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## Wearing Hearing Protection Properly



A 3-D training aid for drillers

**Department of Health and Human Services**  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health



**Information Circular 9472**

**Wearing Hearing Protection Properly:  
A 3-D Training Aid for Drillers**

**By Edward A. Barrett and Roberta A. Calhoun**

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health  
Pittsburgh Research Laboratory  
Pittsburgh, PA

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## **WEARING HEARING PROTECTION PROPERLY: A 3-D TRAINING AID FOR DRILLERS**

By Edward A. Barrett<sup>1</sup> and Roberta A. Calhoun<sup>2</sup>

### **Introduction**

This Instructor's Copy contains most of the information needed to use the *Wearing Hearing Protection Properly* 3-D training reel. It offers practical suggestions on how to use the reel as a training aid, performance objectives for deciding if the training is appropriate for your needs, and discussion notes that provide additional information to the user.

The 3-D reel was designed as a self-teaching aid that drillers and others who work at a drill site can use wherever the opportunity for such training presents itself. The latter could be a company preshift requirement or a tailgate session where workers would have an opportunity to view and discuss the reel. It could also be an individual looking at the reel in a pickup truck prior to beginning work at a drill site. The 3-D training reel is versatile in that it can be used for a small group of persons or for a single worker. For any of these situations, information is transferred to the individual by viewing each of the seven colorful, in-depth 3-D scenes and relating the words that appear in each scene to what is depicted in the visual.

### **Acknowledgment**

The authors thank Linda J. McWilliams, Statistician, NIOSH Pittsburgh Research Laboratory, for her assistance in analyzing the experimental data in this document.

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<sup>1</sup>Mining engineer.

<sup>2</sup>Safety and occupational health specialist.

Pittsburgh Research Laboratory, National Institute for Occupational Safety and Health, Pittsburgh, PA.

## Training Aid Summary

The following summary information is provided to help you decide if this training aid is appropriate for your needs.

Type: 3-D reel containing seven (7) scenes

Length: Approximately 15 minutes, depending on choice of group or individual sessions and length of followup discussions

Skills: Inserting foam earplugs properly  
Understanding use of both earplugs and earmuffs  
Identifying improper use of earmuffs  
Recognizing personal responsibility for wearing hearing protection

Location: Surface drill site

Situation: Seven scenes show the proper use of foam earplugs and earmuffs. Each scene shows workers near a large drill wearing both types of hearing protection. Words are embedded within each scene that provide important information.

There is a related training exercise available entitled *Drill Rig Incident*, DHHS (NIOSH) Publication No. 2005-108 (IC 9473). It can be obtained by contacting NIOSH at:

Telephone: 1-800-35-NIOSH (1-800-356-4674)

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E-mail: [pubstft@cdc.gov](mailto:pubstft@cdc.gov)

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## **How to Use the Training Aid**

1. Look at the performance objectives on the next page. Decide if the training aid is appropriate for your needs.
2. Look at the 3-D reel.
3. Review the discussion notes for each scene in the reel.
4. Decide **how** (either group or individual) and **where** (either company training facility or at the drill site) you want to use the training aid with your employees.
  - Have each person take the pretest found in appendix A. Be sure to read the directions carefully before beginning the pretest.
  - Give each person a reel and 3-D viewer. For individual training at a drill site, these may be left in the cab of the drill or in a pickup truck.
  - Demonstrate how to insert the reel into the viewer and how to achieve optimum lighting (by looking at the sky if outside, or at ceiling lights if inside).
  - Have the individual worker or group of workers look at the 3-D reel.
  - Have each person take the posttest found in appendix A. Be sure to read the directions carefully before beginning the posttest.
  - As appropriate, review and discuss scenes with the trainee(s). Add your own ideas. This can be done immediately after the training. This followup is important in order to reinforce the ideas presented.

### **Performance Objectives**

Objective Number	Capability Verb(s)	Description of required performance and conditions under which it is to occur
1. EP <sup>3</sup>	Recall Apply	Basic procedures for inserting foam earplugs properly
2. EM	Recall Apply	Basic information for wearing earmuffs properly
3. HP	Recognize	Proper use of hearing protection is an individual's responsibility
4. HP	Recall Apply	Information for wearing double hearing protection

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<sup>3</sup>Skill and knowledge domain abbreviations:

EP = Foam earplugs  
EM = Earmuffs  
HP = Hearing protection



## **Discussion Notes**

### **General Information**

NIOSH researchers have observed during drill site visits that hearing protection devices are often misused. As a result, workers may be exposed to excessive levels of noise without realizing it because they think they are wearing their hearing protection properly. The purpose of this training aid is to teach workers about the correct use of hearing protection.

This 3-D training aid is designed to be self-teaching. The visuals are self-instructional because each scene contains wording that briefly and simply describes the particular hearing protection-related activity being shown. As such, no additional information is needed to explain and reinforce the message.

The 3-D reel can be used either by an individual as informal on-the-spot training or by a group of workers in a company-initiated instructional effort. After viewing the 3-D reel, trainees generally look forward to discussing what they see; this serves to reinforce the lesson. Discussions may be held immediately after completing the training or within the next few days. Use the information presented here, along with your own ideas, for dialogue with individual workers or with groups of workers. This will not only help to strengthen knowledge and skills learned, but will also relate the subject to their personal experiences and thus become more meaningful for them.

The following discussion notes provide additional information for your use. The notes are below a 2-D picture of each 3-D scene on the reel. (Note how much more detail can be seen in 3-D compared to the standard two-dimensional pictures shown here.) Read through the notes prior to the actual training activity. Incorporate the information you find here with your own knowledge and make these points, as appropriate, in your followup discussions.

**Scene 1: Wearing hearing protection properly**



The two most common types of hearing protection used in the drilling industry are foam earplugs and earmuffs. To achieve maximum benefit from either of these, they must be worn properly.

Improper use of both earplugs and earmuffs has been observed among drillers. In some cases, foam earplugs were not inserted far enough; in others, they worked their way loose because of head and body movement during work activities. Regardless, earplugs are of little value if they do not fit snug and well within the person's ear.

The improper use of earmuffs typically results in an ineffective seal around the ear and reduced hearing protection.

**Scene 2: Roll and squeeze foam ear plugs**



Before inserting foam earplugs, they should be rolled into a very thin, *crease-free* cylinder. In order to get the diameter of the cylinder as small as possible and crease-free, you should begin by squeezing the earplug lightly as you roll it between your forefinger and thumb. Then gradually apply progressively greater pressure as the plug becomes more tightly compressed.

The earplug may also be rolled in a person's palms to achieve the thin, *crease-free* cylinder. This may be necessary for the person who has small or thin fingers, in which case the cylinder could end up in a distorted "barbell" shape.

A mistake that some people make is to unintentionally roll the foam earplug into a ball or cone, instead of a cylinder. This results in a configuration that cannot be inserted very far into the ear canal and therefore will not provide effective hearing protection.

**Scene 3: Pull ear up and back – insert rolled plug**



In order for the rolled and squeezed cylinder to be inserted into your ear properly, you must reach one hand around the back of your head and pull up and back on your outer ear to straighten the ear canal. If the ear canal is not straightened out, the earplug cannot slide in far enough because of the natural curve inside your ear. You should be able to feel when the earplug is in far enough to provide a good seal.

**Scene 4: Hold plug in ear until expanded**



Foam earplugs must be held in your ear with your finger for 10–20 seconds to allow them to expand. Then, to ensure the best fit possible, you should release and push again for another 5 seconds. At this point, the earplug will be positioned entirely within your ear canal.

**Scene 5: Both muffs and plugs for extremely loud noise**



*Extremely loud noise* may include power saws, guns, pneumatic hammers, radio earphones, and jet airplanes at takeoff.

NIOSH's guideline for using double hearing protection (wearing both earplugs and earmuffs) is for noise exposures that exceed 100 dBA over an 8-hour period. In the mining industry, workplace noise levels of 105 dBA or more over an 8-hour period require mine operators to ensure the use of both earplug and earmuff hearing protectors.

**Scene 6: Glasses and facial hair can cause a bad seal**



The ability of earmuff cushions to seal around the ear is reduced if they are worn over heavy beards, long hair or sideburns, and the sidepieces of eyeglasses. In these cases, the seal is likely to be altered, which will result in loss of hearing protection. To help in maintaining a good seal, it is important that eyeglass sidepieces fit close to the worker's head and be as thin as possible.

**Scene 7: Wear hearing protection *properly***



Hearing loss can be prevented by protecting your hearing in every way possible. This includes wearing hearing protection *both on and off* the job.

The responsibility for wearing hearing protection rests with each worker who may be exposed to loud noise at a drill site.

**Hey! It's Up to You!**

- ... Choose effective hearing protectors
- ... Wear hearing protectors properly
- ... Care for and maintain hearing protectors



## Summary of Field Test Results

NIOSH evaluated the 3-D reel, *Wearing Hearing Protection Properly*, to determine if it is effective for teaching drillers about the proper use of foam earplugs and earmuffs. A simple field experiment was conducted using a sample of 76 persons. The subjects were voluntary participants recruited from conference workshops (National Drilling Association and National Ground Water Association) and drilling company training classes. The procedure used in the experiment was as follows:

Participants were asked to answer eight multiple-choice questions (see appendix A) related to using both types of hearing protection. They were then told to take as much time as needed to view and understand the information shown in all seven scenes on the 3-D reel. Afterward, they were instructed to review their answers in the multiple-choice test and change any they believed to be incorrect. To accomplish this, two sets of answer choices were placed on the multiple choice test sheet—one set in blue (answered before the training), the other set in red (answered after the training). It was theorized that their decision to change answers would be directly related to what they learned from viewing the 3-D reel.

The number of correct answers recorded after viewing the 3-D reel (posttest) was expected to be greater than the number of correct answers recorded prior to viewing the reel (pretest). Such an outcome would support the belief that subjects could learn about the proper use of hearing protection from the training aid. Therefore, it would be concluded that the 3-D reel is an effective training aid for drillers.

The following data were recorded for the experiment:

Subjects had more correct multiple choice answers after viewing the 3-D reel (7.24) than before (6.13). The change in scores was highly significant. It was concluded, therefore, that the 3-D training aid was effective for teaching drillers about wearing hearing protection properly.

### Paired T-test

**N=76**

	Mean	Standard deviation	t-value	p-value
<b>Pretest</b>	6.13	0.998	—	—
<b>Posttest</b>	7.24	0.978	9.38	<0.001

**Answer Key for Pretest / Posttest Questions**

**Wearing Hearing Protection Properly**

1. Which type of hearing protection is it possible to wear improperly?

- a. foam ear plugs
- b. earmuffs
- c. neither a nor b
- d. **both a and b**

- a. *foam ear plugs*
- b. *earmuffs*
- c. *neither a nor b*
- d. ***both a and b***

2. Before placing foam ear plugs in your ears, you should...

- a. roll them in your fingers
- b. squeeze them with your fingers
- c. **roll and squeeze them**
- d. none of the above

- a. *roll them in your fingers*
- b. *squeeze them with your fingers*
- c. ***roll and squeeze them***
- d. *none of the above*

3. Foam ear plugs should be inserted into your ear canals by...

- a. pushing them in with your forefinger until snug
- b. **pulling up and back on ears to open up the canal**
- c. neither a nor b
- d. both a and b

- a. *pushing them in with your forefinger until snug*
- b. ***pulling up and back on ears to open up the canal***
- c. *neither a nor b*
- d. *both a and b*

4. The snug fit of foam ear plugs is achieved by...

- a. inserting them into your ear as far as possible, then letting them expand
- b. **holding them in with your finger until they expand**
- c. neither a nor b
- d. both a and b

- a. *inserting them into your ear as far as possible, then letting them expand*
- b. ***holding them in with your finger until they expand***
- c. *neither a nor b*
- d. *both a and b*

5. Hearing protection for very loud noise should include...

- a. high-quality, well-padded earmuffs
- b. thicker foam ear plugs
- c. ear plugs plus earmuffs**
- d. cotton in your ears plus earmuffs

- a. high-quality, well-padded earmuffs*
- b. thicker foam ear plugs*
- c. ear plugs plus earmuffs***
- d. cotton in your ears plus earmuffs*

6. The effectiveness of earmuffs is reduced by...

- a. long hair
- b. glasses
- c. long sideburns
- d. both b and c
- e. all of the above**
- f. none of the above

- a. long hair*
- b. glasses*
- c. long sideburns*
- d. both b and c*
- e. all of the above***
- f. none of the above*

7. The responsibility for wearing hearing protection rests with...

- a. your supervisor
- b. your spouse or best friend
- c. you**
- d. the manufacturer of the hearing protection
- e. your coworker

- a. your supervisor*
- b. your spouse or best friend*
- c. you***
- d. the manufacturer of the hearing protection*
- e. your coworker*

8. The responsibility for wearing hearing protection **properly** rests with...

- a. your supervisor
- b. your spouse or best friend
- c. you**
- d. the manufacturer of the hearing protection
- e. your coworker

- a. your supervisor*
- b. your spouse or best friend*
- c. you***
- d. the manufacturer of the hearing protection*
- e. your coworker*

## **Appendix A: Pretest / Posttest Questions**

These pages contain the pretest / posttest questions that may be administered to the class or to the individual trainee. Duplicate the pages for each person in the class

**Pretest / Posttest Questions**

**Wearing Hearing Protection Properly**

Directions: Circle the correct answer to each question as follows: Use the first set of answers (normal print) **before** looking at the 3-D reel (pretest), and use the second set of answers (*italic*) **after** looking at the 3-D reel.

1. Which type of hearing protection is it possible to wear improperly?

- a. foam ear plugs
- b. earmuffs
- c. neither a nor b
- d. both a and b

- a. foam ear plugs*
- b. earmuffs*
- c. neither a nor b*
- d. both a and b*

2. Before placing foam ear plugs in your ears, you should...

- a. roll them in your fingers
- b. squeeze them with your fingers
- c. roll and squeeze them
- d. none of the above

- a. roll them in your fingers*
- b. squeeze them with your fingers*
- c. roll and squeeze them*
- d. none of the above*

3. Foam ear plugs should be inserted into your ear canals by...

- a. pushing them in with your forefinger until snug
- b. pulling up and back on ears to open up the canal
- c. neither a nor b
- d. both a and b

- a. pushing them in with your forefinger until snug*
- b. pulling up and back on ears to open up the canal*
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- d. both a and b*

4. The snug fit of foam ear plugs is achieved by...

- a. inserting them into your ear as far as possible, then letting them expand
- b. holding them in with your finger until they expand
- c. neither a nor b
- d. both a and b

- a. inserting them into your ear as far as possible, then letting them expand*
- b. holding them in with your finger until they expand*
- c. neither a nor b*
- d. both a and b*

5. Hearing protection for very loud noise should include...

- a. high-quality, well-padded earmuffs
- b. thicker foam ear plugs
- c. ear plugs plus earmuffs
- d. cotton in your ears plus earmuffs

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6. The effectiveness of earmuffs is reduced by...

- a. long hair
- b. glasses
- c. long sideburns
- d. both b and c
- e. all of the above
- f. none of the above

- a. long hair*
- b. glasses*
- c. long sideburns*
- d. both b and c*
- e. all of the above*
- f. none of the above*

7. The responsibility for wearing hearing protection rests with...

- a. your supervisor
- b. your spouse or best friend
- c. you
- d. the manufacturer of the hearing protection
- e. your coworker

- a. your supervisor*
- b. your spouse or best friend*
- c. you*
- d. the manufacturer of the hearing protection*
- e. your coworker*

8. The responsibility for wearing hearing protection **properly** rests with...

- a. your supervisor
- b. your spouse or best friend
- c. you
- d. the manufacturer of the hearing protection
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- a. your supervisor*
- b. your spouse or best friend*
- c. you*
- d. the manufacturer of the hearing protection*
- e. your coworker*



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