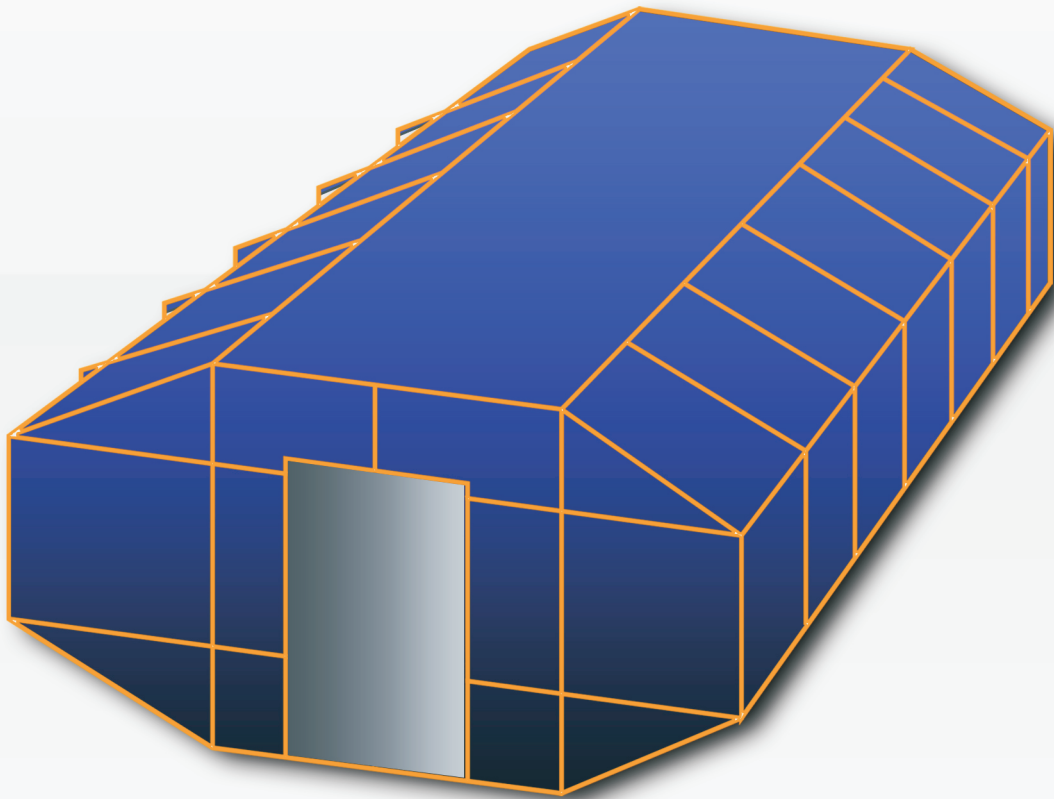


# Emergency Escape and Refuge Alternatives



Information Circular 9525

## **Emergency Escape & Refuge Alternatives Instructor Guide and Lesson Plan**

By Erica E. Hall and Katherine A. Margolis, Ph.D.



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# **Emergency Escape & Refuge Alternatives Instructor Guide and Lesson Plan**

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## **Instructor Guide**

### **Overview**

*Emergency Escape & Refuge Alternatives* was created by a multidisciplinary team at the National Institute for Occupational Safety and Health (NIOSH) to teach miners about emergency escape and using refuge alternatives. The training is a Microsoft PowerPoint presentation and is intended for group-based training. It is designed to be used as a template for mine instructors to modify based on the refuge alternatives and specifics of their mine.

### **Background Information**

Refuge chambers are portable chambers that are either made of steel or are tents that inflate from a steel skid. They provide water, food, toilet, breathable air, and a seal to protect occupants from the outside environment for at least 96 hours, or 4 days. Although states and mines refer to underground refuges by different names, this guide will refer to those nearest to the face as refuge chambers, whether inflatable from a skid or constructed from steel. Other popular terms for refuge chambers are rescue shelters and refuge shelters. Refuges that are toward the mine entrance or shaft, whether a pre-fabricated refuge chamber or one built into a crosscut, will be referred to as outby refuges because of their location in the mine. Outby refuges can be permanent, semipermanent, or portable and are usually located at every other self-contained self-rescuer (SCSR) cache. Outby refuges are sometimes called hardened rooms, outby shelters, and in-place shelters. The term “refuge alternatives” is used to describe both refuge chambers and outby refuges.

This training is designed to encompass both outby and inby refuge alternatives.

### **Purpose**

The purpose of this training presentation is to teach underground miners about refuge alternatives. Refuge alternatives are a technology that may be new to miners. This training is intended to provide miners with an introduction to refuge alternatives.

### **Target Audience**

This material has been designed for underground miners at all skill levels. It can be integrated into required new miner training courses, annual refresher courses, or any other mine site training.

## Requirements for Teaching This Module

- If this training is part of a Mine Safety and Health Administration (MSHA) required course, an approved instructor and/or content expert must deliver the training.
- Basic computer skills (keyboard, mouse, connect computer to LCD projector).
- Knowledge of the mine's emergency response plan (ERP).

## Intended Use

This presentation can be used as it is or can be customized to reflect the specific policies and refuge alternatives of the mine and requirements that may be unique to a specific state. The presentation is intended for group-based training, and it is recommended that the instructor allows for discussion at any point before advancing to the next slide.

## Room Setup and Equipment

- Arrange seating so that everyone has a clear view of the screen.
- Equipment required for large group training:
  - One computer equipped with Microsoft PowerPoint
  - LCD projector
  - Large screen
  - *Emergency Escape & Refuge Alternatives* package (customized to be mine- and chamber-specific)

## Advance Preparation

- The instructor should be thoroughly familiar with the operation and use of the specific refuge alternatives used in the mine where training is taking place. Read the information provided by the manufacturer/supplier about the specific refuge alternatives used in the mine.
- If the instructor wants to customize the presentation for the specific refuge alternatives used in the mine, preparation should be done in advance of the training date. The instructor can include photos of the refuge chambers and outby refuges. The instructor should also consult the refuge alternative manufacturer and mine policies on the use of the refuge alternative as a way station. If the refuge alternative is intended to be used as a way station, guidance is provided for the instructor.
- Double check all computer and audio/visual equipment before the training.
- Familiarize yourself with the lesson plan included in this guide.
- Familiarize yourself with the mine's emergency response plan (ERP).

## Photo Editing Tips

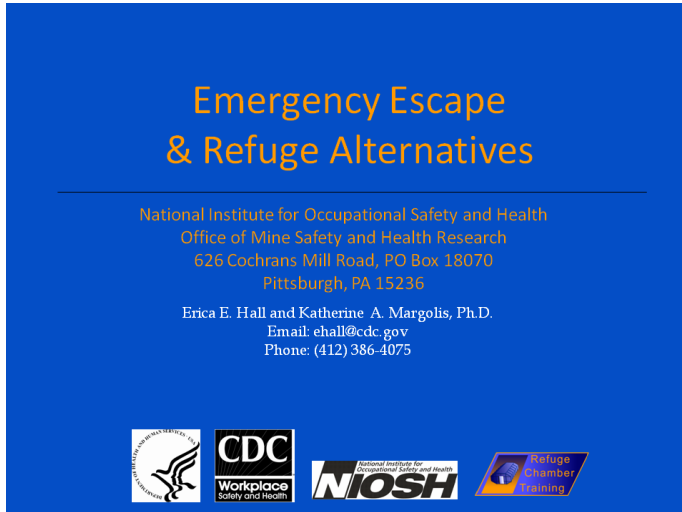
- Take photos of the refuge alternatives specific to your mine to include in the presentation. Be sure to take detailed photos and also zoom in on small features (instruction decals, valves, settings, etc.).
- Use a variety of photos to illustrate each step.
- Insert arrows to accentuate features.
- Document the entire process; photos are essential to providing a clear overview of the operational task.

## Refuge Alternatives as Way Stations

Some refuge alternatives can be used as way stations and others cannot without compromising the air inside the refuge alternative. Refuge alternatives used as way stations can provide a place to rest, to change SCSRs, to care for injuries, etc. Consult with the refuge alternatives manufacturer and the mine management for specifics about using the refuge alternatives as a way station.

## Lesson Plan

The following lesson plan contains discussion questions and notes for each slide of the presentation. The instructor can use these notes and additional information relevant for their class.







**Emergency Escape  
& Refuge Alternatives**

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### **Introduce the training.**

“What do you currently know about refuge alternatives? ... different types? ... location in the mine? ...when to use them?”

“Would you consider using one?”

### **Before advancing to the next slide, ask,**

“Under what circumstances would you evacuate the mine?”



**Reasons to Evacuate the Mine**

- Fire
- Explosion
- Flood
- Gas Inundation
- Ground Movement

### **Discuss reasons (listed on the slide) for evacuating a mine.**

**Personalize it.** “At your location in the mine, which of these events is a possibility?”



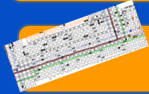
## Remember, When Escaping...

Assemble at the meeting place



Call the surface

Don an SCSR and take a back-up



Take a map

**Seek refuge only as a last resort!**

**Discuss steps to take when escaping** (listed on the slide).

**Personalize it.** Discuss procedures specific to your mine.

**Additional information.**

“Foremen should brief their crew daily on the refuge chamber’s location.”

“Miners should bring any medications that they have with them.”

“Seek refuge over escaping as a last resort.”

## Refuge Alternatives Can Save Lives

From 1970 - 2006

Of those who did not die immediately

– 67 of 99 miners died while escaping.

• A refuge alternative may have saved 85% of those who died trying to escape.

– 17 of 99 miners died while barricaded.

• A refuge alternative may have saved 100% of those who died barricading.

**Discuss statistics listed on the slide.**

**Additional information.** Data comes from the *Foster-Miller Report*, which evaluated the impact refuge chambers would have had on past mine disasters (1970–2006).

**Apply this to your mine’s chambers.**

## What is a Refuge Alternative?

An Airtight Safe Haven With

- Light
- Food
- Water
- Breathable Air
- Phone
- Toilet
- First Aid Kit



**Discuss the definition of a refuge alternative** (listed on the slide).

**Use examples.** If a refuge chamber with a capacity rating of 20 miners is used, but only 10 miners enter the chamber; how does this affect the amount of protection the chamber can provide?

\_\_\_\_\_ or 8 days – it will double.

**Additional information.**

“Refuge alternatives provide a minimum of 96 hours, or 4 days, of fresh air once activated.” “Use refuge alternatives only as a last resort.”

## Types of Refuge Alternatives

### Refuge Chambers

- Within 1,000 ft from nearest working face
- Other Names
  - Rescue chambers
  - Rescue shelters
  - Refuge shelters

### Outby Refuges

- Within 1-hour travel distance from the nearest working face
- Ex., Every other SCSR cache
  - Other Names
    - Hardened rooms
    - Outby shelters
    - In-place shelters

“ ‘Refuge alternatives’ is a term used to collectively describe refuge chambers and outby refuges.”

**Discuss the types of refuge alternatives** (listed on the slide).

**Personalize it.** Use terminology adopted at your mine.

“Outby refuge alternatives are required to be spaced within 1-hour travel distances in outby areas such that persons in outby areas are never more than a 30-minute travel distance from an outby refuge or safe exit.”

## When To Enter a Refuge Alternative

### All escape attempts have failed

- Smoke should never prevent escape

### Due to physical limitation

- Minor injuries should never prevent escape.

**ALWAYS try to ESCAPE!**

**Discuss when** (listed on the slide) **to enter a refuge alternative.**

**Personalize it.** Determine if the refuge alternatives at your mine can be used as way stations by consulting your mine’s policies, ERP, and the manufacturer’s guidelines.

“Way stations can be a place to rest in a protected environment, communicate with each other and the surface, look over maps, treat injuries, etc. Keep in mind that this will lessen the amount of purge air and oxygen available if the chamber is re-entered. When exiting, turn everything off.”

## What It Will Be Like Inside a Refuge Alternative

Hot and humid

Condensation will develop

Cramped – may have to sit or lie down, depending on space

Every miner will react differently, some may be anxious

Not much privacy



**Discuss conditions** (listed on the slide) **inside a refuge alternative.**

**Personalize it.** List any conditions specific to the refuge alternatives at your mine.

“Escape is always the first option. Refuge alternatives should only be used as a last resort.”

“Refuge alternatives are designed to sustain life and should only be used after escape has failed or is impossible.”

## What To Do While Inside a Refuge Alternative

### Communicate

- Call to the surface
- Talk to each other

### Monitor

- The environment inside of the chamber
- The health of others

### Conserve

- Cap lamps
- Supplies – food, water, air, etc.

**Discuss what to do** (listed on the slide) **while inside a refuge alternative.**

**Personalize it.** If your mine uses way stations, modify this slide.

“Conditions may change to make escape possible; injuries may improve given rest. Feedback from the surface may also change miners’ perspectives.”

“If mine rescue teams have started to establish a fresh air base, the smoke may have cleared out and routes thought to be blocked may not be.”

## Remember...

In an emergency escape, refuge alternatives provide additional resources to miners.

**REMAIN CALM.**

Use all your skills & available resources.

Others are working to rescue you.

**Discuss the important things to remember** (listed on the slide).

“Escape is always the first option.”

“Refuge alternatives are only to be used as a last resort.”

**Personalize it.** Add photos of your mine. See Photo Editing Tips in the *Instructor Guide*.

## **Additional Resources**

NIOSH has created a Web page containing a suite of refuge chamber training products and guidance documents. These products and documents can be downloaded directly from the internet. <http://www.cdc.gov/niosh/mining/topics/training/refugechambers.htm>

## Training Evaluation

Age \_\_\_\_\_ Sex \_\_\_\_\_ Total years experience mining \_\_\_\_\_

Total years experience at this mine \_\_\_\_\_

Present job at this mine \_\_\_\_\_

Total years experience in your present job \_\_\_\_\_

Normal shift \_\_\_\_\_

Present location in the mine \_\_\_\_\_

**Please circle the number which tells how much you agree or disagree with the following statements:**

Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Overall, this training was excellent.	1	2	3	4	5
Overall, this training was interesting.	1	2	3	4	5
Overall, this training was easy.	1	2	3	4	5
Overall, this training was informative.	1	2	3	4	5
Overall, this training was useless.	1	2	3	4	5
Overall, this training was important.	1	2	3	4	5

**Please circle the number which tells how much you agree or disagree with the following statements:**

Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
I feel better prepared if I ever find myself in a refuge alternative.	1	2	3	4	5
I am more aware of what it would be like in a refuge alternative.	1	2	3	4	5
I have a better idea of when to use a refuge alternative.	1	2	3	4	5
This training was relevant to my job.	1	2	3	4	5
I liked the format of this training.	1	2	3	4	5

**The following questions ask about what you saw in the presentation. Answer either yes or no.**

	YES	NO
1. Refuge alternatives can be both portable and permanent?	<input type="checkbox"/>	<input type="checkbox"/>
2. There are two types of refuge alternatives: refuge chambers and outby refuges?	<input type="checkbox"/>	<input type="checkbox"/>
3. You should enter a refuge alternative at the first sign of smoke?	<input type="checkbox"/>	<input type="checkbox"/>
4. Refuge chambers are found near the working face?	<input type="checkbox"/>	<input type="checkbox"/>
5. Outby refuges can be located at every other SCSR cache?	<input type="checkbox"/>	<input type="checkbox"/>

## Training Evaluation Answer Key

The following questions ask about what you saw in the presentation. Answer either yes or no.

	YES	NO
1. Refuge alternatives can be both portable and permanent?	✓	<input type="checkbox"/>
2. There are two types of refuge alternatives: refuge chambers and outby refuges?	✓	<input type="checkbox"/>
3. You should enter a refuge alternative at the first sign of smoke?	<input type="checkbox"/>	✓
4. Refuge chambers are found near the working face?	✓	<input type="checkbox"/>
5. Outby refuges can be located at every other SCSR cache?	✓	<input type="checkbox"/>



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