CPWR

THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

Construction Noise

&

Hearing Loss Prevention

Training Program

Instructor Guide

1 Hour Elective Module

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Version I February 2018

BACKGROUND

Construction work is often loud, putting workers at risk of exposure to hazardous noise levels. According to the National Institute for Occupational Safety and Health (NIOSH), roughly 3 out of 4 construction workers are exposed to noise levels above the recommended limit, putting them at risk for hearing loss. Many construction workers experience hearing loss at a young age. As a result, it is common for a construction worker to have the hearing of someone twice their age that has not been exposed to hazardous occupational noise.

There are steps construction employers can take to reduce noise levels and protect their employees from exposure to hazardous noise levels, including buying lower noise equipment, isolating noisy generators or tasks, and providing appropriate hearing protection.

This noise and hearing loss program is designed to provide instructors/trainers with the information needed to raise worker awareness of hazardous noise levels and ways to prevent hearing loss. The program offers options for conducting noise and hearing loss training depending on the time available. It is divided into three parts, each with its own instructor's guide and materials.

This instructor guide for the **1 Hour Module** is designed to provide instructors/trainers with the information needed to successfully fulfill the OSHA 30-hour training program requirement for training on a health hazard.

The other two program modules are:

- **30 Minute Module** – This module is designed to fulfill the OSHA 10-hour training program requirement for a ½ hour training module on a health hazard. Alternatively, it can be used for a portion of the OSHA 30-hour health hazard training requirement.

- **In-Class & Hands-On Refresher Exercises** – This series of short (5-10 minute) exercises are designed to reinforce and apply lessons learned about noise hazards and hearing loss prevention. It includes materials that can be incorporated into safety and health training modules (e.g., PPE, power tools, etc.) or as part of a hands-on skills training programs. The exercises are short (5 – 15 minutes), and each one identifies the materials and related information an instructor will need to carry out the exercise.

  NOTE: The materials can also be used as stand-alone training programs.

To access these other training materials and learn more about hearing loss and methods to control noise, visit https://www.cpwr.com/research/r2p-p2r-work-preventing-hearing-loss.

GENERAL INFORMATION

Teaching materials

- Instructor Guide - includes:
  - Thumbnails and numbers of corresponding PowerPoint slides
  - Notes for each slide
- PowerPoint slides – include:
  - Notes for each slide
  - Video clips:
    - Testimonials from construction workers with hearing loss
    - Steps for inserting ear plugs
- Handouts (referenced in presentation and available in Appendix)
  - *"Are You Talking To Me?"* Exercise Worksheet (Answer key included for instructor's use)
  - *Steps for Inserting Ear Plugs*
  - A pair of foam (formable) hearing protection devices for each participant. You should know how to fit the devices properly and be able to demonstrate their use.

  - The following types of hearing protection devices to show students, including:
    - Reusable earplugs
    - Custom molded plugs
    - Banded or semi-aural
    - Earmuffs
  - A sound level meter or cell phone noise measurement app downloaded onto your phone. If you have an iPhone®, download and use the free NIOSH Sound Level Meter App [https://www.cdc.gov/niosh/topics/noise/app.html]. If you have an Android™, we recommend downloading and using the following free app recommended by NIOSH - SoundMeter App [https://play.google.com/store/apps/details?id=com.gamebasic.decibel]

- Other handouts (optional)
  - *Choosing the Right Hearing Protection*
  - *When and What of Hearing Protection*
  - Hazard Alert Card (pocket size versions available from CPWR by calling 301-495-8500)

Suggestion for time management

It takes approximately 60 minutes to present the noise module. If you are teaching the module for the OSHA 30-hour class to fulfill part of the requirement for 2 hours on health topics, you should make sure you use the full 60 minutes.

PREPARING FOR CLASS

Classroom (NOTE: if this class is being conducted as part of an OSHA 30-hour program, these items may already be in place)

Set up an LCD projector and computer. Click through the PowerPoint to ensure equipment is working properly.

If you don't have a good sound system for your LCD projector, you will need speakers for the video clips used on several slides.

Also you may need a connector device or adapter to hook up the computer, speakers, and screen.

You will also need a flipchart or white board and markers, extra sheets of flipchart paper and masking tape.

REMINDER: Test all embedded video and audio files with the computer and sound system you will be using during the training.

LESSON PLAN

(TIME: 1 HOUR)

Construction Noise & Hearing Loss Prevention

Welcome

NOTES FOR SLIDE 1

The topic of this presentation is Construction Noise and Hearing Loss Prevention.

Introductions

NOTES FOR SLIDE 2

***NOTE* – use this slide if the presentation is being used as a stand-alone training program.**

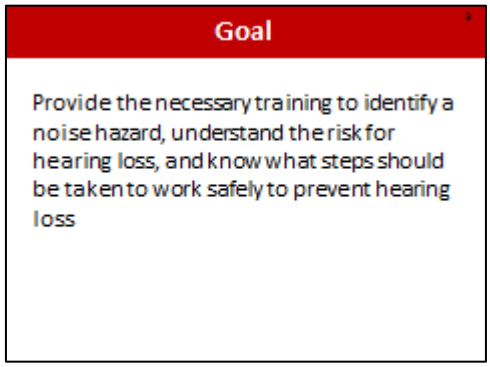
Introductions:

- Your name
- Your trade
- Your years in construction

Goal of the Construction & Hearing Loss Prevention Module

NOTES FOR SLIDE 3

Participants will be introduced to the signs of hearing loss and long-term consequences, sources of hazardous noise, and the importance and proper use of hearing protection.



The Construction & Hearing Loss Prevention Module provides the necessary training to identify a noise hazard, understand the risk for hearing loss, and know what steps should be taken to work safely to prevent hearing loss.

ASK THE CLASS:
Do you know anyone that suffers from hearing loss as a result of working in construction?

OR

Introduce an example from your own experience of someone you know that developed hearing loss because of their years working in construction.

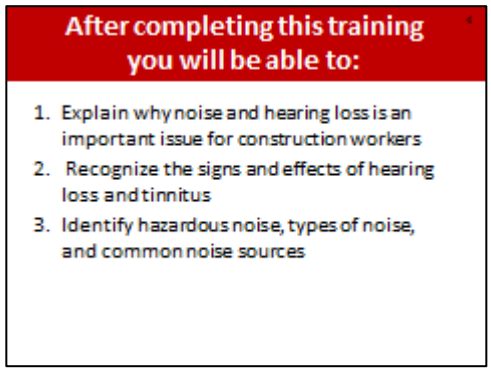
After a brief discussion let them know you'll be talking about ways they can protect their hearing throughout the class.

Learning Objectives

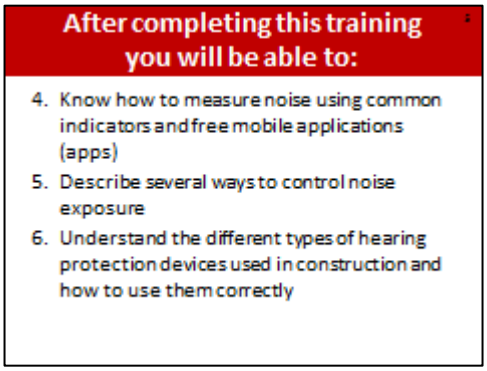
NOTES FOR SLIDES 4 & 5

We expect by the end of this presentation each of you will be able to:

1. Explain why noise and hearing loss is an important issue for construction workers
2. Recognize the signs and effects of hearing loss and tinnitus
3. Identify hazardous noise, types of noise, and common noise sources



4. Know how to measure noise using common indicators and free mobile applications (apps)
5. Describe several ways to control noise exposure
6. Understand the different types of hearing protection devices used in construction and how to use them correctly



How BIG is the Problem?

NOTES FOR SLIDE 6

Hearing loss is a big problem. In fact, it is one of the most common work-related illnesses in the U.S. and, while the numbers vary – according to NIOSH as many as half of construction workers have some job-related hearing problem.

Why care about hearing loss?

NOTES FOR SLIDE 7

ASK THE CLASS:

Why should you care about hearing loss?

On a white board or flipchart write down the responses given by the participants.

Once several people have had a chance to respond, advance the PowerPoint to slide 8.

NOTES FOR SLIDE 8

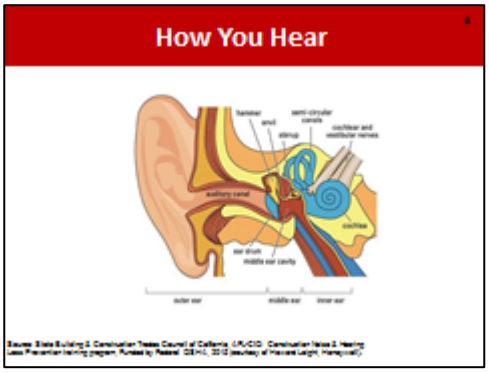
Many construction workers lose their hearing at a young age; it is not just a problem for older workers.

In fact, construction workers experience hearing loss at a younger age than the general population. According to NIOSH, the average 25-year-old construction worker has the hearing of a 50-year old person.

Too often construction workers think that too much noise is just part of the job and nothing can be done about it. This is not the case and that's why it's important to know when noise levels are dangerous and what can be done to control the noise level and protect your hearing.

How You Hear

NOTES FOR SLIDE 9



Let's start with how you hear and how loud noises impact your ability to hear.

This slide shows the anatomy of the ear.

The ear is made up of three basic parts:

1) The outer ear

2) The middle ear

3) The inner ear

Sound travels down the outer ear canal, hits the eardrum and makes it vibrate -- move back and forth. The vibrations pass through the middle ear which creates motion in the inner ear that is filled with fluid. The movement of fluid in the inner ear, also called the cochlea (pronounced coke-lee-a), bends thousands of delicate tiny hair-like nerve cells. The movement of these hair cells sends signals to the brain through the auditory nerve. The brain interprets these signals as sound.

A video produced by Work Safe BC described the hair cells in your ear like grass in a field. When the wind blows, the grass bends and reacts to it. If it is treated

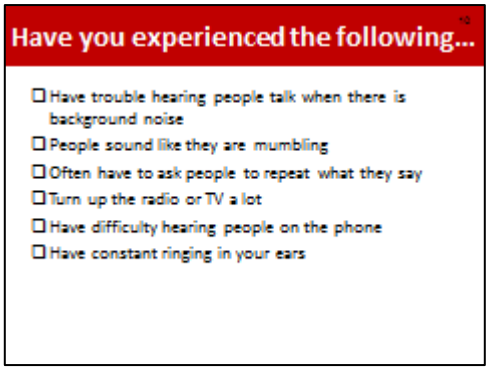
too harshly, the grass stem breaks. When grass is cut it eventually grows back. Unfortunately, your hair cells do not, and that is why hearing loss is permanent and irreversible.

According to the American Speech-Language-Hearing Association, "the human ear is a fully developed part of our bodies at birth," so the hearing you are born with is what you will have for life if it is protected from damage.

Have you experienced the following…

NOTES FOR SLIDE 10

Read each item on the slide. After each item, ask the class to make a note to themselves if they have experienced it.



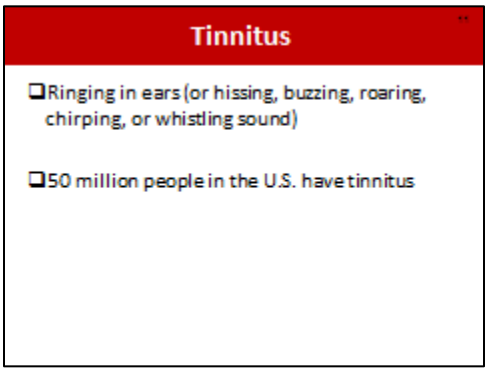
After you read all of them

TELL THE CLASS:
These are all symptoms of hearing loss. Hearing loss occurs gradually over time so you won't notice small changes or loss in hearing immediately.

Ringing In the Ears -- Tinnitus

NOTES FOR SLIDE 11

The last item on the previous slide is a sign of tinnitus (pronounced either ti-NIGHT-us or TIN-i-tus.)



In addition to a ringing sound, tinnitus can sound like a hissing, buzzing, roaring, chirping, or whistling sound. It is a sign that something is wrong in the auditory system, which includes the ear, the auditory nerve that connects the inner ear to the brain, and the parts of the brain that process sound.

Tinnitus can be caused by noise-induced hearing loss, and some health conditions, including ear and sinus infections, brain tumors, and certain medications and drugs.

The American Tinnitus Association (ATA) estimates over 50 million Americans experience tinnitus. Of these, 12 million have tinnitus severe enough to seek medical attention and approximately 2 million people are so debilitated they cannot function at a normal level on a day-to-day basis.

Nothing can be done to fix your hearing once it is permanently damaged – but the good news is that noise-induced hearing loss is preventable.

Are You Talking to Me? What it's like to lose your hearing

NOTES FOR SLIDES 12-19

NOTES FOR SLIDE 12

When you work in construction, you are exposed to noise created by the work you're doing and noise created by other work on the jobsite.

Being able to hear what's going on around you has a direct impact on your safety and your life.

Let's do a listening activity that will help us experience what it's like not to be able to hear.

INSTRUCTOR NOTES

Slides 14-18 contain audio files. You may exclude the final 2 audio files – slides 17 and 18 – if a shorter version is needed.

Play each of the audio files. At the end, show the slide that lists all of the words in the order they were said in the audio files and ask the class to check it against their worksheet.

The files include 10 words that are repeated in the first 4 audio files (the last audio file has a different set of 10 words). The ten words were picked to include a wide variety of speech sounds, but with particular emphasis on sounds that can be significantly affected by hearing loss.

- **The first file simulates what it would be like to have severe hearing loss on a construction site.**
- **The second file simulates what it would be like to have mild hearing loss on a construction site.**

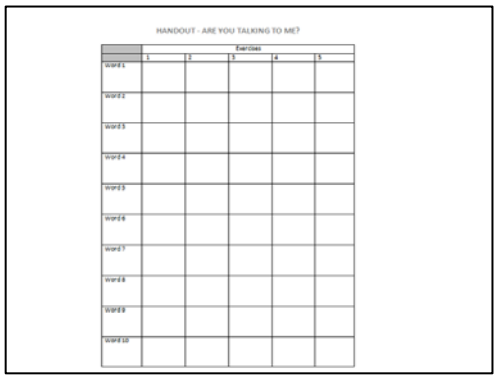
- **The third file simulates what it is like to hear the words with <u>normal</u> hearing on a construction site.**
- **The fourth file simulates what it is like to hear the words with <u>normal</u> hearing in a quiet room.**
- **The fifth file simulates what it would be like to have <u>moderate</u> hearing loss in a quiet room, but with a female speaker.**

Note: Used by permission from Dr. Robert M. Ghent and Brad K. Witt of Honeywell Safety Products, San Diego, CA. The hearing loss simulations were applied using the CDC/NIOSH Hearing Loss Simulator at http://www.cdc.gov/niosh/mining/works/conversheet1820.html. The original speech materials were developed and produced by Dr. Richard W. Harris, Dr. Ron W. Channel, and Dr. Shawn Nissen, Department of Communication Disorders, Brigham Young University.

ARE YOU TALKING TO ME? WORKSHEET

NOTES FOR SLIDE 13

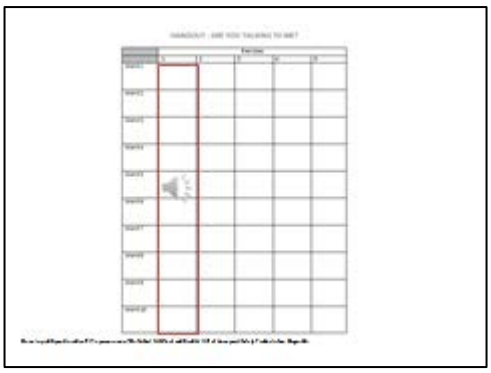
Hand out a copy of the worksheet – Are you talking to me? *("Are You Talking to Me? Worksheet*) to each participant.



TELL THE CLASS:
We're going to go through five hearing exercises – there's a column for each on your worksheet. For each one, I'm going to play an audio file. Each audio file has 10 words in it. As you listen – try to write down each word that you can hear in the correct column of your worksheet. Feel free to make a guess. At the end of this exercise, we will see how many we got correct.

I'm not going to collect the worksheets. The worksheets are so that you can keep track of what you hear for our discussion.

ARE YOU TALKING TO ME? – AUDIO 1



NOTES FOR SLIDE 14

Let's start with the first audio file. You're going to fill in the first column. As you hear words, write them down in the order that you hear them – don't wait until the audio ends.

Play the audio file by clicking the sound image or play button on the screen.

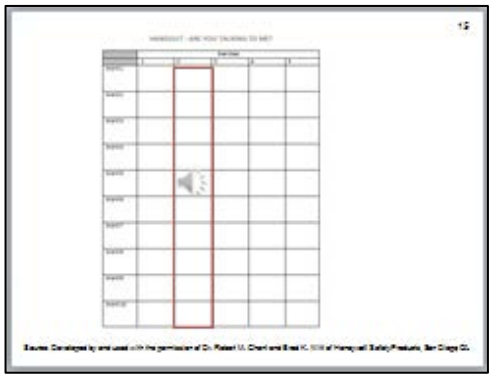
After the audio file finishes:

ASK THE CLASS:
Was it easy to make out the words? What level of hearing loss do you think this represents?

Give the class a few minutes to respond then.

TELL THE CLASS:
This audio was an example of severe hearing loss with a man saying 10 words overtop background noise from a construction site.

ARE YOU TALKING TO ME? AUDIO 2



NOTES FOR SLIDE 15

Now let's listen to the second audio file – write down what you hear in the second column.

Play the audio file by clicking the sound image or play button on the screen. Have the class write what they hear in the second column of their worksheet.

After the audio file finishes:

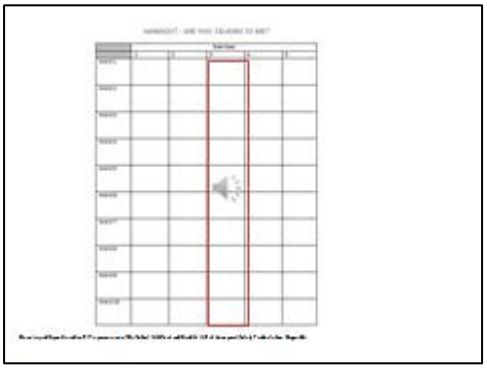
ASK THE CLASS:
Was it easy to make out the words? What level of hearing loss do you think this represents?

Give the class a few minutes to respond then.

TELL THE CLASS:
This audio was an example of mild hearing loss with a man saying 10 words overtop background noise from a construction site.

ARE YOU TALKING TO ME? AUDIO 3

NOTES FOR SLIDE 16



Now let's listen to the third audio file – write down what you hear in the third column.

Play the audio file by clicking on the sound image or the play button on the screen.

After the audio file finishes:

ASK THE CLASS:
Was it easy to make out the words? What level of hearing loss do you think this represents?

Give the class a few minutes to respond then.

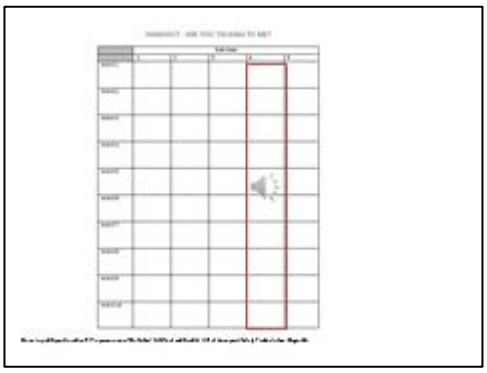
TELL THE CLASS:
This audio was an example of no hearing loss with a man saying 10 words overtop background noise from a construction site.

INSTRUCTOR NOTE:

If you are doing a shorter version and not using slides 17 and 18, jump ahead to slide 19.

ARE YOU TALKING TO ME? AUDIO 4

NOTES FOR SLIDE 17



These last two audio files may be a test of how well you hear away from work. Write down what you hear in the fourth column.

Play the audio file by clicking on the sound image or the play button on the screen.

After the audio file finishes:

ASK THE CLASS:
Was it easy to make out the words? What level of hearing loss do you think this represents?

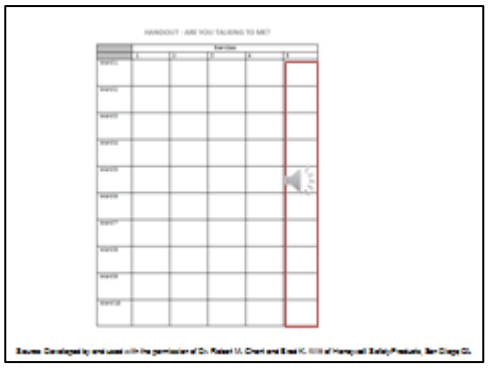
Give the class a few minutes to respond then.

TELL THE CLASS:

This audio was an example of no hearing loss with a man saying 10 words with no background noise.

ARE YOU TALKING TO ME? AUDIO 5

NOTES FOR SLIDE 18



Now let's play the final audio file. Write down what you hear in the final column.

Play the audio file by clicking on the sound image or the play button on the screen.

After the audio file finishes –

ASK THE CLASS:
Was it easy to make out the words? What level of hearing loss do you think this represents?

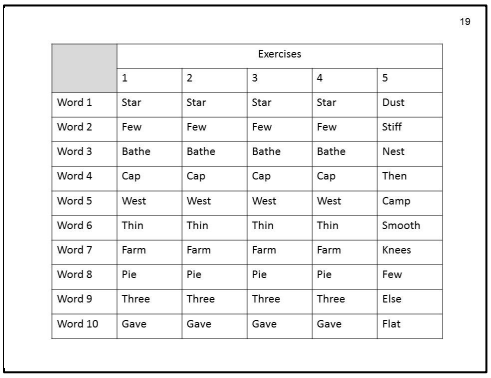
Give the class a few minutes to respond then.

TELL THE CLASS:
This audio was an example of moderate hearing loss with a woman saying 10 words with no background noise.

ARE YOU TALKING TO ME? ANSWERS TO WORKSHEET

NOTES FOR SLIDE 19

Tell the class to take a few minutes to check what they wrote down against the results.



19

	Exercises				
	1	2	3	4	5
Word 1	Star	Star	Star	Star	Dust
Word 2	Few	Few	Few	Few	Stiff
Word 3	Bathe	Bathe	Bathe	Bathe	Nest
Word 4	Cap	Cap	Cap	Cap	Then
Word 5	West	West	West	West	Camp
Word 6	Thin	Thin	Thin	Thin	Smooth
Word 7	Farm	Farm	Farm	Farm	Knees
Word 8	Pie	Pie	Pie	Pie	Few
Word 9	Three	Three	Three	Three	Else
Word 10	Gave	Gave	Gave	Gave	Flat

Here are the words that were in each audio file. Take a few minutes to check how you did.

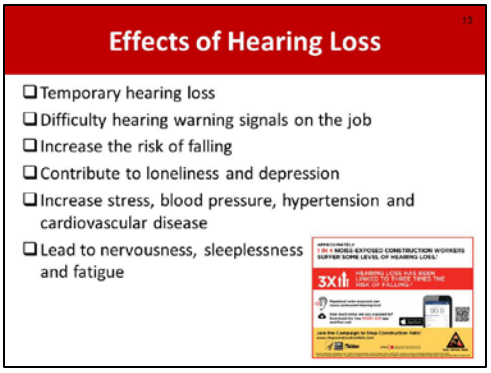
ASK THE CLASS:
Raise your hand if you were surprised by how you did.

THEN ASK THE CLASS:
How did the jobsite noise in the background effect what you could hear?
Give the class a few minutes to respond.

TELL THE CLASS:
Experts tell us that in the first stages of hearing loss, it becomes difficult to hear high frequencies. For example, you may have difficulty hearing or understanding the high-pitched voices of children. People with hearing loss often have difficulty differentiating words that sound alike, especially words that contain S, F, SH, CH, H, TH, T, K, or soft C sounds. The words on the audio files we heard today contained letter combinations that are usually affected by work-induced hearing loss.

Effects of Hearing Loss

NOTES FOR SLIDE 20



Being exposed to loud noises can result in temporary hearing loss lasting 16 to 48 hours.

While the effect may seem temporary, there may be lasting damage to your hearing and have other effects that you might not think about.

Hearing loss can interfere with communication on jobsites, making it difficult to hear warning signals.

It can impact a person's sense of balance leading to an increased risk of falling.

Hearing loss can also have a huge effect on social interactions – leading to feelings of loneliness and depression. Recent research has also shown that hearing loss may play an important role in brain health as an individual ages, from mild impairments to dementia. (Source: https://www.aarp.org/health/brain-health/info-07-2013/hearing-loss-linked-to-dementia.htmlhttps://www.aarp.org/health/brain-health/info-07-2013/hearing-loss-linked-to-dementia.html)

Exposure to excessive noise can also increase stress and blood pressure, and can lead to nervousness, sleeplessness and fatigue.

What causes hearing loss?

NOTES FOR SLIDE 21

The most common cause of hearing loss is exposure to loud noises. Called Noise-Induced Hearing Loss, it can be caused by a one-time exposure to a loud sound like an explosion or by repeated exposure to sounds over 85 decibels for an extended period of time.

Other causes include:

- Ear-damaging drugs, medications and chemicals, such as some solvents used in construction. These are called ototoxic drugs and chemicals.
- Aging – approximately one in three people between the ages of 65 and 74 has hearing loss.
- Heredity
- A head injury
- Headphone use – listening to loud music or noises using headphones, particularly ear buds, have been shown to cause some damage to cochlea, which may become permanent
- Childhood illnesses – such as an ear infection

INSTRUCTOR NOTE:

The following are links to additional resources on causes of hearing loss from childhood illnesses, drugs, chemicals, and headphone use:

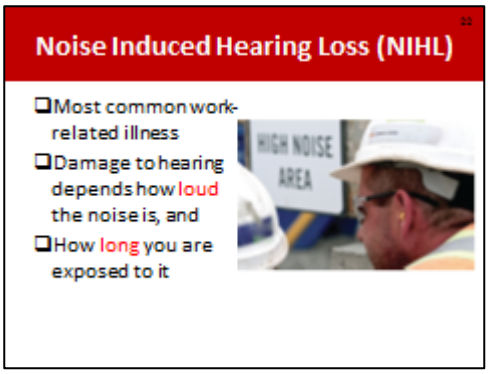
- **Childhood hearing loss: https://www.asha.org/public/hearing/Causes-of-Hearing-Loss-in-Children/**
- **Ototoxic drugs: https://www.asha.org/public/hearing/Ototoxic-Medications/**

- **Ototoxic chemicals:** http://www.howardleight.com/assets/attachments/421/Oto toxic-Chemical-Exposures-2015.pdf?1449175343
- **Headphone use:** http://www.scielo.br/scielo.php?pid=S1516-18462014000300779&script=sci_arttext&tlng=en & http://www.osteopathic.org/osteopathic-health/about-your-health/health-conditions-library/general-health/Pages/headphone-safety.aspx

Noise Induced Hearing Loss (NIHL)

NOTES FOR SLIDE 22

Noise-induced hearing loss continues to be one of the most common work-related illnesses in the U.S.



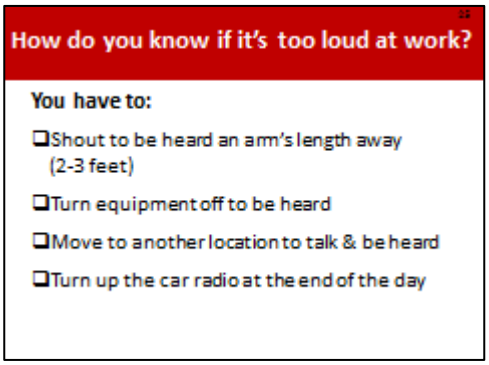
It can be caused by a one-time exposure to a loud sound, like an explosion, or by repeated exposure to loud sounds over the recommended limit of 85 decibels for an extended period of time.

The amount of damage done by noise depends mainly on how loud the noise is and how long you are exposed to it. The louder the sound, the shorter the amount of time it takes for noise-induced hearing loss to happen.

How Do I Know If It Is Too Loud?

NOTES FOR SLIDE 23

Only show the title of the PowerPoint slide "How do you know if it's too loud at work?"



ASK THE CLASS:
Does anyone know a way to determine if the noise level is too loud while you are at work?

Give them a few minutes to answer – if no one knows, click to bring up the rest of the slide.

This slide lists a few easy ways to know if it's too loud:

- You have to shout to be heard when you're an arm's length – about 2 or 3 feet away from the person you're talking to.
- You need to turn off the equipment you're using to be heard.
- You need to move to another location to talk and be heard.
- You have to turn the sound on your car radio up after the shift.

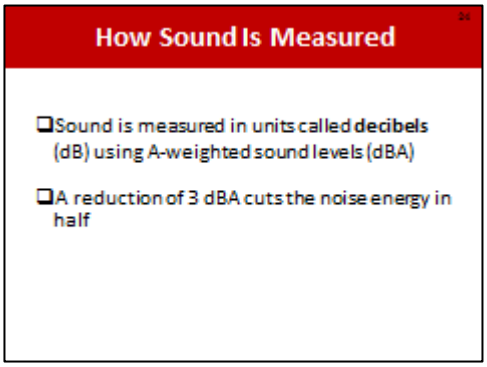
TELL THE CLASS:
For your take-home assignment, the next time you drive to work, turn your radio on to the lowest level where you can hear it without having to strain to listen.

Don't change the settings before you get out of the car.

After work, see if you need to turn up the sound – if you need to, that's a sign you've been exposed to hazardous noise levels during the day.

How Is Sound Measured?

NOTES FOR SLIDE 24



Now, the ones we just discussed are informal measures.

But how is sound actually measured?

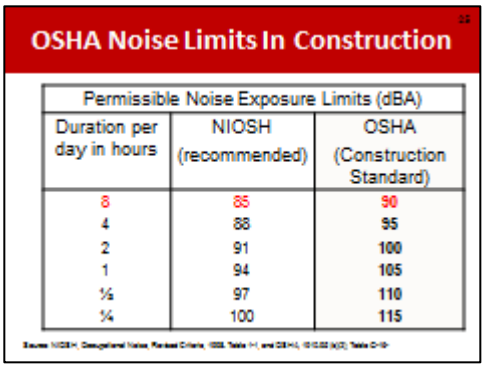
It's measured in units of sound pressure levels called decibels (named after Alexander Graham Bell) using A-weighted sound levels (dBA). The A-weighted sound levels closely match the perception of loudness by the human ear.

The decibel scale is a logarithmic scale – meaning that a small increase in dBA numbers represents a huge change. For example, using equipment just 3 decibels lower can cut the noise energy reaching your ears by half. That's why even a small increase or decrease in a piece of equipment's noise level can make a big difference for your hearing.

OSHA Noise Limits in Construction

NOTES FOR SLIDE 25

The table in the slide shows the limits set by NIOSH and OSHA for the amount of noise workers can be exposed to on the job by the length of time.



Permissible Noise Exposure Limits (dBA)		
Duration per day in hours	NIOSH (recommended)	OSHA (Construction Standard)
8	85	90
4	88	95
2	91	100
1	94	105
½	97	110
¼	100	115

The NIOSH **R**ecommended **E**xposure **L**imit or REL is 85 decibels for an 8 hour day. OSHA's **P**ermissible **E**xposure **L**imit or PEL for noise is 90 decibels for an 8 hour day.

OSHA states: "If you are exposed to an average of 90 decibels for 8 hours…that 'feasible' administrative and engineering controls must be used," and "If these fail to reduce sound levels to the PEL, workers must wear hearing protection devices (HPDs) and be trained on how to properly use them."

While the PEL is the legal limit, averaged over an 8-hour workday, for exposure to workplace noise (unless you use special protection or controls), NIOSH has recommended OSHA update their PEL to the REL of 85 decibels for an 8 hour day stating, "Exposures at and above this level are considered hazardous."

As this chart shows, the louder a noise is (the last two columns), the less time it takes to have been exposed above the NIOSH REL and the OSHA PEL (the first column).

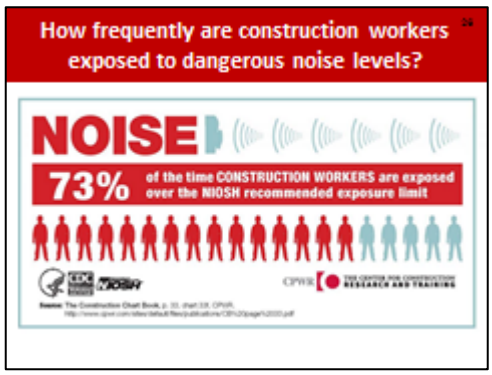
How frequently are construction workers exposed to dangerous noise levels?

NOTES FOR SLIDE 26

Only show the title of the slide "How frequently are construction workers exposed to dangerous noise levels?"

ASK THE CLASS:

While it will vary by trade and type of work, overall what percentage of the time do you think construction workers are exposed to dangerous noise levels?

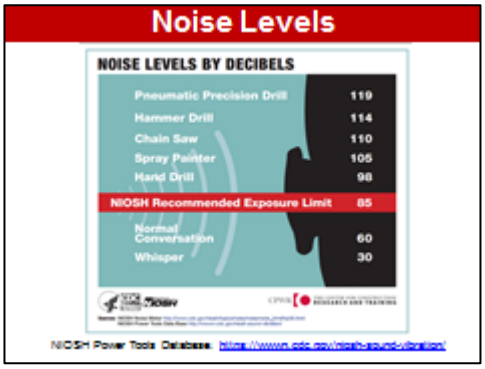


Once several people respond, click on the PowerPoint to show the rest of the slide.

TELL THE CLASS:
The answer is that overall, construction workers are exposed to noise levels over the NIOSH REL – the recommended limit – 73% of the time.

Noise Levels

NOTES FOR SLIDE 27



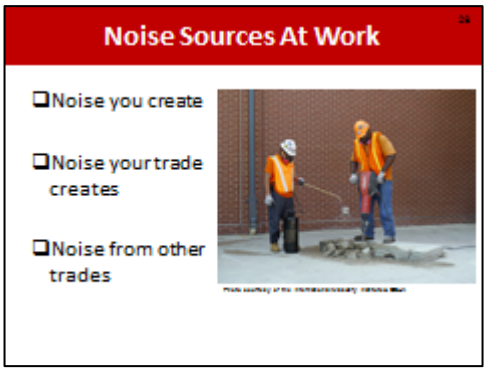
This slide shows noise levels for common tools compared to the NIOSH REL, normal conversation, and a whisper.

As you can see, even a hand drill – which can be found on most job sites – produces dangerous noise levels that can damage hearing.

One resource you can use to get a rough idea of the noise produced by a given tool is the NIOSH power tools database. While it does not have every tool, it has enough to give you a good idea of whether or not the one you are using may be putting your hearing at risk. You can find it at: https://wwwn.cdc.gov/niosh-sound-vibration/.

Noise Sources at Work

NOTES FOR SLIDE 28



In addition to the noise generated by individual tools, noise is also generated by tasks:

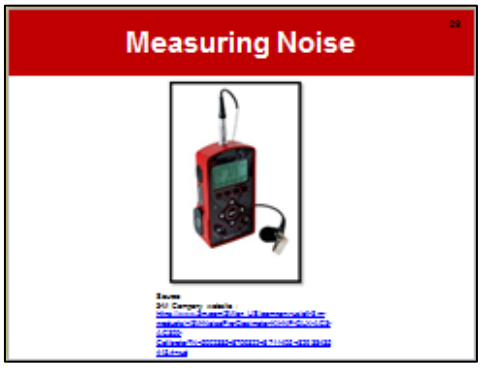
- That you are doing.
- That others in your trade are doing.
- And that other trades are doing.

Some of this noise you or your employer may be able to control – but some you won't be able to. To protect your hearing, you need to think about all of the noise being generated around you.

Measuring Noise Tells You More

NOTES FOR SLIDE 29

While the simple signs mentioned earlier and the noise levels assigned to specific pieces of equipment may alert you to hazardous noise, the only way to accurately know how much noise you are being exposed to is by monitoring the noise while it's happening.



Noise Measurement Devices

NOTES FOR SLIDE 30

If you have a sound meter, personal dosimeter, and/or an in-ear dosimeter show them to the class.

There are different ways to measure noise.

Two commonly used methods to monitor noise levels at the workplace are personal (worker) sampling using a noise dosimeter and area sampling using a sound level meter.

A noise dosimeter is worn by the worker to measure the amount of noise the worker is exposed to during the work shift or sampling period. The dosimeter stays on the worker for a certain sampling period – several hours, or even the entire workday – and continuously monitors the noise. At the end of the sampling period, a read-out shows the average noise level.

The newest method to measure exposure is to directly measure the individual's protected exposure with "**in-ear dosimetry**." Integrated into earplugs or earmuffs, an in-ear dosimetry device measures and records the actual amount of noise the worker is exposed to, with and without hearing protection, over their entire work shift.

A person has to be trained to use both of these methods.

A sound level meter (SLM) is the basic instrument for measuring noise levels. Any worker can use a SLM. Some common uses for sound level meters include to:

- Spot check noise levels in the work area
- Determine an individual employee's noise levels
- Check an individual noise source – such as a piece of equipment or task being performed.

Cell Phone Apps Can Help You Measure Noise

NOTES FOR SLIDE 31

There are also free sound level meter apps you can put on a smart phone. While not as accurate as the equipment we just discussed, these mobile apps are readily accessible and they keep improving.

The new sound level meter app developed by NIOSH for the iPhone is considered very good. In addition to measuring sound levels in the workplace, it includes recommendations to reduce hearing loss. It can be downloaded on any iPhone https://www.cdc.gov/niosh/topics/noise/app.html.

For those with an Android device, NIOSH recommends the SoundMeter App. Apps for android devices vary in accuracy and generally are not as accurate as the iPhone app because the phone manufacturers vary. As a result, the android apps in particular work better if you install an external microphone on your phone.

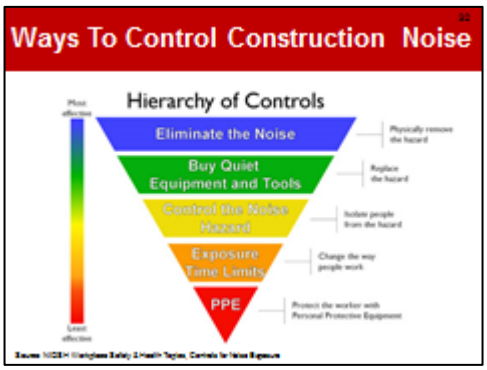
If you have an app installed on your phone, show it to the class and demonstrate how it works by measuring the noise in the room.

ASK THE CLASS:
Can you think of some ways that a noise app could be used as part of your training or on the job?

Write their responses on a flip chart or white board – after the class, share the ideas with CPWR's Training Department so that the ideas can be shared with other trainers and incorporated into future versions of the training program.

Ways to Control Noise

NOTES FOR SLIDE 32



So far, we've discussed the risk, sources of, and how to measure noise.

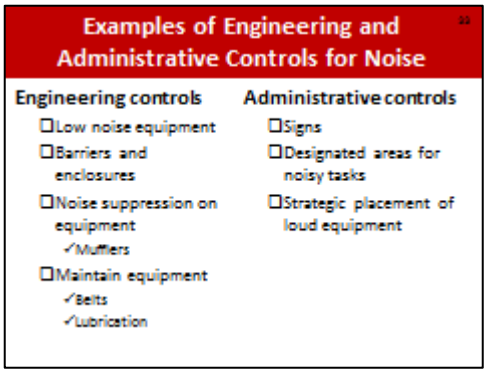
Now we're going to shift to ways to control construction noise.

This slide shows the hierarchy of controls, specific to noise.

The most effective option is to eliminate the noise altogether – this may seem challenging in construction, but research on quieter equipment is moving the industry in that direction. If you can't eliminate the noise source, then the next best option is to look for ways to reduce the noise levels.

Examples of Engineering and Administrative Controls for Noise

NOTES FOR SLIDE 33



Engineering controls are considered the most effective because they get rid of the hazard at the source.

Examples of engineering controls would be low-noise equipment, putting barriers or enclosures around noisy equipment (such as generators), putting noise suppression devices (such as mufflers) on equipment, and making sure equipment is well maintained.

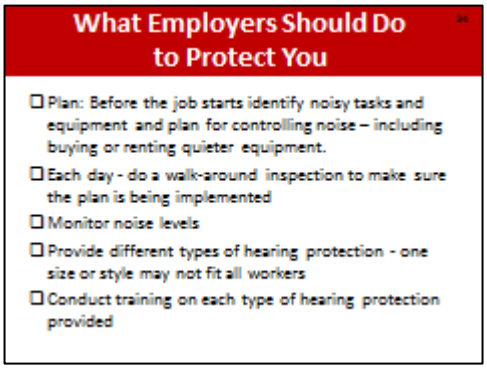
A recent CPWR study on drills found a significant reduction in noise just by replacing a worn drill bit with a new one.

Administrative controls can also help. These are policies and procedures to reduce noise by limiting workers exposure to it. Examples of administrative controls include putting up signs warning workers that noise within a specific area

is hazardous, designating specific areas for performing noisy tasks – such as cutting materials with power tools, and placing loud equipment in locations where the fewest number of workers will be exposed.

What Employers Should Do to Protect You

NOTES FOR SLIDE 34



Although it is your hearing that's at risk, it is the employer's responsibility to take steps to protect you from exposure to dangerous noise levels.

Here are some steps that an employer can take to reduce their employees' exposure to dangerous noise levels:

- **Plan:** Before the job starts, identify the noisy tasks and equipment, when and where they will be performed, and the actions that will be taken to reduce noise exposures.
- **Inspect:** Each day, do a walk-around inspection to make sure the plan is being implemented.
- **Monitor** noise levels.
- **Provide** different types of hearing protection - one size or style may not fit all workers.
- **Conduct training** on each type of hearing protection provided.

"Buy Quiet" Now, Hear Later

NOTES FOR SLIDE 35

Employers can also buy quieter equipment.
NIOSH's Buy Quiet program was established to:

- Encourage companies to purchase or rent quieter equipment to reduce worker noise exposure.
- Provide information on equipment noise levels, so companies can make informed decisions when replacing or renting equipment.
- And move manufacturers to design quieter equipment by creating a demand for quieter products.

Signs Can Tell You When to Wear Your Hearing Protection

NOTES FOR SLIDE 36

While there are many things your employer can do to prevent or reduce noise exposure, when exposed to noise above OSHA PEL of 90 decibels, you are required to wear hearing protection. However, when exposed to noise above NIOSH's recommended exposure level of 85 decibels, we recommend wearing hearing protection.

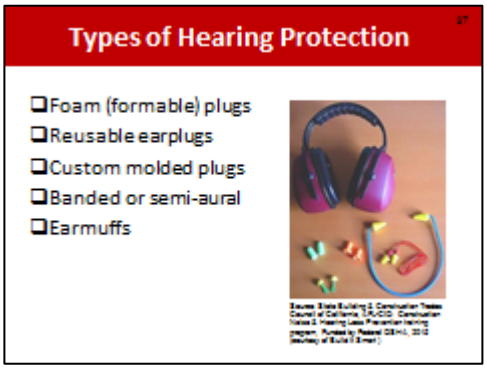
Types of Hearing Protection

If you have examples of hearing protection, hold them up as you mention each one.

NOTES FOR SLIDE 37

There are several types of hearing protection:

- Foam plugs
- Reusable earplugs
- Custom molded plugs
- Banded or semi-aural
- Earmuffs



OSHA requires employers to provide hearing protection at no cost to their employees.

Selecting Hearing Protection

NOTES FOR SLIDE 38

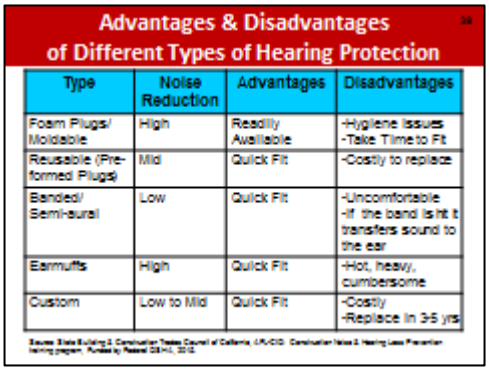
There are seven factors to consider when selecting hearing protection. Convenience, comfort, communication needs, hygiene, hearing ability, noise levels – and most importantly the noise reduction needed.

Advantages & Disadvantages of Different Types of Hearing Protection

NOTES FOR SLIDE 39

Each type of hearing protection has advantages and disadvantages.

Foam plugs and ear muffs provide a high level of protection and tend to be readily available. But they need to be used and maintained properly.



Care and Maintenance

NOTES FOR SLIDE 40

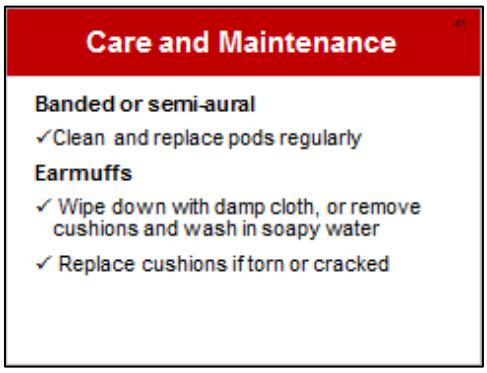
As noted earlier, care and maintenance of your hearing protection is critical. OSHA requires employers to make sure hearing protection is provided and properly maintained.

This slide and the next show the basic care that is needed for hearing protection.

- Formable foam ear plugs should be replaced after each use.
- Reusable plugs should be cleaned with soap and water and replaced when worn or damaged.
- Custom plugs should be cleaned with mild soapy water.

NOTES FOR SLIDE 41

Banded or semi-aural hearing protection should be cleaned and the pods (the part that goes in your ear) replaced regularly.



Earmuffs should be wiped down with a damp cloth – and if the cushions can be removed, they should be cleaned with soapy water. Cushions that are torn or cracked should be replaced.

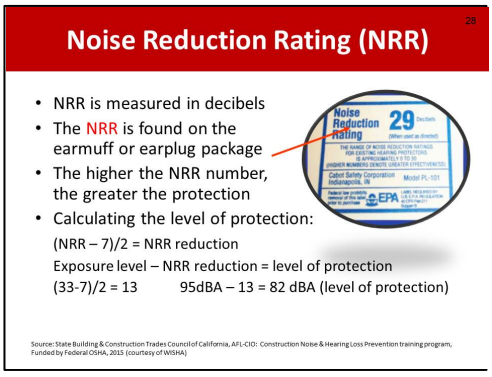
Remember, your employer must train you on ways to properly care for this equipment, and the manufacturer will also have instructions for their use.

And ask for new hearing protection if yours is dirty or worn.

Noise Reduction Rating (NRR)

NOTES FOR SLIDE 42

Now that you know they need to be maintained, how do you select the right hearing protection for the noise you are being exposed to?



Hearing protection devices are tested in a laboratory to determine how much noise they block from reaching your ears. This is called the **N**oise **R**eduction **R**ating or NRR. The EPA requires manufacturers to list the NRR on the hearing protection device's package.

The higher the NRR, the greater the protection, however, since lab conditions are not the same as workplace conditions, the actual noise reduction is at least 7 dBA less than the printed NRR. So if, for example, you select hearing protection with a NRR of 29, you should plan for noise reduction of 22.

Here's one way to figure out how much your hearing protection is reducing your exposure. If your hearing protection's NRR is 33, for example. You would subtract 7 from 33 and divide the results by 2 – so 33 minus 7 equals 26. 26

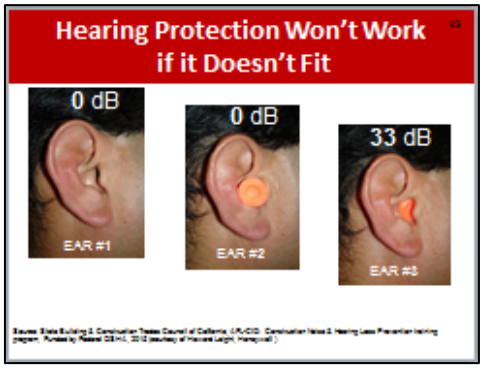
divided by 2 equals 13. Subtracting that number from your noise exposure of 95 dBA will let you know that your exposure with this hearing protection is 82 – below the NIOSH REL and the OSHA PEL.

If you do not have the hearing protection device's packaging, ask your supervisor or employer for the NRR. Another option is to go online. You can either look up the NRR if you know the brand and name of the device or you can use NIOSH's Hearing Protector Device Compendium (https://www.cdc.gov/niosh/docs/2012-178/) to look up the device.

Hearing Protectors Don't Work If They Don't Fit

NOTES FOR SLIDE 43

Each click will bring up another image: It will show 0 dB for ear #1, 0 dB for ear #2, and 33 dB for ear #3.



But as the examples on this slide shows, even if it's the right NRR, if the hearing protection is not used properly – if it does not fit – then it will not work.

ASK THE CLASS:
Why do you think the second ear #2 is not protected?

Give them a few minutes to respond and then explain:

The second earplug is not fitted properly and it is also worn around the edges, so it doesn't give a good fit, and won't be protective.

Roll – Pull – Hold

NOTES FOR SLIDE 44

Since ear plugs will not protect your hearing unless they are inserted properly, let's start by watching this short NIOSH video on how to properly use ear plugs.

Click on the play button on the embedded video to start. The video is 30 seconds. Internet connection is not required to play the video.

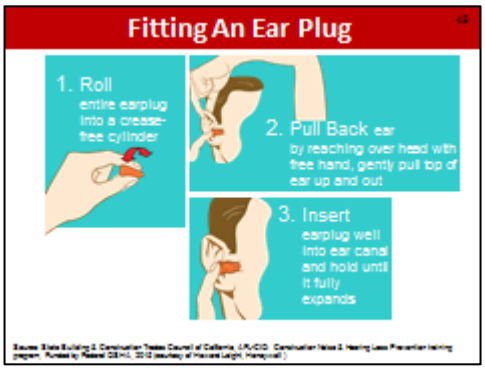
ADDITIONAL INSTRUCTOR NOTES:

This video has been tested to play on the Windows platform. Mac users experiencing difficulty can view the video here, https://www.youtube.com/watch?v=Veayb1NucTA (requires internet connection) or contact CPWR's Training Department for a version of the presentation that includes Mac compatible video.

How to Fit an Ear Plug

NOTES FOR SLIDE 45

Pass out a set of foam ear plugs to each class participant and tell them to follow your instructions.



Now let's try to insert ear plugs correctly. I'll walk you through the steps so we're all doing it together.

- First roll foam plug tightly. Make sure there are no creases.
- Next, pull your ear back gently at the top to straighten the ear canal.
- Insert the plug.
- Release your ear while holding the plug for 20-30 seconds. It will expand to the shape of your ear canal.
- When plug has expanded, tug on it gently to see if it is secure.

Now let's do our other ear. Remember:

- First roll foam plug tightly. Make sure there are no creases.
- Next, pull your ear back gently at the top to straighten the ear canal.
- Insert the plug.
- Release your ear while holding the plug for 20-30 seconds. It will expand to the shape of your ear canal.
- When plug has expanded, tug on it gently to see if it is secure.

Check the fit when you're all done. Cup your hands firmly over your ears and release.

TELL THE CLASS:
You can take them out now.

When you did that last step, the earplugs should have been blocking enough noise so that covering your ears with your hands resulted in no significant change in noise level.

Don't hesitate to ask me or another instructor how to insert them properly – I guarantee you – we didn't all do it right the first time.

Give all participants a copy of handout *"Steps for Inserting Ear Plugs."*

This handout includes the steps for proper use of ear plugs and the link to the video we watched. I'd encourage you to retry inserting the ear plugs until you're comfortable that you understand how to do it properly.

What's it like to lose your hearing?

NOTES FOR SLIDE 46

Show the slide, but do not click on the video immediately – to play the video, click on the middle of the screen or the play button. The video should begin to play. The video is 2 minutes and 25 seconds long and does not need an internet connection to play.

We've reviewed the risk and discussed how to prevent hearing loss and use hearing protection.

Before we end this session, I want to focus on the real-life implications of losing your hearing.

Play the video clip.

Remember, hearing protection won't work if you don't use it. If your employer doesn't hand it out – ask for it. If your employer says hearing protection is optional – you should wear hearing protection. Also, you can ask for your employer to reduce noise by isolating noisy equipment, buying low noise equipment, or other controls. As Robbie Hunter said in the video – make the investment in the quality of your life by ensuring your hearing is protected.

ADDITIONAL INSTRUCTOR NOTES:

This video has been tested to play on the Windows platform. Mac users experiencing difficulty can view the video here, https://youtu.be/20KKMEyd6SE (requires internet connection) or contact CPWR's Training Department for a version of the presentation that includes Mac compatible video.

The full video was developed by the California State Building Trades. Excerpts are being used with their permission. The full video can be found on YouTube: https://www.youtube.com/watch?v=YX1kMPDZbgg&feature=youtu.be or you can request a copy from CPWR.

Another video created by the Oregon-Columbia Chapter of AGC in cooperation with the Northwest Carpenters Union and Dwightly Creative Agency can be used and found here: https://www.agc-oregon.org/industry-priorities/focus-four-health/.

What We Covered

NOTES FOR SLIDES 47

Just to recap – today we covered the risk for hearing loss, sources of noise, how to measure noise levels and control exposures, hearing protection devices, and real life lessons.

If you decide to use any of the optional handouts, distribute them now and tell the class to use them as reminders of what they learned: "*Choosing the Right Hearing Protection;*" "*When to use hearing protection;*" and the "*Noise and Hearing Loss Hazard Alert Card.*"

Does anyone have any final questions or comments?

Acknowledgements

NOTES FOR SLIDE 48

Instructor Note – bring this slide up and leave on the screen for a few minutes.

Before we close, I just want to note that many of the materials for this module were adapted from a training program produced by the State Building and Construction Trades Council of California (under an OSHA Susan Harwood Grant -SH-26283-SH4) and used with their permission.

The “Are You Talking To Me?” audio tapes and exercise were developed by and used with the permission of: Dr. Robert M. Ghent and Brad K. Witt of Honeywell Safety Products, San Diego, CA.

ACKNOWLEDGEMENTS

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Many of the materials for this module were adapted from a training program produced by the State Building and Construction Trades Council of California (under an OSHA Susan Harwood Grant -SH-26283-SH4) and used with the permission of Laura Boatman, Project Coordinator for the SBCTC of CA.

The “Are You Talking To Me?” audio demonstration and exercise materials were developed, edited, produced by and used with the permission of Dr. Robert M. Ghent and Brad K. Witt of Honeywell Safety Products, San Diego, CA. They were originally created on behalf of Laura Boatman, Project Coordinator for the State Building and Construction Trades Council of California, for a training project produced under grant SH-26283-SH4 from the Occupational Safety and Health Administration, U.S. Department of Labor. Original recordings of the English and Spanish speech materials were developed and produced by Dr. Richard W. Harris, Dr. Ron W. Channel, and Dr. Shawn Nissen, Department of Communication Disorders, Brigham Young University, Provo, UT, and supported in part by grants from Brigham Young University and the David O. McKay School of Education. Copyright 1998 – 2008, Richard W. Harris, Ph.D., Ron W. Channel, Ph.D., Shawn Nissen, Ph.D., and Brigham Young University. Used by permission. The recording of the construction worksite environment is a segment of a track obtained from the Bainbridge Living Sound Effects Library, Volume 1. The tracks in this collection were processed, edited, and mixed by Dr. Robert M. Ghent using Adobe Audition versions 3.0 and CS6. The audio files included in this demo collection are not for sale. Resale of these materials is expressly prohibited. They may be freely, but narrowly distributed for the purposes of hearing loss prevention education. This document should accompany distribution of the files.

Funding is provided by Cooperative Agreements ES06185 and ES09764 from the National Institute of Environmental Health Sciences (NIEHS), NIH. The contents are solely the responsibility of the authors and do not necessarily represent the official views of NIEHS or NIH.

APPENDIX

1. **Are you talking to me Exercise**
2. **Are you talking to me Exercise_Answers**
3. **Steps for inserting ear plugs final**
4. **Choosing the Right Hearing Protection**
5. **Noise Hazard Alert Card**
6. **When and What of Hearing Protection**

ARE YOU TALKING TO ME?

	Exercises				
	1	2	3	4	5
Word 1					
Word 2					
Word 3					
Word 4					
Word 5					
Word 6					
Word 7					
Word 8					
Word 9					
Word 10					

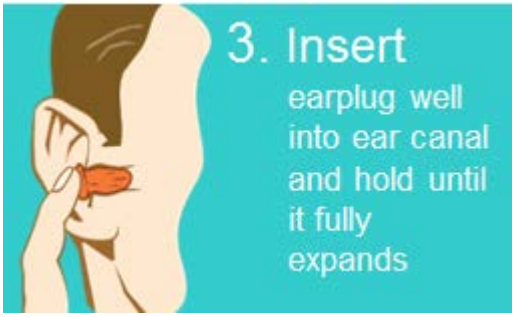
ARE YOU TALKING TO ME? ANSWER KEY

	1	2	3	4	5
Word 1	star	star	star	star	dust
Word 2	few	few	few	few	stiff
Word 3	bathe	bathe	bathe	bathe	nest
Word 4	cap	cap	cap	cap	then
Word 5	west	west	west	west	camp
Word 6	thin	thin	thin	thin	smooth
Word 7	farm	farm	farm	farm	knees
Word 8	pie	pie	pie	pie	few
Word 9	three	three	three	three	else
Word 10	gave	gave	gave	gave	flat

STEPS FOR INSERTING EAR PLUGS

1. Roll the earplug up into a small, thin "snake" with your fingers. You can use one or both hands.

2. Pull the top of your ear up and back with your opposite hand to straighten out your ear canal. The rolled-up earplug should slide right in.



3. Hold the earplug in with your finger. Count to 20 or 30 out loud while waiting for the plug to expand and fill the ear canal. Your voice will sound muffled when the plug has made a good seal.

Check the fit when you're all done. Proper insertion should result in an acoustic seal, which causes a very pronounced lowering of noise levels. With earplugs inserted, cup your hands firmly over your ears and release. The earplugs should be blocking enough noise so that covering the ears with your hands results in no significant change in noise level.

Watch NIOSH show you how to insert an ear plug at:

https://www.youtube.com/watch?v=Veayb1NucTA&feature=youtu.be

Source: State Building & Construction Trades Council of California, AFL-CIO: Construction Noise & Hearing Loss Prevention training program, Funded by Federal OSHA, 2015 (courtesy of Howard Leight, Honeywell). Additional content sourced from The National Institute for Occupational Safety & Health (NIOSH) - https://www.cdc.gov/niosh/mining/content/earplug.html and Hear Forever - A Howard Leight by Honeywell Initiative - http://www.hearforever.org/tools-to-learn/assessing-fit-effectiveness-of-earplugs.

CHOOSING THE RIGHT HEARING PROTECTION

Repeated exposure to high noise levels can lead to permanent hearing loss. Because construction jobsites so often expose workers to these high levels of noise, you are at a much higher risk of developing hearing loss than workers in other industries – in fact, one study suggests the risk is as much as 3.5 times higher among construction trade workers. It is important to use proper hearing protection whenever you are around loud equipment or noise producing tasks. Below are the different types of protection and tips for using them from NIOSH.

EXPANDABLE FOAM PLUGS

These plugs are made of a formable material designed to expand and conform to the shape of each person's ear canal. Roll the expandable plugs into a thin, crease-free cylinder. Whether you roll plugs with thumb and fingers or across your palm doesn't matter. What's critical is the final result—a smooth tube thin enough so that about half the length will fit easily into your ear canal. Some individuals, especially women with small ear canals, have difficulty rolling typical plugs small enough to make them fit. A few manufacturers now offer a small size expandable plug.

PRE-MOLDED, REUSABLE PLUGS

Pre-molded plugs are made from silicone, plastic or rubber and are manufactured as either “one-size-fits-most” or are available in several sizes. Many pre-molded plugs are available in sizes for small, medium or large ear canals.

A critical tip about pre-molded plugs is that a person may need a different size plug for each ear. The plugs should seal the ear canal without being uncomfortable. This takes trial and error of the various sizes. Directions for fitting each model of pre-molded plug may differ slightly depending on how many flanges they have and how the tip is shaped. Insert this type of plug by reaching over your head with one hand to pull up on your ear. Then use your other hand to insert the plug with a gentle rocking motion until you have sealed the ear canal.

Advantages of pre-molded plugs are that they are relatively inexpensive, reusable, washable, convenient to carry, and come in a variety of sizes. Nearly everyone can find a plug that will be comfortable and effective. In dirty or dusty environments, you don't need to handle or roll the tips.

CANAL CAPS

Canal caps often resemble earplugs on a flexible plastic or metal band. The earplug tips of a canal cap may be a formable or pre-molded material. Some have headbands that can be worn over the head, behind the neck or under the chin. Newer models have jointed bands increasing the ability to properly seal the earplug.

The main advantage canal caps offer is convenience. When it's quiet, employees can leave the band hanging around their necks. They can quickly insert the plug tips when hazardous noise starts again. Some people find the pressure from the bands uncomfortable. Not all canal caps have tips that

adequately block all types of noise. Generally, the canal caps tips that resemble stand-alone earplugs seem to block the most noise.

EARMUFFS

Earmuffs come in many models designed to fit most people. They work to block out noise by completely covering the outer ear. Muffs can be "low profile" with small ear cups or large to hold extra materials for use in extreme noise. Some muffs also include electronic components to help users communicate or to block impulsive noises.

Workers who have heavy beards or sideburns or who wear glasses may find it difficult to get good protection from earmuffs. The hair and the temples of the glasses break the seal that the earmuff cushions make around the ear. For these workers, earplugs are best. Other potential drawbacks of earmuffs are that some people feel they can be hot and heavy in some environments.

MISCELLANEOUS DEVICES

Manufacturers are receptive to comments from hearing protection users. This has led to the development of new devices that are hybrids of the traditional types of hearing protectors. Because many people like the comfort of foam plugs, but don't want to roll them in dirty environments, a plug is now available that is essentially a foam tip on a stem. You insert this plug much like a pre-molded plug without rolling the foam.

Scientists are developing earmuffs using high-tech materials to reduce weight and bulk, but still effectively block noise. On the horizon may be earplugs with built in two-way communication capability.

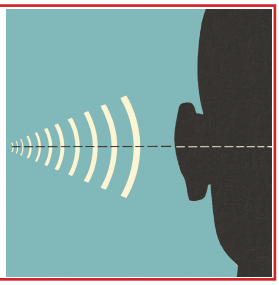
Still, the best hearing protector is the one that is comfortable and convenient and that you will wear every time you are in an environment with hazardous noise.

For additional assistance finding the right hearing protection for your comfort and the level of noise you are being exposed to, use NIOSH's Hearing Protector Device Compendium.

HAZARD ALERT

CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

NOISE AND HEARING LOSS



What?

You can damage – even lose – your hearing from working:

- Around loud noises (85 decibels or higher); and/or
- With paints, degreasing, cleaning, and other construction products that contain solvents such as toluene.

NOISE LEVELS BY DECIBELS

What will you miss when you lose your hearing?

- On the job: Hearing your boss or co-worker alert you to a hazard
- At home: The ability to communicate with friends and family

According to the National Institute for Occupational Safety and Health (NIOSH), approximately 1 out of 4 construction workers suffer from some level of hearing loss.

Once your hearing is gone, it's gone forever.

If you think you are in danger:

Contact your supervisor.
Contact your union.
Call OSHA
1-800-321-OSHA

Learn more about NIOSH's Sound Level Meter App and how to prevent hearing loss at
http://bit.ly/CPWR-NOISE

To receive copies of this Hazard Alert
and cards on other topics
Call 301-578-8500

When you work around noise ...

1 Ask for controls

Noise is measured in decibels (dBs). Using equipment just 3 dBs lower can cut the noise energy reaching your ears by half.

Ask your employer to rent or buy low-noise equipment, or put a sound barrier around loud equipment like compressors.

Worker using earplugs for hearing protection.

2 Wear hearing protection

According to OSHA, your employer must provide you with hearing protection when you work around loud noise.* Types of hearing protection include earplugs and earmuffs.

Make sure your hearing protection fits and is comfortable. The louder the job, the more hearing protection you need.

*Source: The Occupational Safety and Health Administration (OSHA) – 29 CFR 1926.101

Worker taking a hearing test.

3 Get trained and tested

Your employer should train you on how to:

- Protect your hearing; and
- Use hearing protection.

An annual hearing test will let you know if your hearing is getting worse.*

*The hearing test is called an audiometric test.

Noise is bad for your safety and health

- Noise can distract you.
- You may not hear warnings.
- Hearing loss increases your risk of falling.
- Years of noisy job sites can make you deaf.

Noise can cause "tinnitus" or ringing in the ears, which can interfere with your sleep. Noise can cause high blood pressure and stress.

If you have to raise your voice to be heard by someone an arm's length away, your hearing is in danger.

 Production of this document was supported by cooperative agreement OH 009762 from the National Institute for Occupational Safety and Health (NIOSH). The contents are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH.

When to use Hearing Protection

Hearing protection should be used anytime the noise level is above 85 decibels. To give you an idea of what that means, normal conversation is about 60 decibels and a hand drill is 98 decibels. If you have to raise your voice to be heard by someone an arm's length away, it is probably too loud!

Not sure how loud it is?

Download the NIOSH Sound Level Meter App in your iPhone app store!

https://www.cdc.gov/niosh/topics/noise

Noise Levels by Decibel	
Pneumatic Precision Drill	**119**
Hammer Drill	**114**
Chain Saw	**110**
Spray Painter	**105**
Hand Drill	**98**
OSHA Permissible Exposure Limit (PEL)	**90**
NIOSH Recommended Exposure Limit (REL)	**85**
Normal Conversation	**60**

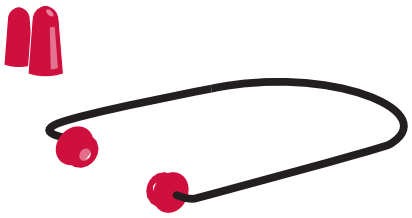
Source: The National Institute for Occupational Safety & Health, https://www.cdc.gov/niosh/topics/noise/choose.html

What you need to know about **Hearing Protection**

Your employer should provide hearing protection. The louder the job, the more protection is needed. Common types include: expandable foam ear plugs, pre-molded, reusable plugs, canal caps, and earmuffs. They only protect your hearing if used correctly.

Expandable foam ear plugs are one of the most common. Follow these steps when inserting them:

1. **Roll** entire earplug into a crease-free cylinder,
2. **Pull Back** your ear by reaching over your head with your free hand, and gently pull the top of the ear up and out,
3. **Insert** the earplug well into ear canal, and
4. **Hold** until it fully expands.



What type of hearing protection should I use?

NIOSH's Hearing Protector Compendium can help you decide.

https://www.cdc.gov/niosh/topics/noise/hpdcomp/

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