____

    III. _____

    IV. _____

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Fire Extinguishers

Answer Key

1. False
2. False
3. False (two)
4. False
5. False
6. True
7. False
8. False
9. PULL-AIM-SQUEEZE-SWEEP
10. Adequate pressure on gauge, and:
    - Pin in place and secured
    - No deformities to hose
    - No deformities to canister
    - Nozzle not blocked

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Tool Box Talk #19	
Title	**Fire Detection Systems**
Purpose/Benefit	To acquaint miners with fire detection systems (e.g., AMS, CO monitors), its sensor requirements, and the response required if a sensor detects CO
Learning Objective	The miner will describe the fire detection system, sensor requirements, the response required when CO is detected

Important Safety Points
o Where conveyor belts are used, they are to be monitored for fire.
o When the CO reaches 10 ppm above the established ambient level at any sensor location, the AMS must provide an effective warning signal.
o The manned surface location must have a telephone or equivalent communication with all miners who may be endangered and an updated map showing sensor location, etc.
o The AMS must be monitored for 4 hours after the belt is stopped, unless an examination for hot rollers and fire is made.
o The fire detection system must include a means for rapid evaluation of electrical or other defects to its proper operational condition.
o When a malfunction/warning signal is received at the manned surface location, the activated sensors must be identified and appropriate personnel notified immediately.
o Upon notification, personnel must immediately initiate an investigation to find the cause of the malfunction/warning signal and take action if miners are endangered.
o If the warning signal will be activated during calibration of sensors, all affected personnel should be notified in advance and following the calibration.
o If any AMS component becomes inoperative, take immediate action to repair it; operation of the belt may continue if manual monitoring is maintained at the affected area.
o Persons who conduct monitoring must have 2-way voice communication capability, and must report CO concentrations to the surface at intervals not to exceed one hour.
o Persons must immediately report to the surface any concentration of CO that reaches 10 parts per million unless it is known that the source of CO does not pose a threat.
o Handheld detectors used must have capability equal to the AMS monitors.

What You Must Know and Do
o Fires can occur in conveyor belt entries, so a fire detection system is for your safety.
o When CO is sensed at 10 parts per million above the established ambient level, a warning will be given to working sections/locations & to the manned surface location
o If a malfunction/warning occurs, the activated sensor(s) must be reported
o Notification must be given to all affected personnel before and after sensor calibration

Discussion
o The Fire Detection System in this mine is…types of sensors….malfunctions, # of warnings, unusual circumstances (e.g., AMS sensors at bleeder “taps”).

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Fire Detection Systems

Instructor Reference Material

FIRE DETECTION SYSTEMS

Where conveyor belts are used, an automatic fire detection system must be used to monitor carbon monoxide gas. When the carbon monoxide level reaches 10 parts per million above the established ambient level at any sensor location, the automatic fire detection system must provide an effective warning signal at 1) working sections, 2) other work locations where miners may be endangered, and 3) at a manned surface location where personnel have an assigned duty post.

If a malfunction or warning occurs, the activated sensor(s) must be identified and appropriate personnel notified immediately. The fire detection system must be monitored for 4 hours after the belt is stopped, unless an examination for hot rollers and fire is made. The fire detection system must be monitored for 4 hours after the belt is stopped, unless an examination for hot rollers and fire is made. The fire detection system must include a means for rapid evaluation of electrical or other defects to its proper operational condition. The fire detection system must have a manual reset feature.

When a malfunction or warning signal is received at the manned surface location, the sensors that are activated must be identified and appropriate personnel notified immediately. Upon notification, the appropriate personnel must immediately initiate an investigation to determine the cause of the malfunction or warning signal and take required actions as follows for a warning, unless the mine operator determines that the signal does not present a hazard to miners: 1) notify miners in affected working sections and at other locations specified in the approved mine emergency evacuation and firefighting program of instruction, 2) immediately withdraw all miners in the affected areas to a safe location identified in the mine emergency evacuation and firefighting program of instruction, unless assigned emergency response duties.

If the warning signal will be activated during calibration of sensors, all affected personnel should be notified in advance and following the calibration. If any fire detection component becomes inoperative, immediate action must be taken to repair it, and while repairs are being made, operation of the belt may continue if the following requirements are met: 1) If one sensor becomes inoperative, a trained person must continuously monitor for carbon monoxide at the inoperative sensor, 2) If two or more adjacent sensors become inoperative, trained persons must patrol and continuously monitor the affected areas for carbon monoxide so that they will be traveled each hour in their entirety; or a trained person must be stationed at each inoperative sensor to monitor for carbon monoxide.

Trained persons who conduct monitoring must have two-way voice communication capability, at intervals not to exceed 2,000 feet, and must report carbon monoxide concentrations to the surface at intervals not to exceed one hour. Trained persons must immediately report to the surface any concentration of carbon monoxide that reaches 10 parts per million above the established ambient level, unless the mine operator knows that the source of the carbon monoxide does not present a hazard to miners. Handheld detectors used to monitor the belt entry for these purposes must have a detection level equivalent to that of the system's carbon monoxide sensors.

Additional Resources:

Questions and answers: MSHA's final rule on conveyor belt, fire prevention and detection, and use of air from the belt entry (www.msha.gov/REGS/COMPLIAN/Guides/BeltAir.pdf)

PROGRAM INFORMATION BULLETIN NO. P09-04 (March 3, 2009). AMS Operator Training Guide and Part 48 Task Training Addendum (http://www.msha.gov/regs/complian/PIB/2009/pib09-04.asp)

Program Policy Manual

VOLUME V - COAL MINES

http://www.msha.gov/REGS/COMPLIAN/PPM/PMVOL5J.HTM

75.1103-2 Automatic Fire Sensors; Approved Components; Installation Requirements

75.1103-3 Automatic Fire Sensor and Warning Device Systems; Minimum Requirements; General

75.1103-4 Automatic Fire Sensor and Warning Device Systems; Installation; Minimum Requirements

75.1103-5 Automatic Fire Warning Devices; Manual Resetting

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Tool Box Talk Series

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Fire Detection Systems

Safety Quiz

FIRE DETECTION SYSTEMS

TRUE OR FALSE?

1. ___ Heat sensors are preferred for use along belt lines to monitor for a fire.

2. ___ At the manned surface location, an updated map or schematic must show the locations of sensors and the intended air flow direction at those locations.

3. ___ When carbon monoxide is sensed at 5 parts per million above the established ambient level, a warning must be given.

4. ___ A fire detection system must be monitored for 4 hours after the belt is stopped.

5. ___ When a sensor becomes inoperative, any miner can continuously monitor for carbon monoxide at the inoperative sensor location.

6. ___ A carbon monoxide sensor malfunction requires that miners be withdrawn from affected areas.

FILL IN THE BLANK

7. If a malfunction or warning occurs, the activated sensor(s) must be _____ and appropriate personnel _____ immediately.

8. After notification of a warning, required actions include notification of _____ and _____ of them to a safe location.

9. If the warning signal will be activated during calibration of sensors, all affected personnel should be notified _____ and _____ the calibration.

10. Describe why carbon monoxide is a dangerous gas.

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Fire Detection Systems

Answer Key

1. False
2. True
3. False
4. True
5. False
6. False
7. investigated and notified
8. notification of miners in the affected area and withdraw of miners to a safe location
9. before and after
10. CO is very lethal. A small concentration in the breathable atmosphere can result in serious health effects. This gas is colorless, odorless and tasteless, yet highly toxic.

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The Pennsylvania State University

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Tool Box Talk Number #20	
Title	**Procedures When the Alarm Sounds**
Purpose/Benefit	To acquaint miners with the procedures that would be followed when the alarm for an emergency situation sounds.
Learning Objective	The miner will describe the sequence of procedures for responding to an alarm signaling an emergency situation and evacuation.

Important Safety Points
o When the alarm signaling an emergency sounds, timely communication is imperative
o Contact with the responsible person (RP) in charge during a mine emergency is critical
o Preparing the section for possible evacuation can save lives
o On orders to evacuate, account for all crew members and meet at the designated staging location
o Once all crew members are present and accounted for, don SCSRs, if not already done, and tether together before beginning the evacuation
o Gather additional SCSRs & the escapeway map, if safe to do so, and proceed to the escapeway designated by the RP or choose best escapeway based on conditions
o Evacuate… following the continuous lifeline in the escapeway

What You Must Know and Do
o When the emergency alarm sounds, communicate immediately with the responsible person and follow directions (e.g., gathering information about the emergency)
o Know how to prepare the section for possible evacuation
o Know the critical steps in performing a successful evacuation once told to do so, i.e. account for all crew members, don SCSRs, and tether together
o Know the location of the primary and secondary escapeways and how to find the lifeline and determine the proper direction of travel
o After determining whether it is safe to do so, gather extra SCSRs and the escapeway map and proceed to the designated or selected escapeway
o Travel the escapeway to evacuate with confidence…be positive

Discussion
o Communication systems available on the section are located…
o When an alarm sounds for an emergency, the person to contact immediately is:
o If possible, the following things would be done to prepare the section for evacuation:
o Once the evacuation order is given, the following immediate steps would be taken:
o If safe to do so, what other items would be gathered for the evacuation?
o The following additional protections exist in the escapeways:

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Instructor Reference Material

PROCEDURES WHEN THE ALARM SOUNDS

Each underground coal mine uses a Mine Emergency Evacuation and Firefighting Program of Instruction plan (here after referred to as an Evacuation Plan) and an Emergency Response Plan (ERP) to provide miners with information on resources available, procedures, and materials crucial to achieving and maintaining a high level of mine emergency preparedness. When an alarm is activated, and after someone hears or sees the alarm, it is crucial that they follow up with appropriate action without delay.

The Mine Emergency Evacuation and Firefighting Program of Instruction plan provides specific information regarding the role and duties of miners when an alarm is detected, or when a mine fire, explosion and/or gas or water inundation occurs. While miners will warn others of an emergency, only the responsible person, or next person in charge will initiate and conduct mine evacuations once the emergency has been verified and it has been determined that the situation presents a danger to miners.

Communication is a key component of any emergency related plans, and is also a crucial element of implementing those plans.

Your Evacuation and Emergency Response Plan provides important information regarding telephones, and miner tracking systems used in the mine. When you hear or see an alarm, or become aware of an emergency situation, immediately notify the responsible person, and follow his/her instructions.

Because so many controls, procedures, and best practices are part of modern mining, serious mine emergencies (large fires, explosions, and inundations) are relatively rare events. But, when they do occur, each miner must be prepared to act and do their part to successfully evacuate, escape, or take refuge until rescued.

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30 CFR § 75.1502

Mine emergency evacuation and firefighting program of instruction.

Each operator of an underground coal mine shall adopt and follow a mine emergency evacuation and firefighting program that instructs all miners in the proper procedures they must follow if a mine emergency occurs.

(a) Program approval. The operator shall submit this program of instruction, and any revisions, for approval to the District Manager of the Coal Mine Safety and Health district in which the mine is located. Within 30 days of approval, the operator shall conduct training in accordance with the revised program.

(b) New or revised provisions. Before implementing any new or revised approved provision in the program of instruction, the operator shall instruct miners in the change.

(c) Instruction plan. The approved program shall include a specific plan designed to instruct miners on all shifts on the following:

(1) Procedures for--

(i) Evacuating the mine for mine emergencies that present an imminent danger to miners due to fire, explosion, or gas or water inundation;

(ii) Evacuating all miners not required for a mine emergency response; and

(iii) The rapid assembly and transportation of necessary miners, fire suppression equipment, and rescue apparatus to the scene of the mine emergency.

(2) The use, care, and maintenance of self-rescue devices, including hands-on training in the complete donning and transferring of all types of self-rescue devices used at the mine.

(3) The deployment, use, and maintenance of refuge alternatives.

(4) Scenarios requiring a discussion of options and a decision as to the best option for evacuation under each of the various mine emergencies (fires, explosions, or gas or water inundations). These options shall include:

(i) Encountering conditions in the mine or circumstances that require immediate donning of self-rescue devices.

(ii) Using continuous directional lifelines or equivalent devices, tethers, and doors;

(iii) Traversing undercasts or overcasts;

(iv) Switching escapeways, as applicable;

(v) Negotiating any other unique escapeway conditions; and

(vi) Using refuge alternatives.

(5) Location and use of the fire suppression and firefighting equipment and materials available in the mine.

(6) Location of the escapeways, exits, routes of travel to the surface, including the location of continuous directional lifelines or equivalent devices.

(7) Location, quantity, types, and use of stored SCSRs, as applicable.

(8) A review of the mine map; the escapeway system; the escape, firefighting, and emergency evacuation plan in effect at the mine; and the locations of refuge alternatives and abandoned areas.

(9) A description of how miners will receive annual expectations training that includes practical experience in donning and transferring SCSRs in smoke, simulated smoke, or an equivalent environment and breathing through a realistic SCSR training unit or device that provides the sensation of SCSR airflow resistance and heat.

(10) A summary of the procedures related to deploying refuge alternatives.

(11) A summary of the construction methods for 15 psi stoppings constructed prior to an event.

(12) A summary of the procedures related to refuge alternative use.

(d) *Instructors*. (1) The mine operator shall designate a person who has the ability, training, knowledge, or experience to conduct the mine emergency evacuation instruction and drills in his or her area of expertise.

(2) Persons conducting SCSR donning and transferring training shall be able to effectively train and evaluate whether miners can successfully don the SCSR and transfer to additional SCSR devices.

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Additional Resources:

Kravitz, J. H. & Peluso R. G. (1986). Crisis management training: preparing managers for mine emergency operations. In Howard F. Disbury, Jr. (Ed), *Challenges and Opportunities: From Now to 2001*. Bethesda, Maryland: The World Future Society, 1986.

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Safety Quiz

TRUE OR FALSE?

1. ____ Good and timely communication is imperative when the alarm sounds signaling an emergency.

2. ____ The shift foreman is in charge of decision making during an emergency.

3. ____ If time is available, section preparation would include shoveling loose coal in the working places.

4. ____ Additional SCSRs and the escapeway map should be gathered for evacuation, if safe to do so.

5. ____ No evacuation may ever begin until the responsible person gives the order.

6. ____ A lifeline does not have to be used if the crew members are tethered together.

FILL IN THE BLANK

7. The first two key things to accomplish immediately when ordered to evacuate include _____ and _____.

8. The next two key things to do after this include _____ and _____.

9. If safe, two additional things to gather as the evacuation is begun include _____ and _____.

10. After an alarm sounds signaling an emergency, describe the role of the responsible person.

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ANSWER KEY

1. True
2. False
3. False
4. True
5. False
6. False
7. accounting for crew member and meet at designated meeting place
8. don SCSRs and tether together
9. gather additional SCSRs and escape map
10. The responsible person directs and coordinates the evacuation

PART III

MINE EMERGENCY SCNARIOS

The purpose of the Mine Emergency Scenarios is to promote discussion on how a crew of miners could/should respond to a serious mine emergency. The scenarios have been designed and developed for miners to enhance the knowledge needed to follow adequate reporting procedures, assess a mine emergency, make good decisions, and conduct an appropriate evacuation/escape.

Primary and Secondary Target Audience

Miners who work on a production crew, responsible persons, and all miners working underground.

Objectives

At the conclusion of the scenarios, the miners will be able to:

1. Describe how a battery fire on mining machinery in intake air can affect other miners in two different working areas.

2. Discuss/describe how they (miners) would react in a similar situation using the site-specific emergency procedures at their particular mine.

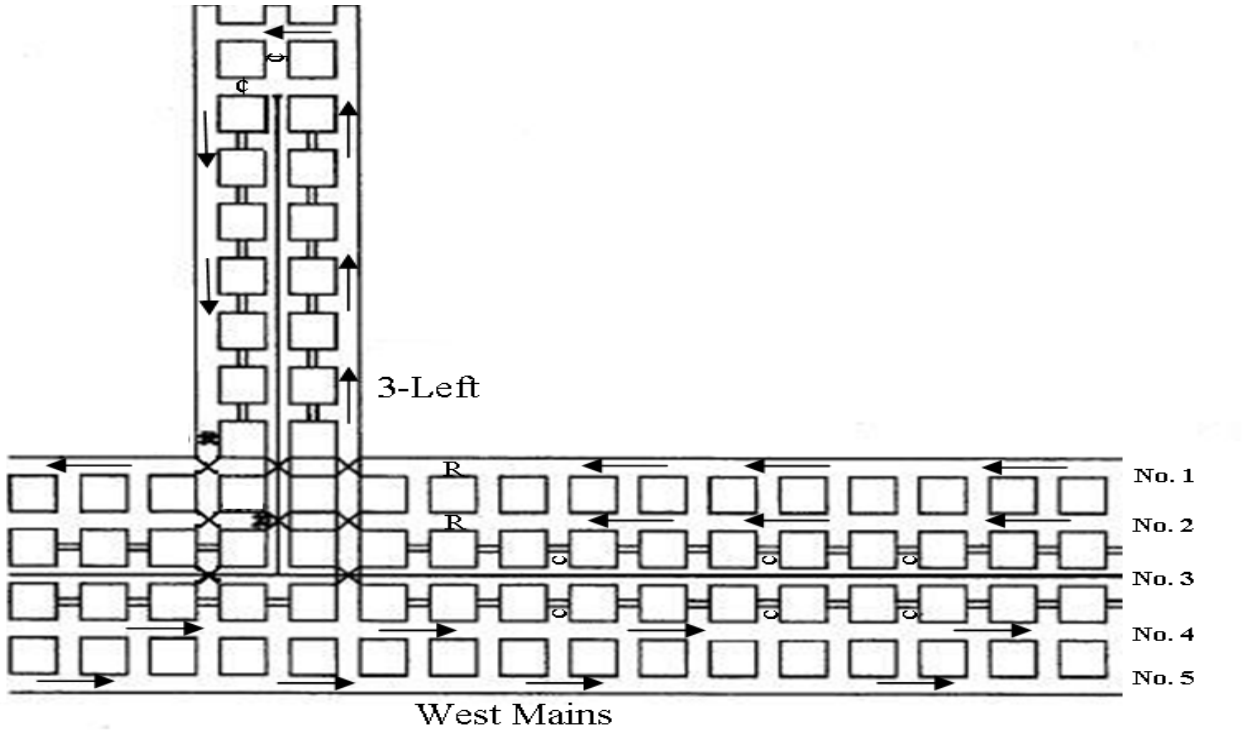
3. Evaluate a simple mine map and determine where primary and secondary escape routes are located.

Suggestions for Using These Scenarios

Scenarios are an excellent training tool to stimulate mine emergency discussions and introduce mine specific procedures. The scenarios offer an excellent opportunity for discussion during a training program. Miners have the opportunity to evaluate a given problem in the scenario and then describe appropriate actions. The scenarios contain "Questions for General Discussion" and "Questions for Site-Specific Discussion." The scenarios are meant to be a supplement to a larger mine emergency curriculum. The scenarios are especially suited to group discussion and interaction. They are best used by an instructor who is familiar with mine emergencies as well as mine-specific emergency plans and procedures. The scenarios can be modified, expanded or condensed at the instructor's discretion.

Scenario 1

You are part of a 7-person mining crew actively mining a 3-entry section in 3-Left to develop a longwall panel (see map). There is also a mining crew working inby on the West Mains.



Joe Smith was assigned to take roof support posts to be installed where roof had deteriorated in the West Mains intake air course. A battery scoop tractor was used to transport the posts from 3-Left into West Mains number 4 entry. The roof had deteriorated seven crosscuts inby the junction of 3-Left in number 4 entry of West Mains.

Joe traveled from 3-Left section to the West Mains and traveled inby five crosscuts in number 4 entry when he determined that the batteries had somehow shorted out on his scoop and a fire had started. Joe hit the emergency stop button and activated the fire suppression system. For some reason, the fire suppression system did not activate. Joe tried using a fire extinguisher on the batteries, but was not able to extinguish the fire. Joe then proceeded outby 2 crosscuts to a man door. Joe went through the man door to the mine phone on the belt line. Joe called the outside and the West Mains section simultaneously as he knew that the fire was on intake air and that smoke would soon reach the West Mains working crew.

West Mains took the call and Joe advised them of the situation. The outside then called 3-Left and advised them of the situation. The 3-Left foreman took the call and advised the outside that he was gathering his crew to evacuate their section.

Questions for General Discussion

1. What would be the probable route for the smoke to reach the miners in West Mains?
2. What would be the most probable escapeway for workers in West Mains?
3. What would be the secondary escapeway for the workers in West Mains?
4. What would be the probable route for the smoke to reach the miners in 3-Left?
5. What would be the primary escapeway for workers in 3-Left?
6. What would be the secondary escapeway for the workers in 3-Left?
7. Where would the miners from 3-Left be attempting to reach in order to leave the mine?
8. Who would most probably be in charge of the evacuation?
9. What kind of information should be given to the outside and received from the outside in the section?

Questions for Site-Specific Discussion

Given a similar situation in your mine, and under similar circumstances, how would you react? How do your emergency plans address the following discussion points?

1. If the person on the section who takes the call is not the foreman, who should that notify immediately.
2. What are several things that the foreman would be thinking about after receiving the message?
3. Who would your foreman send to deenergize the power in your section?
4. Where is the emergency meeting point in your section?
5. Where are your SCSR’s stored on your section?
6. Where do the lifelines begin on your section?
7. Where are the tethers located on your section?
8. Where are the SCSR caches on your section?
9. What entry is the primary escape way in your section?

10. What entry is the secondary escapeway in your section?

11. What types of directions would the foreman give after everyone is assembled?

12. Describe how to don your self-contained self rescuer?

13. Describe several situations that would require immediate donning of your SCSR.

14. Who would miners on the section notify to advise that they are evacuating the mine? At your mine, who would make this call?

15. Who would lead your crew as you evacuate your mine?

16. Who would be the tail man on your section as you evacuate your mine?

Scenario 2

Based on the situation in Scenario 1, the miners from 3-Left have begun to evacuate the section. They have not yet encountered smoke. As they enter the West Mains, they begin to encounter dense smoke. Visibility suddenly becomes limited.

Questions for General Discussion

1. From the map (above), what would be the most probable primary escapeway once they reach the West Mains?
2. What are several things that the lead person would possibly be thinking about as the crew encounters smoke?
3. How would the miners communicate with each other while under breathing apparatus (SCSR's)?
4. What are several potential obstacles for the miners as they enter the West mains?
5. What will the presence of smoke do to the evacuation speed of the crew?

Questions for Site-Specific Discussion

Given a similar situation in your mine, and under similar circumstances, how would you react? How do your emergency plans address the following questions?

1. How are the primary and secondary escapeways noted on your mine map?
2. Describe where and how signs are used in your mine to assist in evacuation or escape.
3. How do you communicate while wearing a SCSR?
4. Describe why you should never, ever remove your SCSR until you are in 'known fresh air'?
5. Where are the SCSR caches located in your section and along the escapeways in your mine?
6. How are SCSR caches noted on your mine map?
7. Describe how you make a switch of SCSR's with the type of SCSR's that you use in your mine?
8. With the lifeline system used in your mine:
    a. In which direction does the cone point?
    b. What does a ball on the lifeline indicate?

c. What does two cones butted together indicate?

d. Describe any other signal systems used on lifelines in your mine?

9. Describe what actions would be taken before and after entering a man-door during an evacuation/escape in your mine.

10. Describe why you should leave all ventilation devices just the way you found them during an evacuation/escape at your mine.

THE END

APPENDIX A

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