

Do You Understand Mine Emergencies?



Are You Prepared for a Mine Emergency?

Instructor's Guide

MODULE 6: BREATHABLE AIR SAFE HAVENS/REFUGE CHAMBERS

PENN STATE MINER TRAINING PROGRAM
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MINER TRAINING PROGRAM

DO YOU UNDERSTAND MINE EMERGENCIES?

ARE YOU PREPARED FOR A MINE EMERGENCY?

MODULE 6: BREATHABLE AIR SAFE HAVENS/REFUGE CHAMBERS

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Please note that any mention or use of pictures of commercial products associated with mine emergencies does not constitute an endorsement by Penn State, MSHA, or the authors.

Preface

The history of underground coal in the United States is notable for its successes and failures. In the distant past, coal fueled and played a prominent role in our industrial revolution, rail transportation, iron and steel making, and heating needs. Most recently, it has been the source for affordable electricity, and for a myriad of other fuels and products. Extracting and processing coal is challenging, and the miners who work in the industry work in one of the Nation's most hazardous occupations.

Mine emergencies, such as mine explosions, fires, and inundations have been all too common. 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. Mining stakeholders, such as the industry, government, organized labor, the academic community, those who supply products and equipment, and the miners themselves have worked diligently by applying technology, engineering, best work practices, standards, and training to make the mines a less hazardous occupation.

The tragedies of recent mine emergencies, such as 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 vigilance is our vision, and continuous safety improvement is our goal—a challenge to every new generation. The Mine Improvement and New Emergency Response Act of 2006 (MINER ACT) is the latest example of a multi-faceted, and focused attack on underground coal mining hazards. Essentially, it seeks to enhance mine emergency preparedness and response through improving emergency planning, mine rescue capabilities, mine emergency equipment, technology, and training, specifically through the competitive Brookwood-Sago grant program.

The training program, titled, *Do you understand mine emergencies? Are you prepared for a mine emergency?* is the result of a 2007/2008 Brookwood-Sago Mine Safety Grant. This grant, one of several awarded in 2007 by the Mine Safety and Health Administration, was awarded to the Penn State Miner Training program on September 30, 2007.

The program was the result of a cooperative effort between many mining stakeholders (See Acknowledgements), and consists of an achieved webcast, titled, *Escape and survive*, and the training program referred to above. This program includes Instructor's and Participant's Guides. We believe that frequent, quality training is the key to better identify, avoid, and prevent hazards in an around the mines, and that through the use of this program, miner survivability—as they response to an emergency—will be enhanced.

These materials are available for a limited time at www.minerstownhall.org, or through the MSHA Academy at www.msha.gov.

We encourage your use and evaluation of this program. We look forward to your comments and suggestions. Please don't hesitate to contact us at 814.865.7472, or by contacting any of the authors (See Appendix C).

INTRODUCTION

Purpose

The training program, titled, *Do you understand mine emergencies? Are you prepared for a mine emergency?* was prepared for miners. The purpose of the training program is to enhance a miner's capability to survive a mine emergency, primarily through mine emergency preparedness (MEP). Survivability will depend on many factors, such as size of the mine, location of miners, the scope of the incident, amount of energy released, availability/use of emergency technology, emergency plans, training on MEP, and decision-making. The physical factors of the incident may often be beyond the control of those who manage and mine the coal. What we can control is our knowledge of and skills in emergency preparedness and response. By enhancing a miner's knowledge of emergency principles, standards, laws, procedures, policies, and best practices, combined with excellent performance and practice on emergency skills, and decision-making capabilities, more miners will be able to survive mine emergencies.

Format/content

This innovative training program uses webcast technology (Internet and CD ROM based), combined with PowerPoint presentations, Instructor's and Participant's Guides. The webcast is a multi-media resource that can be accessed through the Internet at www.minerstownhall.org or played from a CD. During the webcast panel commentaries, PowerPoint slides are used to summarize and supplement most of the main points made by the panelist. In addition, a series of high definition (HD) video clips are embedded within the webcast and "rolled in" at the appropriate times. This realistic clips, shot on location at a working mine, represent a simulated mine emergency and response, and feature donning/switching of the SCSR, and the use of directional lifelines.

This training program consists of six training modules that address the following major mine emergency preparedness issues:

- Mine emergencies
- Emergency response plans
- CSE SR-100 Self-contained self-rescuers
- Emergency communications and miner tracking
- Escape and evacuation
- Breathable air safe havens/refuge chambers

Instructors using these modules are encouraged to tailor the material to their needs. This may mean omitting some of the information, and in some cases, adding site-specific or supplemental information (e.g., pictures, video clips, group activities, quizzes, etc.) other than the ones included in the Participant's Guide. To supplement the content on mine emergency preparedness contained in the modules, the hour-long webcast—featuring an expert panel—is used to introduce and comment on important topics, concerns, and issues, such as the key provisions of the MINER ACT, progress in mine rescue and mine emergency preparedness technology, miner tracking, miners' stress in response to emergencies, decision making, innovative training, and barricading. In the next section, more detailed information is provided on using the materials contained in the training program.

SUGGESTIONS ON USING THIS TRAINING PROGRAM

Planning, Development and Presentation

Quality training results from a combination of good training material, and competent instructors. The first responsibility of the instructor is to design and develop a lesson plan that is based on a good training needs assessment, and pre-assessment. Essentially, the purpose of the needs assessment defines the training content. The best content is practical, relevant, and selected to meet the needs (both skill- and knowledge-based) of the miner. Typically, miners are willing to open up to learning if they are convinced that the material and information being presented—in short the curriculum—will enhance their safety, and help them achieve their goals. Another way of stating this is to remind instructors to always bear in mind that today's adult learners are tuned in to only one channel—WIIFM—**“What's In It For Me.”!** Further, today's miners are well informed, highly trained, and better educated than previous generations of miners. Today's younger miners—whose ranks are increasing daily—respond best to training that is interactive, image-rich, and lean on lecture-type instructional methods.

Miners should pay attention to training on mine emergency preparedness, and take it very seriously. Part of the responsibility for achieving that rests with the miner. No one learns if they are not ready or willing to learn. The other part of the responsibility lies with the instructor and mine management. The most effective training should always be well-planned, and structured. Ample time and resources should be available to ensure quality training.

Instructors need to also be reminded that the greatest potential for learning (understanding) and retention occurs when the instructional methods provide an opportunity for active participation through doing/demonstrating the skills/knowledge they have been presented and demonstrated to them. With that in mind and what has been already been said regarding the importance of planning and preparation, here are some specific suggestions for presenting this training course:

1. Thoroughly prepare yourself by finding out about your mine's most important training needs in mine emergency preparedness.
2. Read over and study the lesson plans, and make notes to yourself about information you want to emphasize, and specific examples and materials (your ERP plan, information on your mines communication and tracking system, etc.) that you want to use and include in the discussions.
3. The information on the PowerPoint slides is to be used as "talking points." You must master the information (the details of instruction) and be prepared to ask a variety of questions to spur discussion or achieve other participant learning objectives, such as test knowledge of requirements, analyze a problem, explain how things differ, or to understand how things fit together to form the "big picture." The lesson plan consists of instructor objectives, key points to cover (column 1), details of instruction (column 2), and instructor notes (column 3). **You may choose to omit some of the details of the instruction (column 2). Some of this information falls into the category of "nice to know" information. While it is important information, it is not critical to the goal of the training program, i.e., providing the miners with the information and skills that are directly relevant to successfully escaping dangers associated with mine emergencies.** However, it was included in the modules for the benefit of the instructor who may need or want such information and the level of detail provided if he/she is training supervisors, management, responsible persons, etc.

Column 3 contains reminders to the instructors regarding ways to make the training more site-specific, suggestions for getting the students to participate by involving them in the discussions, and additional key points that are not addressed in column 1. The instructor who is adept at asking questions will be better able to get the participants

involved, and consequently have more success in meeting their training needs and goals. Questions are tools that can be used to achieve specific objectives. Generally, if you want to encourage discussions, then use open ended questions. A well prepared instructor will maximize student learning by:

- a) discussing the purpose of the lesson, and how the information and/or skills learned will help them (e.g., enhance their chance of surviving an emergency by remaining isolated from toxic atmospheres, enable them to get accurate information to those who need it...to those who can help them escape the mine, etc.);
- b) sharing the learning objections with the participants;
- c) using group activities if time permits (e.g., using their mine map to get out of the mine in the most efficient way);
and
- d) encouraging discussion of mine-specific issues and concerns (e.g., improving ERPs, clarifying policies, procedures, etc.).

Application

Opportunities to apply the knowledge and skills learned in class can be demonstrated in class or out of class. Skills (behaviors) and knowledge and attitudes (SKAs) that are learned and retained for the purpose of emergency response are unique. They must be learned and frequently relearned as a proactive strategy to reduce loss due to injury and property damage if an emergency occurs; however, everyone hopes that the only application of the SKAs stay strictly in the “classroom.” This type of training can become repetitious and participant and instructor motivation and enthusiasm can wane. Therefore, everyone must make a concerted effort to do their part to contribute to the training experience so that the necessary skills and knowledge are learned and retained, and ever ready should the need arise.

Evaluation of Effectiveness

Training should always be evaluated. It can be evaluated on several different levels, including reaction (satisfaction of the participants with the material, instructor, etc.), learning (did the participants learn a knowledge/skill/attitude in the classroom and can they demonstrate that they learned it?), behavior/performance (was a new behavior or set of skills learned that can be observed outside the classroom, such as donning a SCSR in response to an actual emergency at the mine?), and outcomes or results (are more miners able/capable of evacuating or surviving a mine emergency as a result of the training?). This training program gives the instructor a means to evaluate the training in terms of reaction and learning. This training program includes an evaluation form that should be distributed to the participants at the end of the course, or at the end of a lesson. Summarizing these results will give the instructor data on how well the training program was received and whether the participants were satisfied with the experience (see Appendix A). The training program also includes pre- and post-tests. These tests are intended to measure learning. The pre-tests (limited to five questions) were designed to get a baseline of a participant's knowledge prior to training. The questions that have been prepared evaluate only knowledge. However, instructors are encouraged to include a pre-test of a skill (e.g., donning/switching an SCSR, decision-making when confronted with an escape problem or challenge). The post-tests (include the pre-test questions and several additional questions) are designed to measure (when results are compared with the results from the pre-test) changes in learning resulting from the training. Instructors are encouraged to evaluate changes in behavior or performance that may have resulted from the training.

Summary

- Quality training results from a combination of good training material, and competent instructors.
- Instructors must take the time to prepare for presenting the training by studying the material, and personalizing/tailoring the lesson plan to their mine.

- Lesson objectives are statements about what you want the participants to know and/or do; they should always be shared with the participants at the beginning of the lesson.
- Instructors need to discuss how the information being presented and the skills being learned will help them in their daily lives to better achieve their goals.
- Participants learn best when a variety of their senses are engaged in the learning; therefore, instructors need to use a variety of instructional methods and choose several methods that actively involve the participants.
- While it varies depending on experience, adult learners possess a wealth of knowledge and skills; instructors need to plan for ways to acknowledge and tap into this valuable training resource.
- One of the best strategies for ensuring participant involvement is to make liberal use of questions.
- During lesson implementation, instructions should summarize often; not only does it allow the instructor to reinforce the most important points of the lesson, it gives the participants an opportunity to reflect on and digest what is being covered, and that in turn often leads to questions by the participants.
- Remember to evaluate the training. Asking questions during the presentation—aside from enriching the curriculum through participant input and involvement, it also gives the instructor the opportunity to gauge how well the material is being understood.
- In addition, oral and written quizzes, and observation of skills (e.g., switching SCSRs) are proven ways to measure learning and changes in performance.
- Be enthusiastic about what you are presenting, and how you present it. Earn the respect of those you train by mastering the material.
- Finally, show that you care...participants respond best to the training when instructors demonstrate that they care about them by taking an interest in their safety and health. People can teach you how to elevate and enhance your training skills, but no one can teach how you care.

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Module 6

Breathable Air Safe Havens/ Refuge Chambers

Instructor's Guide

Purpose of the Module

To increase the knowledge and skills of the miner to understand breathable air safe havens/refuge chambers, and their role in the escape, evacuation, survival and rescue phases of mine emergency/disaster response.

Outline

1. The process of getting out of the mine safely
2. Mine design features to promote escape, evacuation and survival
3. Breathable air safe havens
4. Requirements for the quantity of breathable air
5. Requirements for the location and methods of providing breathable air
6. Assumptions: safe havens
7. Breathing rate and calculations
8. Supplied air specifications
9. Emergency supplies
10. Approval of refuge chambers
11. MSHA examples of safe havens
12. NIOSH testing program of refuge chambers
13. Escape versus refuge

14. Aspects of decision making

Learning Objectives

- Describe the general procedures after an emergency has been discovered:
 - Control of emergency
 - Preparing for follow-up actions including escape, evacuation, survival, and rescue
- Describe the types of survival procedures if one cannot escape or evacuate:
 - The breathable air safe havens or refuge chambers
 - Move to safer areas of the mine
 - Past procedures of barricading
- Describe the regulatory requirements regarding breathable air safe havens or refuge chambers:
 - Construction
 - Provisions inside the safe haven or chamber
 - Location of the safe havens or chambers
 - Time period approved for safe havens or refuge chambers, etc.
- Discuss the role of breathable air safe havens or refuge chambers and the consequences of deciding to seek refuge
- Discuss the importance of the miner's personal decision/role in the decision to seek refuge

Using the Module

- **Instructor PowerPoint slide presentation consists of bulleted talking points**
 - Familiarize yourself thoroughly with the detailed information in this lesson and elaborate on key points as needed
 - Involve the group by following up on suggestions in the Instructor Notes
- **Use site-specific examples whenever possible**
 - Introduce mine-specific examples when possible
 - Use mine maps, emergency response plans, and corporate policies to tailor this information to your own mine.
- **Pre-test**
 - Have adequate tests available.
 - Allow 10 minutes for completion of test.
 - Each trainee takes his/her own test.
 - Explain purpose of pre-test: Pre-test will establish baseline of pre-existing knowledge.
 - Collect and score pre-test before completion of this module

- **Present the Lesson**

- Using the slides, introduce the purpose of the module
- Introduce the lesson objectives to the participants (Slides 5-8)
- Present the information in the module

At the end of the lesson administer the post-test

- Allow 15 minutes for completion of the test

SLIDE 7
SAFELY GETTING OUT OF THE MINE IN AN EMERGENCY

Slide Contents		
	Details of Instruction	Instructor Notes
<ul style="list-style-type: none"> • <i>Evacuation</i> • <i>Escape</i> • <i>Survive</i> • <i>Rescue</i> 		
<p>Definition and discuss:</p> <ul style="list-style-type: none"> • Evacuation • Escape • Survive • Rescue <p>The act of escape/or evacuation is #1 priority</p>	<p>Evacuation: In response to a decision (usually by person of authority), an act of leaving the mine according to an established, formal procedure.</p> <p>Escape: Act of leaving a place of danger by any means necessary</p> <p>Survive: The act of finding or creating a safe place with provisions for existing during an emergency when escape or evacuation is blocked.</p> <p>Rescue: The act by an emergency response team of freeing from danger miners who sought refuge from the threats of the emergency that trapped them in the mine.</p>	<p>Explain the differences in the terms.</p> <p>Ask the miners to list some mine design features that promote evacuation, escape and survival...some possible responses: <i>Multiple Air Shafts With Escape Hoists, Parallel Airways Comprising Escape Ways, Maintaining Conditions and Integrity of Escape Ways, State-of-The-Art Tracking System, Safe Havens/Rescue Chambers</i></p>

SLIDE 8
SAFELY GETTING OUT OF THE MINE IN AN EMERGENCY

SLIDE CONTENTS

- *Assess Risk of Escape*
 - *Decision That Escape Is Too Dangerous*

Important Points	Details of Instruction	Instructor Notes
<p>Explain the priority order of escape choices.</p> <p>Escape is ALWAYS first priority!</p>	<p>First priority! ESCAPE, if at all possible (see module on Escape and Evacuation)</p> <ul style="list-style-type: none"> • If escape is too dangerous, assess the feasibility of seeking refuge at specific locations: <ol style="list-style-type: none"> 1. breathable air safe haven 2. refuge chamber 3. barricade location 	<p>Ask the group to describe WHY escape is the first priority.</p>

SLIDE 9
SAFELY GETTING OUT OF THE MINE IN AN EMERGENCY

SLIDE CONTENTS

The Choice of Selecting a Refuge Option Depends Upon the Following:

- A. Knowledge of Emergency Situation*
- B. Knowing That Escape Routes are Blocked*
- C. Knowing Locations of Breathable Air Safe Havens/Refuge Chambers, And Feasibility of Reaching One of Them*

Important Points	Details of Instruction	Instructor Notes
<p>Describe necessity for miners to evaluate the extent of the emergency, the conditions of escapeways and locations of refuge chambers.</p> <p>Describe how knowledge is critical in a mining emergency.</p>	<p>The choice of selecting a refuge option depends upon the following:</p> <ul style="list-style-type: none"> • Knowledge of the type and extent of the emergency. • Knowing that escape routes are blocked. • Knowing locations of breathable air safe havens/refuge chambers, and feasibility of reaching one of them from where they are presently located. 	<p>Ask the group to describe how they would get the information to make informed decisions in an emergency.</p>

SLIDE 10
SAFELY GETTING OUT OF THE MINE IN AN EMERGENCY

SLIDE CONTENTS

- *Selecting a Refuge Option...*
 - *Location of Barricade Materials*
 - *Consideration of Any Other Possible Safe Areas in the Mine*

Important Points	Details of Instruction	Instructor Notes
<p>Explain that seeking a refuge option depends on a number of factors.</p> <p>Stress to miners to think like an emergency response team in a crisis!</p>	<ul style="list-style-type: none"> • Depends on location in mine and emergency scenario causing the threat. • Knowing <u>location of barricade materials</u> when blocked from reaching safe haven/refuge chamber • <u>Consideration of any other possible safe areas</u> in the mine, if current location is deemed too dangerous; others unreachable 	

SLIDE 11
SURVIVAL: BREATHABLE AIR SAFE HAVENS

SLIDE CONTENTS

- *In-Place Shelters Developed By Taking An Existing Part of the Mine*
- *Locations Marked On Map; Known by Responsible Person*
- *Required Specifications Given Later*

Important Points	Details of Instruction	Instructor Notes
<p>Explain the concept of what a Safe Haven is.</p>	<p>In-place shelters, e.g., a crosscut; isolating it with one or more bulkheads (meeting seal standards); and then equipping the shelter with supplies and equipment to sustain life for a period of time.</p> <p>Safe haven locations must be marked on the mine map.</p> <p>The Responsible Person must know all safe haven locations.</p>	<p>Ask the group to describe the location of their safe havens (if applicable).</p> <p>Point out the locations of safe havens on the mine map (if applicable).</p> <p>If training anthracite miners, instructor may want to omit material on Refuge Chambers</p>

SLIDE 12
SURVIVAL: REFUGE CHAMBERS

SLIDE CONTENTS

- *Manufactured Rigid Or Inflatable Vessels*
- *Locations Marked on Map; Known By Responsible Person*
- *Required Specifications Given Later*

Important Points	Details of Instruction	Instructor Notes
Explain the concept of what a refuge chamber is.	Manufactured rigid or inflatable vessels that are outfitted with supplies and equipment to sustain life for a period of time.	Ask the group to describe the location of their refuge chambers (if applicable). Point out the locations of refuge chambers on the mine map (if applicable).

SLIDE 13
SURVIVAL: BARRICADE

SLIDE CONTENTS

- *Definition*
- *Locations of Barricade Materials*
- *Understanding Barricading*

Important Points	Details of Instruction	Instructor Notes
<p>Explain what a barricade is, where the supplies are located and that it is a LAST RESORT!</p> <p>Stress that barricading is a LAST RESORT.</p>	<p>Definition: Wall constructed of concrete blocks or brattice cloth/plastic and fastened to the ribs, roof, and floor to create a breathable atmosphere which isolates miners from contaminated air</p> <p>Locations of barricade materials must be marked on the mine map and known by Responsible Person</p> <p>Barricading is NOT considered to be a viable refuge alternative; last option of last resort choices!</p>	<p>Ask the group to describe how emergency supplies are stored.</p> <p>Ask the group to describe where emergency supplies are stored in relation to their work areas.</p>

SLIDE 14
SURVIVAL: OTHER SAFE AREAS

SLIDE CONTENTS

- *Knowledge of Mine Layout And Ventilation Patterns*
- *Communications?*
- *Responsible Person*
- *Communication Not Possible*

Important Points	Details of Instruction	Instructor Notes
<p>Explain what types and where any additional safe areas are located.</p> <p>Knowledge of the mine layout (escapeways) is critical.</p> <p>Explain that knowledge of the mine ventilation system is critical.</p> <p>Explain highlights of ventilation plan.</p>	<p>Requires good knowledge of mine layout and ventilation patterns.</p> <p>Would communications survive there?</p> <p>Responsible Person should be consulted before attempting this option.</p> <p>If communication not possible, think like the emergency response team – would they find you?</p>	<p>Point out escapeways on the mine map.</p>

SLIDE 15
REGULATORY REQUIREMENTS:
QUANTITY OF BREATHABLE AIR OPTIONS

SLIDE CONTENTS

- *Established Borehole*
- *48-Hour Supply of Breathable Air*

Important Points	Details of Instruction	Instructor Notes
<p>Explain what is required if an established borehole is planned to supply breathable air.</p>	<p>Established borehole:</p> <ul style="list-style-type: none"> • Capable of providing fresh air to a location within 2000 feet of the working section or a hardened room located within 2000 feet of the working section <p>48 hour supply of Breathable Air:</p> <ul style="list-style-type: none"> • Provide each miner a 48-hour supply of breathable air, if advance contingency arrangements have been made to reliably assure that miners who cannot be rescued within 48 hours will receive additional supplies of breathable air sufficient to sustain them until rescue 	

SLIDE 16
REGULATORY REQUIREMENTS:
QUANTITY OF BREATHABLE AIR OPTIONS

SLIDE CONTENTS

48-Hour Supply of Breathable Air (continued)

- *Contingency Arrangements (“Guideline”)*
- *A Pre-Arranged, Pre-Surveyed Area for Barricading*
- *The Drill Rig Capacity for Pre-Surveyed Location*

Important Points	Details of Instruction	Instructor Notes
<p>Explain any contingency arrangement in effect for this mine.</p> <p>Explain who the drilling company is, what they are required to know and how long it would take to drill the hole and where the hole is located.</p>	<p>Contingency arrangements should be based on the following (other arrangements offering similar levels of protection may also suffice):</p> <p>Locations that would isolate the miners from toxic air, located within 2000 feet of the working section.</p> <p>Must have the capacity to promptly transport a drill rig to a pre-surveyed location such that a drilled hole would intersect the area designated for barricading (or other alternatives that would isolate the miners from contaminated environments).</p> <p>The drill rig must have a pre-surveyed, pre-determined location to drill a borehole.</p>	

SLIDE 17
REGULATORY REQUIREMENTS:
QUANTITY OF BREATHABLE AIR OPTIONS

SLIDE CONTENTS

- *96-Hour Supply of Breathable Air*
- *Other Methods*

Important Points	Details of Instruction	Instructor Notes
Describe the breathable air requirement.	<p>96 hour air supply</p> <ul style="list-style-type: none"> • Each miner should be provided a 96-hour supply of breathable air located within 2000 feet of the working section <p>Other methods</p> <ul style="list-style-type: none"> • Use other methods to provide breathable air sufficient to sustain miners trapped underground for a period of time that reasonably would be expected to establish a fresh air source for trapped miners, as long as these methods provide equivalent safety protection. 	<p>Describe how breathable air will be supplied at this mine.</p> <p>Ask the group to describe where their additional breathable air is located.</p>

SLIDE 18
BREATHABLE AIR REQUIREMENTS

SLIDE CONTENTS

- *Locations of Breathable Air*
- *Various Methods of Supply*

Important Points	Details of Instruction	Instructor Notes
<p>Describe the methods used to supply breathable air.</p> <p>MSHA Hazard Awareness Training For Compressed Air And Compressed Oxygen is required</p> <p>All Miners Must Be Trained On Breathable Air Provisions.</p>	<p>Locations of breathable air must be shown on escape map.</p> <p>Various methods of supply: the supply of breathable air could be provided through various methods, including the following:</p> <ul style="list-style-type: none"> • Boreholes with fresh air blowing fans capable of providing fresh air to trapped miners • Buried or otherwise protected air lines supplied by surface positive pressure blowers and routed to locations that will isolate miners from contaminated • Buried or otherwise protected air lines supplied by surface positive pressure blowers and routed to locations that will isolate miners from contaminated environments. • Compressed air cylinders, O₂ cylinders, or chemical oxygen generators located at a designated area for barricading or other alternatives that would isolate miners from contaminated environments. When one of these methods, carbon dioxide scrubbing is necessary to prevent contamination of the isolated environment. 	<p>Point out the locations of breathable air on the mine map.</p>

SLIDE 19
SAFE HAVENS

SLIDE CONTENTS

Site-Specific Aspects of Safe Havens:

- Construction*
- Chemically generated oxygen*
- Location of compressed air lines*

	Details of Instruction	Instructor Notes
<p>Describe how the safe haven at this mine is constructed (if applicable) and describe why it was built this way.</p> <p>Describe how the chemically generated oxygen system works (if applicable).</p> <p>Describe where compressed air lines are located and how it designed to function;</p> <p>Describe the purpose and function of boreholes (if applicable). Describe why multiple safe havens are used and point out their location on the mine map.</p>	<p>Instructor will cover mine specific aspects of the safe havens at the mine</p>	<p>Ask the group to describe how they would enter the safe haven and where the oxygen cylinders are located.</p> <p>Ask the group to describe where their oxygen generation system is located, and how to sure it is functional.</p> <p>... to describe how to be sure the compressed air system is functional.</p> <p>...to describe how the borehole system at this mine functions and how they will use it in an emergency situation.</p>

SLIDE 20
SOME SAFE HAVEN ASSUMPTIONS

SLIDE CONTENTS

- *AIR QUALITY*
- *ENVIRONMENTAL REQUIREMENTS*

Important Points	Details of Instruction	Instructor Notes
<p>Describe the air quality requirements of safe havens.</p> <p>Describe air quality monitoring requirements</p> <p>Describe compressed air and oxygen cylinder use</p>	<p><i>No Methane Liberation Into Safe Haven</i></p> <p><i>CO₂ Scrubbing Does Not Account for Strata Oxidation Rates</i></p> <p><i>Miners Die From Effects Of CO₂ Rather Than O₂ Deficiency</i></p> <p><i>CO Purging Utilizing Compressed Air Cylinders</i></p> <p>Maximum temperature</p> <ul style="list-style-type: none"> • Must be maintained at less than 95° F. <p>Monitoring of air quality</p> <p>Miners must monitor air quality through approved multiple gas detectors which includes oxygen, carbon monoxide, carbon dioxide, and methane safety protection. Compressed air flows are controlled through the usage of a regulator.</p>	<p>MSHA also has requirements for breathing rates</p>

SLIDE 21
SUPPLIED AIR SPECIFICATIONS

SLIDE CONTENTS

- *Lithium hydroxide*
- *“K” size compressed air cylinders*
- *Safe Haven Purging “Efficiency”*
- *Air Source And Quality Provided for Compressors And Blowing Fans*

Important Points	Details of Instruction	Instructor Notes
<p>Explain how lithium oxide works to scrub CO₂ from the air.</p> <p>Explain the size and air quantity of a “K” cylinder and how much air it will supply.</p> <p>Explain how air purging is accomplished.</p>	<p>Lithium hydroxide</p> <ul style="list-style-type: none"> • Used for CO₂ scrubbing through woven curtains. <p>“K”-sized compressed air cylinders</p> <ul style="list-style-type: none"> • Each cylinder contains 282 cubic feet at 2200 psi and weighs 170 lbs. Dimensions: 9.25 inches diameter x 60 inches height. <p>Air purging</p> <ul style="list-style-type: none"> • Compressed air cylinders providing at least 3 times the amount of the safe haven volume. Miners are to be inside of safe haven wearing an SCSR during purging. • Air source and quality provided for compressors and blowing fans are considered to be uncontaminated ambient air. 	

SLIDE 22
EMERGENCY SUPPLIES

SLIDE CONTENTS

- *Chemical toilet*
- *Brattice cloth*
- *Tools/Repair Materials*
- *Ready to eat meals*
- *Valve regulators*

Important Points	Details of Instruction	Instructor Notes
Explain what types and quantities of emergency supplies are required to be maintained in safe havens and refuge chambers.	Supplies can be stored on a portable skid or in manner that provides equivalent safety protection.	Ask the group to describe where their emergency supplies are located.

SLIDE 23
REFUGE CHAMBERS APPROVED/PENDING APPROVAL

SLIDE CONTENTS

- *Chem Bioshelter, Inc.*
- *Draeger Safety, Inc.*
- *Kennedy Metal Products, Inc.*
- *Strata Products (USA), Inc. (Pending MSHA Electrical Approval)*
- *Modern Mine Safety Supply*

Important Points	Details of Instruction	Instructor Notes
<p>Describe that at this time there are several options in refuge chambers. In the future there could even be more options.</p>	<p>Prior to the MINER Act, there were very few types of refuge chambers available.</p> <p>As technology improves, refuge chambers will improve.</p>	

SLIDE 24
CHEMBIO SHELTER, INC.
LIFE SHELTER

SLIDE CONTENTS

- *Photo of Chem Bioshelter, Inc. Life Shelter*

Important Points	Details of Instruction	Instructor Notes
Point out the type of refuge chamber used at this mine (if applicable).	Describe why the company chose this type of refuge chamber (if applicable).	

SLIDE 25
DRAEGER SAFETY, INC.

SLIDE CONTENTS

- *Photo of Draeger Safety, Inc, Refuge Chamber*

Important Points	Details of Instruction	Instructor Notes
Point out the type of refuge chamber used at this mine (if applicable).	Describe why the company chose this type of refuge chamber (if applicable).	

SLIDE 26
KENNEDY METAL PRODUCTS, INC.

SLIDE CONTENTS

- *Photos of Kennedy Metal Products, Inc.*

Important Points	Details of Instruction	Instructor Notes
Point out the type of refuge chamber used at this mine (if applicable).	Describe why the company chose this type of refuge chamber (if applicable).	

SLIDE 27
STRATA PRODUCTS (USA), INC.

SLIDE CONTENTS

- *Photo of Strata Products (USA), Inc.*

Important Points	Details of Instruction	Instructor Notes
Point out the type of refuge chamber used at this mine (if applicable).	Describe why the company chose this type of refuge chamber (if applicable).	

SLIDE 28
MODERN MINE SAFETY SUPPLY

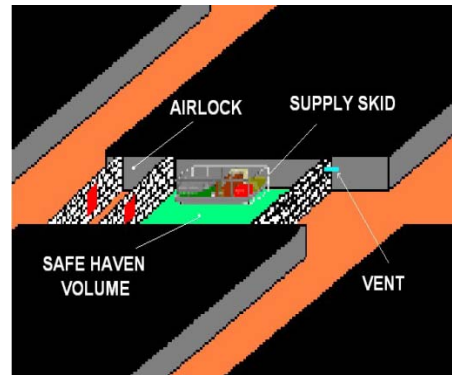
SLIDE CONTENTS

- *Photos of Modern Mine Safety Supply*

Important Points	Details of Instruction	Instructor Notes
Point out the type of refuge chamber used at this mine (if applicable).	Describe why the company chose this type of refuge chamber (if applicable).	

SLIDE 29
SAFE HAVEN EXAMPLES – MSHA

SLIDE CONTENTS



OXYGEN CYLINDERS

	Details of Instruction	Instructor Notes
Describe how a safe haven is constructed (if applicable)	<p>Describe how the safe haven at this mine is constructed (if applicable).</p> <p>Describe why it was constructed in the manner it was.</p>	<p>Ask the group to describe how they would enter the safe haven and where the oxygen cylinders are located.</p>

SLIDE 30
SAFE HAVEN EXAMPLES - MSHA

SLIDE CONTENTS

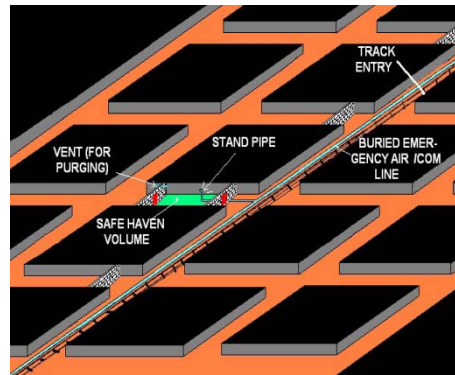


CHEMICALLY GENERATED OXYGEN

Important Points	Details of Instruction	Instructor Notes
<p>Describe how a safe haven is constructed (if applicable)</p>	<p>Describe how the chemically generated oxygen system works (if applicable).</p>	<p>Ask the group to describe where their oxygen generation system is located, and how to sure it is functional.</p>

SLIDE 31
SAFE HAVEN EXAMPLES - MSHA

SLIDE CONTENTS

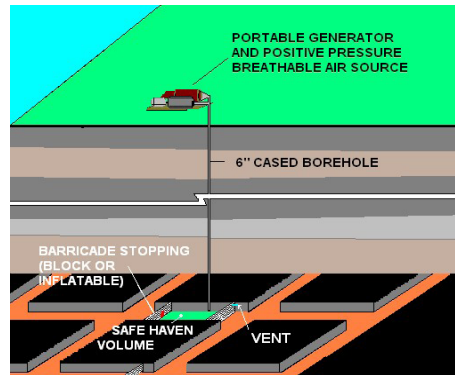


COMPRESSED AIR LINES

Important Points	Details of Instruction	Instructor Notes
Describe how a safe haven is constructed (if applicable)	Describe where compressed air lines are located and how it designed to function.	Ask the group to describe how to sure the compressed air system is functional.

SLIDE 32
SAFE HAVEN EXAMPLES – MSHA
VERTICAL BOREHOLES

SLIDE CONTENTS

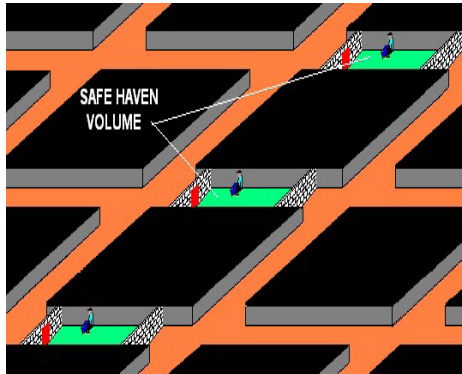


VERTICAL BOREHOLES

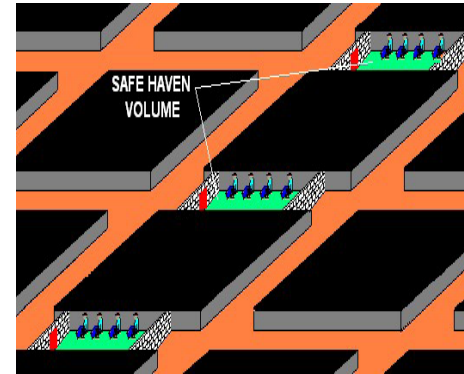
Important Points	Details of Instruction	Instructor Notes
<p>Describe where boreholes are located; their size and expected air capacity.</p>	<p>Describe the purpose and function of boreholes (if applicable).</p>	<p>Ask the group to describe how the borehole system at this mine functions and how they will use it in an emergency situation.</p>

SLIDE 33
SAFE HAVEN EXAMPLES - MSHA

SLIDE CONTENTS



Multiple Safe Havens-One Miner



Multiple Safe Havens-Multiple Miners

Important Points	Details of Instruction	Instructor Notes
Describe the purpose of multiple safe havens (if applicable)	Describe why multiple safe havens are used. Point out their location on the mine map.	

SLIDE 34
NIOSH TESTING PROGRAM

SLIDE CONTENTS

- *Goals of NIOSH testing*

Important Points	Details of Instruction	Instructor Notes
Describe NIOSH role in testing refuge chambers.	<p>NIOSH is charged with detailed testing of refuge chambers.</p> <p>NIOSH evaluates chamber performance over a wide range of testing parameters to provide data to miners, manufacturers and MSHA.</p>	

SLIDE 35
RISK OF SEEKING REFUGE OVER ESCAPE

SLIDE CONTENTS

- *Last resort!*
- *Weigh the risks*
- *Importance of good, early communication*

Important Points	Details of Instruction	Instructor Notes
Re-emphasize the importance of escaping and evacuating the mine.	<p>Seeking refuge in a safe haven, refuge chamber, or behind a barricade is a <u>LAST RESORT!</u></p> <p>This does not mean that you should take any risk to your life by trying to escape in what you believe is a serious, infeasible escape scenario.</p> <p>Describe numerous hypothetical emergency situations.</p>	Ask the group to describe their response to hypothetical emergency situations.

SLIDE 36
JUDGMENT AND RISKS

SLIDE CONTENTS

- *Decision/judgment*
- *Best approach to the decision*
- *Risk and the miner act*

Important Points	Details of Instruction	Instructor Notes
<p>Emphasize the importance of making sound decisions.</p> <p>Emphasize that a mine might look very different after a fire or explosion.</p> <p>The best decisions are made with a cool, calm and clear head.</p>	<p>Emergency scenarios will often have significant uncertainty associated with them, and in the end you must make the decision, with your fellow miners, to escape or seek refuge.</p> <p>It is best to err on the side of caution. What decision will give you the best chance of survival?</p> <p>Following the MINER Act, the new provisions have improved your probability for survival – but no combination of technologies can guarantee your survival.</p>	<p>Advise the group to run hypothetical emergency situations through their mind and imagine how they would handle such situations.</p> <p>Ask the group to describe the information they would need to make good decisions.</p>

SLIDE 37
SAFE WORK = REDUCED RISK

SLIDE CONTENTS

- *Prevention*
- *If emergency situations do not occur, then you won't be threatened.*

Important Points	Details of Instruction	Instructor Notes
Good safety practices can prevent emergencies!	<p>The prevention of major hazard events is still the number one priority.</p> <p>Executing all aspects of your job faithfully, with the lives of your fellow miners in mind, is the best way to prevention.</p> <p>If emergency situations do not occur, then you won't be threatened.</p>	

SLIDE 38
STRESS IN MINING EMERGENCIES

SLIDE CONTENTS

- *Stress*

Important Points	Details of Instruction	Instructor Notes
<p>Describe the mental and physical effects of stress.</p> <p>Emphasize the importance of thinking optimistically during a mining emergency.</p>	<p>Stress:</p> <ul style="list-style-type: none"> • Describe how stress affects judgment. • Dealing with stress during an emergency is not an easy task. • Stress is a normal reaction. • Be optimistic and think positive! • Think about getting out! 	<p>Ask the group what things they might think or talk about to stay optimistic during an emergency or during time in a refuge chamber.</p>

SLIDE 39
IMPORTANCE OF TRAINING

SLIDE CONTENTS

Need improved skills, through training on:

- *Smoke*
- *Supervisors*
- *Responsible person*
- *Effective teamwork and team-building*
- *Leadership skills*

Important Points	Details of Instruction	Instructor Notes
<p>Describe training as a “never-ending process,” and emphasize its importance.</p>	<p>Critical training areas:</p> <ul style="list-style-type: none"> • Knowing how to escape if smoke is present. • Training supervisors on how to make decisions during emergencies • Training Responsible Persons on how to make decisions during emergencies • Effective teamwork, team-building and leadership skills. 	<p>Ask the group to describe what areas they believe training would be valuable in recognizing and reacting to mine emergencies.</p>

**SLIDE 40
SUMMARY**

SLIDE CONTENTS

- Your knowledge and skills and your understanding of the available options during a mine emergency/disaster are the key to survival.*
- You must assess the risk created by the emergency/disaster.*
- If you decide that the risk of escape or evacuation is too great you need to make a choice between breathable air safe havens/refuge chambers and barricading.*

Important Points	Details of Instruction	Instructor Notes

**SLIDE 41
SUMMARY**

SLIDE CONTENTS

- You must rely on your knowledge of the mine layout and ventilation pattern, communications with the responsible person and your best judgment.*
- Emergency scenarios will have significant risk associated with them and in the end you must make the decision with your fellow miners.*
- The key to not having to make this type of a decision is PREVENTION.*

Important Points	Details of Instruction	Instructor Notes

APPENDIX A

MODULE 6 BREATHABLE AIR SAFE HAVENS/REFUGE CHAMBERS

PRE-TEST—INSTRUCTOR'S ANSWER KEY

1. Which of the following would not be especially helpful in selecting a refuge option?
 - a. **Access to drinking water**
 - b. Knowledge of blocked escape routes
 - c. Information about the emergency situation
 - d. Knowledge of the location of breathable air safe havens

2. A good barricade would be a wall constructed of concrete blocks or brattice cloth/plastic and fastened to the ribs, roof, and floor to create a _____ which isolates miners from contaminated air.
 - a. safe haven
 - b. **breathable atmosphere**
 - c. warm area
 - d. ventilated area

3. What mine design feature that would not be especially helpful for escape, evacuation and survival?
 - a. **The number of the track entries**
 - b. State of the art tracking system
 - c. Safe haven/rescue chambers
 - d. Maintaining the escape way

4. Barricading is the last option of a last resort.
 - a. **True**
 - b. False

5. The location of breathable air safe havens must be shown on an escape map.
- a. **True**
 - b. False

MODULE 6

BREATHABLE AIR SAFE HAVENS/REFUGE CHAMBERS POST-TEST—INSTRUCTOR'S ANSWER KEY

6. Which of the following would not be especially helpful in selecting a refuge option?
 - a. **Access to drinking water**
 - b. Knowledge of blocked escape routes
 - c. Information about the emergency situation
 - d. Knowledge of the location of breathable air safe havens

7. A good barricade would be a wall constructed of concrete blocks or brattice cloth/plastic and fastened to the ribs, roof, and floor to create a_____which isolates miners from contaminated air.
 - a. safe haven
 - b. **breathable atmosphere**
 - c. warm area
 - d. ventilated area

8. What mine design feature that would not be especially helpful for escape, evacuation and survival?
 - a. **The number of the track entries**
 - b. State of the art tracking system
 - c. Safe haven/rescue chambers
 - d. Maintaining the escape way

9. A key factor in seeking refuge over escape is good, early communication.
 - a. **True**
 - b. False

10. Barricading is the last option of a last resort.

- a. **True**
- b. False

11. The location of breathable air safe havens must be shown on an escape map.

- a. **True**
- b. False

12. Each miner should be provided a 96-hour supply of breathable air located within _____feet of the working section.

- a. 500
- b. 1000
- c. 1500
- d. **2000**

13. Emergency supplies **do not** include

- a. a chemical toilet.
- b. brattice cloth.
- c. **spare transportation.**
- a. ready to eat meals.

14. Decision making skills can be improved through training in smoke, supervisory training and responsible person training.

- a. **True**
- b. False

15. The key to not having to deal with an emergency is prevention, and the best way to achieve it is

- a. any type of training.
- b. **faithfully executing all aspects of your job.**
- c. having the best equipment.
- d. having a safety program.

APPENDIX B

Post-Training Evaluation Form

*Do You Understand Mine Emergencies?
Are You Prepared for a Mine Emergency?*

1. Was the material covered relevant to your needs, interests, and expertise?
Very Much So To Some Extent Needs More Work No

2. Were the objectives of the course met?
Very Much So To Some Extent Needs More Work No

3. Were the instructors knowledgeable and competent in the subject area(s)?
Very Much So To Some Extent Needs More Work No

4. Was the course content logically organized?
Very Much So To Some Extent Needs More Work No

5. Was the length of the course adequate?
Yes, keep as is Not long enough Shorten it

6. Was there an adequate opportunity for discussions and questions?
Yes, keep as is Allow more time for discussions and questions

7. Was the use of audiovisuals adequate and appropriate for the course materials?
 Yes No (If no, why?)

8. Do you believe that today's training help you survive a mine emergency?
 Very Much So To Some Extent No

SUGGESTIONS/RECOMMENDATIONS TO IMPROVE THIS TRAINING:

APPENDIX C

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