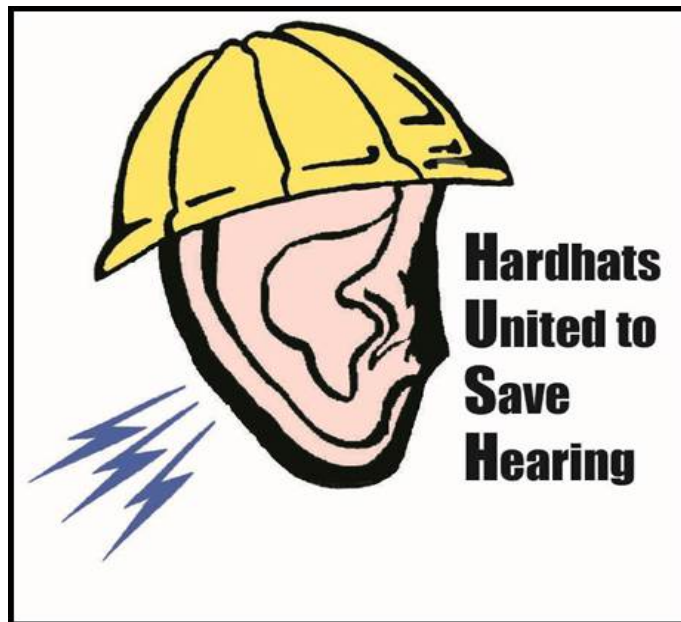


# **Construction Noise & Hearing Loss Prevention**

**State Building & Construction Trades Council of CA**

## **Train-the-Trainer Course 2015**



**State Building and Construction Trades Council of California**  
and the  
Labor Occupational Health Program,  
University of California, Berkeley  
2015

# **Construction Noise & Hearing Loss Prevention**

## **State Building & Construction Trades Council of CA Train-the-Trainer Course 2015**

### **Acknowledgements**

The State Building and Construction Trades Council of California (SBCTC) acknowledges Build It Smart of Olympia, Washington, who originally developed this course. The course was originally adapted by the SBCTC and LOHP (Labor Occupational Health Program) in 2004 and was revised in 2015.

For more information, contact:

State Building & Construction Trades Council of California (SBCTC)  
1231 I Street, Suite 302  
Sacramento, CA 95814  
Phone: 916-443-3302  
Fax: 916-443-8204  
Website: <http://safety.sbctc.org/>

This training is supported under grant number SH-26283-SH4 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

NOTE: This training is based on Cal/OSHA's requirements. There are twenty-eight OSHA-approved State Plans, operating state-wide occupational safety and health programs. State Plans are required to have standards and enforcement programs that are at least as effective as OSHA's and may have different or more stringent requirement. When conducting training using these materials, ensure you are training on the Federal or State requirement for that state.

# Overall Course Objectives

**By the end of this training, participants will be able to:**

1. Discuss what it is like to experience simulated hearing loss.
2. Explain the effects of hearing loss, warning signs of hearing loss and tinnitus.
3. Discuss hazardous noise, causes of hearing loss, noise-induced hearing loss, how we hear, types of noise and common hearing loss devices.
4. Describe how sound is measured, Cal/OSHA noise limits in construction, and devices used to measure noise.
5. Identify sources of noise at a construction site.
6. Discuss ways to control construction noise.
7. Review the types of hearing protection devices used in construction and demonstrate how to use an earplug correctly.

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- 

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#### **Binder Pocket**

- Laminated cards (talking points on noise in construction)

## How This Binder Is Organized

This training program consists of this course binder along with a flash drive that has everything on it you need to teach a Noise workshop. The material in the binder is described below. It also includes plastic laminated cards which are located in the inside pocket of the binder for you to use in Tailgate Trainings.

**Flash Drive.** The flash drive has everything on it that is in this course binder, plus some additional information on construction noise and hearing loss we thought you might find useful.

**Tab 1:** This section of the binder has the training-of-trainers **(TOT) agenda**, pre and post tests, OSHA quiz and the TOT evaluation. All of this material is used in the TOT course. You do not have to use it in your workshop.

**Tab 2:** This section of the binder has the **Instructor's Guide**. This guide provides an overview of the Construction Noise and Hearing Loss Prevention Training program and summarizes each session topic.

**Tab 3:** This section of the binder has the **PowerPoint® and curriculum**. The curriculum was designed to be taught with the PPT. It provides discussion questions and answers, and describes the activities in the training.

**Tab 4:** This section of the binder has **Tailgate Training Guides** on Noise and Hearing Loss Prevention designed for on-the-job training. The guide developed by SBCTC and LOHP has two parts including a Safety Walkaround Checklist and Training Guide. Both have been reviewed by Cal/OSHA and updated as of January 2015. We have also included two training guides developed by other organizations for reference; however these have not been updated for this project.

**Tab 5:** This section of the binder has the **Worksheet and Handouts** referred to in the curriculum. They are to be used in your workshop, depending on the session(s) you teach.

**Tab 6:** This section of the binder has **Training Tips**. It contains information on training techniques that you may find useful.

**Tab 7:** This section of the binder has a list of **Resources** on noise in construction. It contains links you can follow to get additional background information.

**Tab 8:** This section of the binder has the **Training Forms** you will need to complete and return to the SBCTC after your training.

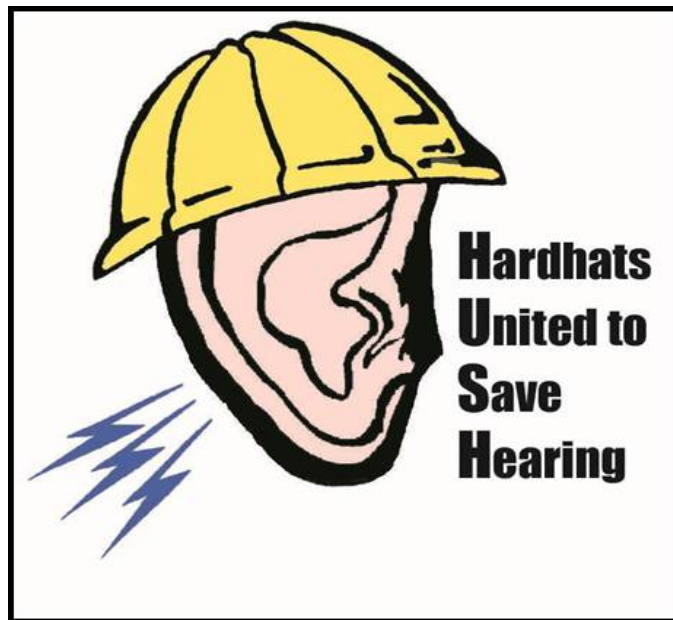
**Laminated cards.** You will also find a set of laminated plastic cards in the binder pocket. They illustrate common issues related to noise and construction. They can be

used in Tailgate Training (or any other training) as discussion triggers or talking points on construction noise.

## **Section 2: Instructor's Guide**

**Construction Noise & Hearing Loss Prevention**  
**State Building & Construction Trades Council of CA**  
**Train-the-Trainer Course 2015**

# **Instructor's Guide**



**State Building and Construction Trades Council of California**  
and the  
Labor Occupational Health Program,  
University of California, Berkeley

## Overview of Training

The goal of this training is to give workers the information they need to address noise in construction and how to prevent hearing loss. It is designed as a model worker training program based on best practices that are feasible for the construction industry. The training is intended to be presented to rank-and-file construction workers at the job site, union, and/or students in apprenticeship classes.

This course binder includes the Instructor's Guide, Curriculum, PowerPoint slides, worksheet and factsheets needed to teach the entire training. A copy of the PowerPoint (PPT) developed for your workshop is provided on a USB Flash Drive in Microsoft PowerPoint® for use with an LCD projector. The flash drive also includes everything in the course binder and has some additional material.

The curriculum begins with the "Learning Objectives" of the training and provides an "At a Glance" chart. This chart has a brief summary of the different sessions, time, materials and resources needed to teach each session.

There is also a "Preparing to Teach This Training" section, listing steps to take prior to teaching the class. This shows all the equipment and materials you will need and photocopying that should be done. There is also a complete set of "Instructor's Notes," detailing how to teach the class, with specific instructions on how to lead each activity.

The course emphasizes participatory training methods. It includes class discussion, small interactive group activities, demonstrations and short videos. These activities encourage participants to relate the material they are learning to their own jobs and experiences.

Specialized technical knowledge is not necessary to teach this training. With some preparation, foremen, union staff, apprenticeship instructors and others can present the material. The "training of trainers" (TOT) classes we offer to help prepare people to teach this training allows trainers from a variety of backgrounds to become familiar with the training and later present it to workers.

The training is flexible and can be presented in different ways. The curriculum is organized around nine sessions. Each session is described later in this Instructors Guide (page 5-13.). You can teach each session separately if you like. However it is good for everyone to have a basic understanding of hazardous noise and hearing loss as a foundation for the other sessions. This is covered in session 3. Feel free to adapt it to your own situation. Most commonly, trainers who have completed the TOT class will give one 20-40 minute session at the job site or apprentice classroom on a section of the training they think is most relevant at the time. Another option is to present the training in one 2 ½ - 3 hour class.

Following is a list of the 8 sessions in the curriculum:

- 1) Introduction
- 2) What's It Like To Lose Your Hearing?
- 3) Hazardous Noise and Hearing Loss
- 4) Measuring Noise
- 5) Soundscape Activity
- 6) Ways to Control Construction Noise
- 7) Hearing Protection Devices
- 8) Wrap Up

## How This Curriculum Is Organized

The curriculum provides all the information the instructor needs to teach the course. Questions posed by the instructor to the class appear in **bold** with a ► icon next to the question. The information for the answer to each question follows. Do not read the information in the answer to the class. Read through the curriculum before teaching it to decide what you want to say.

Each PowerPoint (PPT) slide is next to the question and is referenced in the curriculum in *italic*. Additional background information is provided for the instructor in boxes throughout the curriculum. Review the curriculum, PowerPoint, and handouts to decide what is relevant to the people you are going to teach.

### Optional Activities

You also have several optional activities to use in the training. You have the option of showing a short video on how you hear in *Section 3) Hazardous Noise and Hearing Loss*. We recommend a video clip from *The Hearing Video* (produced by Worksafe BC) that is 5:47 minutes long. It shows how you hear (in your inner ear), how your hearing is damaged, and hearing protection devices. It also shows how to fit ear plugs correctly. Another optional activity in this session is a paint brush demonstration. This involves showing two paint brushes (3" or 4" flat brushes). One brush has the top ¾ length of the bristles cut off, leaving just a short stub of the brush to demonstrate how noise damages the inner ear (cochlea).

In *Section 4) Measuring Noise* there are two optional activities involving the use of a sound level meter. You will need to review and prepare the activities in advance if you choose to do them.

In *Section 5) Soundscape* you have the option of conducting a walkaround inspection and toolbox training at the job site. These activities are described in the curriculum.

In *Section 6), Ways To Control Construction Noise*, the instructor can conduct short discussions on different noise topics using photo trigger cards. Some of the cards illustrate how to control noise at a construction site.

Before you present this training have the following materials and equipment available:

- The course USB flash drive (with PPT slides and all course materials)
- Computer and LCD projector for the PowerPoint presentation
- Extension cord for equipment
- Speakers for the Say What hearing loss simulation (if you don't have a good sound system for your LCD projector)
- Course curriculum
- One set of flipchart markers (black, red, blue, and green) for each small group (4-5 participants per group).
- Extra sheets of flipchart paper and masking tape
- Five different types of hearing protection devices to demonstrate:
  - Foam (formable) plugs, have a pair of roll up ear plugs for each participant.
  - Reusable earplugs
  - Custom molded plugs
  - Banded or semi-aural
  - Earmuffs
- Sound level meter. (There are two sound level meter applications listed in the Resource Guide, one for iPhones and one for Android phones.)
- Copies of the Say What worksheet or (Optional activity) What Does Noise-Induced Hearing Loss Sound Like?
- Workshop sign in sheet
- Copies of the handouts for all participants
- Copies of the workshop evaluation for all participants
- (Optional) Video clip from "The Hearing Video" (5:47 minutes), located on USB flash drive
- (Optional) Piece of noisy equipment (e.g. electric drill) and a homemade barrier (simple enclosure to put around drill made of plywood.)
- (Optional) Two paint brushes (3" or 4" flat brushes). One brush has the top cut off (the top  $\frac{3}{4}$  length of the bristles, leaving just a short stub of the brush.)
- (Optional) Walkaround Inspection Checklist and Toolbox Training Guide on noise
- (Optional) Laminated discussion cards

## Worksheet and Handouts

The worksheet and handouts are located in the course binder under tab 5. They are produced by LOHP, OSHA, The Center for Construction Research and Training (CPWR), and other organizations. You can duplicate them as needed.

# SESSION 1. Course Introduction

## Key teaching points of this session:

This session covers the acknowledgements, funding, photo credit and duplication, and course objectives, why the SBCTC focused on noise and hearing loss prevention, and how big the problem is for workers.

Specific instructions for teaching this session appear in the curriculum.

## Overall Course Objectives

### By the end of this training, participants will be able to:

1. Discuss what it is like to experience simulated hearing loss.
2. Explain the effects of hearing loss, warning signs of hearing loss and tinnitus.
3. Discuss hazardous noise, causes of hearing loss, noise-induced hearing loss, how we hear, types of noise and common hearing loss devices.
4. Describe how sound is measured, Cal/OSHA noise limits in construction, and devices used to measure noise.
5. Identify sources of noise at a construction site.
6. Discuss ways to control construction noise.
7. Review the types of hearing protection devices used in construction and demonstrate how to use an earplug correctly.

### You Need:

- Construction Noise & Hearing Loss curriculum
- Construction Noise & Hearing Loss PowerPoint presentation (flash drive)
- Computer and projector for the presentation
- Handout: *Noise* factsheet

## Teaching Methods

Interactive lecture/discussion.

## SESSION 2. What's It Like To Lose Your Hearing?

### Key teaching points of this session:

- hearing loss (simulation activity: *Say What*)
- effects of hearing loss
- warning signs of hearing loss and tinnitus

Specific instructions for teaching this session appear in the curriculum.

### Optional Activity

#### What Does Noise-Induced Hearing Loss Sound Like?

For training rooms where a computer connection or sound system is not available, the trainer can still simulate the effects of noise-induced hearing loss by simply reading a page of written text, where the high-frequency sounds are gradually deleted. The sample sentences demonstrate how you would hear the sentences with hearing loss.

### You Need:

- PowerPoint presentation (The *Say What* hearing loss simulation activity is embedded in the PPT on the USB flash drive )
- Computer and projector for the presentation
- Speakers for the *Say What* activity (if you don't have a good sound system for your LCD projector)
- Extension cord
- Handout(s):
  - 1) *Say What* worksheet
  - 2) (Optional) *What Does Noise-Induced Hearing Loss Sound Like?*

### Teaching Methods

Interactive lecture/discussion and audio hearing loss simulation demonstration (audio) or (optional) read by the trainer.

## SESSION 3. Hazardous Noise and Hearing Loss

### Key teaching points of this session:

- hazardous noise
- causes of hearing loss
- noise induced hearing loss (NIHL)
- how you hear
- types of noise in construction
- common hearing loss devices (e.g. hearing aids and cochlear implants)

Specific instructions for teaching this session appear in the curriculum.

### Optional Activities

#### Video Clip

You can show a short video from “*The Hearing Video*” (5:47 minutes) that is on your USB Flash Drive. It shows how you hear, how your hearing is damaged, and hearing protection devices. It also shows how to fit ear plugs correctly.

#### Paint Brush Activity

Instructor demonstrates what happens in a healthy ear compared to an ear damaged by noise induced hearing loss using two paint brushes. One paint brush is uncut. One brush has the bristles cut short. The uncut brush represents a healthy ear with no damage to the hair-like nerve cells. The brush with the bristles cut down illustrates what happens to the nerve endings in your ear (cochlea) if they become damaged.

### You Need:

- PowerPoint presentation
- Computer and projector for the presentation
- (Optional) a video clip from *The Hearing Video* (produced by Worksafe BC) that is 5:47 minutes long (on USB flash drive). It shows how you hear (in your inner ear), how your hearing is damaged, and hearing protection devices. It also shows how to fit ear plugs correctly.
- (Optional) two paint brushes (3” or 4” flat brushes work best). On one brush cut off the top  $\frac{3}{4}$  length of the bristles, leaving just a short stub of the brush. (Prepare before the training)
- Handouts:
  - 1) *How You Hear*
  - 2) *Hear Today...Hear Tomorrow*

## **Teaching Methods**

Interactive lecture/discussion, video (optional) and paint brush demonstration (optional).

## SESSION 4. Measuring Noise

### Key teaching points of this session:

- measuring sound
- Cal/OSHA noise limits in construction
- noise measurement devices
- common noise levels in construction

Specific instructions for teaching this session appear in the curriculum.

### Optional Activity

#### Using A Sound Level Meter

Students use a sound level meter to measure noise. Instructor makes a sound level barrier to demonstrate in class.

### You Need:

- PowerPoint presentation
- Computer and projector for the presentation
- Sound level meter (There are two sound level meter applications listed in the Resource Guide, one for iPhones and one for Android phones.)
- (Optional) noisy hand tool (e.g. drill)
- (Optional) sound barrier for hand tool made in advance (e.g. wooden enclosure for drill)
- Handouts:
  - 1) *Construction Noise*
  - 2) *Common Noise Levels In Construction*

### Teaching Methods

Interactive lecture/discussion and the (optional) sound level meter activities.

## SESSION 5. Soundscape Activity

### Key teaching points of this session:

- class works in small groups
- small groups create a noise map (Soundscape) and report back to the class

Specific instructions for teaching this session appear in the curriculum.

### Optional Activity

#### Walkaround Inspection and Tailgate Noise Training

Using the Noise Safety Walkaround Checklist (in Tab 4 of your binder) the instructor conducts an inspection of the job site. The Training Guide on Noise (in Tab 4) provides a lesson plan for a toolbox (tailgate) training.

Instructions for this activity are provided at the end of session five.

### You Need:

- PowerPoint presentation
- Computer and projector for the presentation
- Different color of flipchart pens
- Flipchart paper
- Masking tape (to tape Soundscape on flipchart or wall)
- Handouts:
  - 1) *Protecting Yourself From Noise In Construction (OSHA pocket guide).*
  - 2) (Optional) *SBCTC-LOHP Noise Safety Walkaround Checklist, and SBCTC-LOHP Noise Training Guide*

### Teaching Methods

Interactive lecture/discussion and small group activity. (Optional) Walkaround inspection and Tailgate Training.

## SESSION 6. Ways To Control Construction Noise

### Key teaching points of this session:

- how to eliminate or control noise hazards
- small groups show how to control noise on their Soundscapes

Specific instructions for teaching this session appear in the curriculum.

### Optional Activity

#### Discussion Card Activity

Using laminated cards (located in the pocket of the binder) the instructor conducts a discussion on different noise topics. Some of the cards illustrate how to control noise at a construction site. They can be used in Tailgate Training (or any other training) as discussion triggers or talking points.

Instructions for this activity are provided at the end of session six.

### You Need:

- PowerPoint presentation
- Computer and projector for the presentation
- Handouts:
  - 1) *Controlling Noise on Construction Sites, and*
  - 2) (Optional) *Laminated Cards*

### Teaching Methods

Interactive lecture/discussion, small group activity, and (optional) trigger discussions.

## **SESSION 7. Hearing Protection Devices (HPDs)**

### **Key teaching points of this session:**

- demonstrate five different types of hearing protection devices (HPDs)
- demonstrate how to use an ear plug correctly

Specific instructions for teaching this session appear in the curriculum.

### **You Need:**

- PowerPoint presentation
- Computer and projector for the presentation
- Different types of hearing protection devices (obtain in advance) including:
  - Foam (formable) plugs (for each participant)
  - Reusable earplugs
  - Custom molded plugs
  - Banded or semi-aural
  - Earmuffs
- Handout: *Don't Let Noise Steal Your Hearing*

### **Teaching Methods**

Interactive lecture/discussion and student demonstrations.

## SESSION 8. Wrap Up

### Key teaching points of this session:

- conclude the class
- participants complete workshop evaluation

Specific instructions for teaching this session appear in the curriculum.

### You Need:

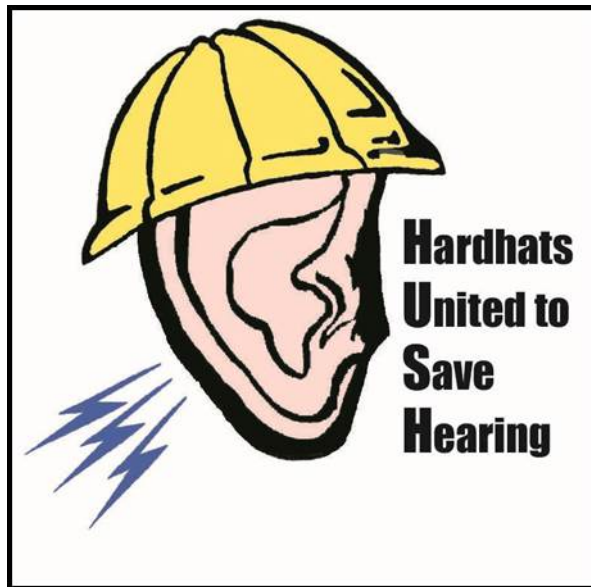
- PowerPoint presentation
- Computer and projector for the presentation
- Handout: *Workshop Evaluation*

**The instructor sends the workshop sign in sheet and workshop evaluation to the State Building & Construction Trades Council after each training he or she does on Noise and Hearing Loss.**

## **Section 3: Curriculum and PowerPoint Slides**

# Construction Noise and Hearing Loss Prevention

## Training Curriculum



**State Building and Construction Trades Council of California**

and the

Labor Occupational Health Program,  
University of California, Berkeley

2015

# Overall Training Objectives

By the end of this training, participants will be able to:

1. Discuss what it is like to experience simulated hearing loss.
2. Explain the effects of hearing loss, warning signs of hearing loss and tinnitus.
3. Discuss hazardous noise, causes of hearing loss, noise-induced hearing loss, how we hear, types of noise and common hearing loss devices.
4. Describe how sound is measured, Cal/OSHA noise limits in construction, and devices used to measure noise.
5. Identify sources of noise at a construction site.
6. Discuss ways to control construction noise.
7. Review the types of hearing protection devices used in construction and demonstrate how to use an earplug correctly.

## At a Glance

Activity	Time	Materials & Resources
<b>1) Introduction</b>  The instructor reviews the training objectives and introduces the topic.	5 minutes	<ul style="list-style-type: none"> <li>▪ Slides #1 - 13</li> <li>▪ LCD, course USB flash drive, computer (for entire training)</li> <li>▪ Flipchart, paper, flipchart pens (for entire training)</li> <li>▪ Handout: <i>Noise</i></li> </ul>
<b>2) What's It Like To Lose Your Hearing?</b>  Conduct the <i>Say What</i> hearing loss simulation activity; explain the effects of hearing loss, warning signs of hearing loss and tinnitus.  (Optional Activity) Read a statement that demonstrates how you would hear with severe hearing loss	20 minutes	<ul style="list-style-type: none"> <li>▪ Slides #14 - 22</li> <li>▪ Handout(s)               <ol style="list-style-type: none"> <li>1) <i>Say What</i> worksheet</li> <li>2) (Optional) <i>What Does Noise-Induced Hearing Loss Sound Like?</i></li> </ol> </li> </ul>
<b>3) Hazardous Noise and Hearing Loss</b>  Discuss hazardous noise, causes of hearing loss, noise-induced hearing loss, how you hear, and types of noise.  (Optional Activities) Show The Hearing Video and/or do the Paint Brush demonstration.	10-25 minutes	<ul style="list-style-type: none"> <li>▪ Slides #23 - 29</li> <li>▪ (Optional) video clip from "The Hearing Video" located on the instructor's USB flash drive.</li> <li>▪ (Optional) paint brush demonstration (made in advance)</li> <li>▪ Handouts:               <ol style="list-style-type: none"> <li>1) <i>How You Hear</i></li> <li>2) <i>Hear Today...Hear Tomorrow</i></li> </ol> </li> </ul>

Activity	Time	Materials & Resources
<p><b>4) Measuring Noise</b></p> <p>Explain how sound is measured, Cal/OSHA noise limits, noise measurement devices, and construction noise levels.</p> <p>(Optional Activity) Measure sound with and without a sound barrier.</p>	10-25 minutes	<ul style="list-style-type: none"> <li>▪ Slides #30 - 37</li> <li>▪ Sound level meter (SLM)</li> <li>▪ (Optional equipment) SLM, piece of noisy equipment, and sound enclosure (made in advance)</li> <li>▪ Handouts:               <ol style="list-style-type: none"> <li>1) <i>Construction Noise</i></li> <li>2) <i>Common Noise Levels In Construction</i></li> </ol> </li> </ul>
<p><b>5) Soundscape Activity</b></p> <p>Small groups create a Soundscape of a construction site and report back on noise hazards.</p> <p>(Optional Activities) Conduct a Walkaround Inspection and Toolbox Training on noise at the job site.</p>	40 minutes	<ul style="list-style-type: none"> <li>▪ Slides #38 - 40</li> <li>▪ Sets of 4 flipchart markers for each small group (black, red, blue, and green).</li> <li>▪ Flipchart paper</li> <li>▪ Masking tape</li> <li>▪ Handouts:               <ol style="list-style-type: none"> <li>1) <i>Protecting Yourself From Noise In Construction (OSHA pocket guide), or optional</i></li> <li>2) <i>(Optional) SBCTC-LOHP Noise Safety Walkaround Checklist, and</i></li> <li>3) <i>(Optional) SBCTC-LOHP Noise Training Guide</i></li> </ol> </li> </ul>
<p><b>6) Ways to Control Construction Noise</b></p> <p>The class discusses the three main methods of hazard control. Small groups brainstorm ways to control construction noise identified in their Soundscape.</p> <p>(Optional Activity) Conduct short discussions on controls at job site or training using laminated cards.</p>	40 minutes	<ul style="list-style-type: none"> <li>▪ Slides #41 – 43</li> <li>▪ Handouts:               <ol style="list-style-type: none"> <li>1) <i>Buy Quiet, Hearing Loss Is Preventable</i></li> <li>2) <i>Controlling Noise on Construction Sites</i></li> <li>3) <i>(Optional) Laminated discussion cards</i></li> </ol> </li> </ul>

Activity	Time	Materials & Resources
<p><b>7) Hearing Protection Devices (HPDs)</b></p> <p>Instructor reviews five different types of HPDs. Students demonstrate how to properly use an earplug.</p>	<p>20 minutes</p>	<ul style="list-style-type: none"> <li>▪ Slides #44 - 55</li> <li>▪ Different types of hearing protection devices: <ul style="list-style-type: none"> <li>○ Foam (formable) plugs (for each participant)</li> <li>○ Reusable earplugs</li> <li>○ Custom molded plugs</li> <li>○ Banded or semi-aural</li> <li>○ Earmuffs</li> </ul> </li> <li>▪ Handout: <i>Don't Let Noise Steal Your Hearing</i></li> </ul>
<p><b>8) Wrap Up</b></p> <p>The instructor asks the class to complete the workshop evaluation.</p>	<p>5 minutes</p>	<ul style="list-style-type: none"> <li>▪ Slide #56</li> <li>▪ Handout: <i>Workshop evaluation</i></li> </ul>

**Total time: Approximately 2 1/2 – 3 hours**

# Preparing to Teach This Training

Before you present this training have the following materials and equipment available:

- The course USB flash drive (with PPT slides and all course materials)
- Computer and LCD projector for the PowerPoint presentation
- Extension cord for equipment
- Speakers for the *Say What* hearing loss simulation (if you don't have a good sound system for your LCD projector)
- Course curriculum
- One set of flipchart markers (black, red, blue, and green) for each small group (4-5 participants per group).
- Extra sheets of flipchart paper and masking tape
- Five different types of hearing protection devices to demonstrate:
  - Foam (formable) plugs, have a pair of roll up ear plugs for each participant.
  - Reusable earplugs
  - Custom molded plugs
  - Banded or semi-aural
  - Earmuffs
- Sound level meter. (There are two sound level meter applications listed in the Resource Guide, one for iPhones and one for Android phones.)
- Copies of the *Say What* worksheet or (Optional activity) *What Does Noise-Induced Hearing Loss Sound Like?*
- Workshop sign in sheet
- Copies of the handouts for all participants
- Copies of the workshop evaluation for all participants
- (Optional) Video clip from "The Hearing Video" (5:47 minutes), located on USB flash drive
- (Optional) Piece of noisy equipment (e.g. electric drill) and a homemade sound barrier (simple enclosure to put around drill made of plywood.)
- (Optional) Two paint brushes (3" or 4" flat brushes work best). On one brush cut off the top  $\frac{3}{4}$  length of the bristles, leaving just a short stub of the brush.
- (Optional) Conduct a Walkaround Inspection and Toolbox Training on noise at the job site.
- (Optional) Discussion Card Activity

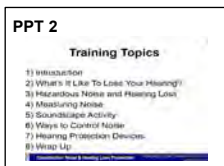
## Instructor's Notes

## 1) Introduction (5 minutes)

### Key points in this session:

- **Acknowledgements**
- **Funding sources**
- **Photo credits and duplication**
- **Course objectives**
- **Why the SBCTC focused on noise and hearing loss prevention**

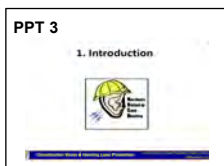
**Handout:** *Noise* (CPWR Hazard Alert)



(Slide #1 is the title page)

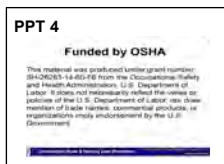
Show slide #2, *Training Topics*

Tell the class that there are eight topics in this training. (Identify ahead of time which topic(s) you are going to teach. Tell the class.)



Show slide #3, Introduction

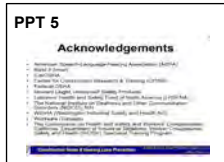
This is the first topic of the training.



Show slide #4, *Funded by OSHA*

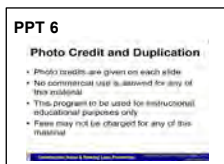
Explain that federal OSHA provided funding for the training.

Show slide #5, *Acknowledgements*



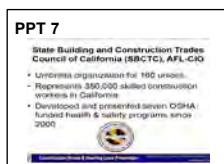
Acknowledge the organizations that shared their material in the development of this training.

Show Slide #6, *Photo Credit and Duplication*



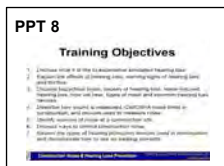
Explain that no one can charge a fee for any of the material used in this training.

Show slide #7, *State Building and Construction Trades Council of California (SBCTC), AFL-CIO*



Describe the SBCTC who sponsored this program.

Show slide #8, *Training Objectives*.



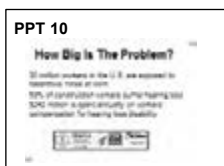
► **Does anyone here have hearing loss or know someone who does?** (Wait for a response. Then show the next slide.)

Show slide #9, *Why Care About Hearing Loss?*



Before the Industrial Revolution very few people were exposed to high levels of noise in the workplace. In the 19th century steam was the major source of energy for machinery used in the Industrial Revolution. Workers who made the steam boilers (Boilermakers) developed serious hearing loss in such large numbers that the condition became known as “Boilermakers Disease.”

In the 1905 photo on this slide the Boilermakers Local 248 (from DuBois, Pennsylvania) “feared no noise.” They prided themselves on their ability to work around loud noise. Little did they know that their job would result in significant hearing loss. The SBCTC chose this topic for training because over 100 years later, noise-induced hearing loss continues to be a serious problem for construction workers.



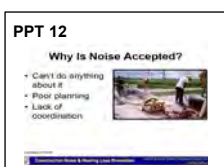
Show slide #10, *How Big Is the Problem?*

The data shown here makes a strong case for raising awareness and taking action to control noise and protect workers. The good news is that occupational hearing loss is preventable!



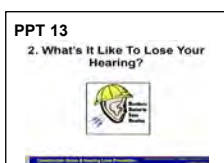
Show slide #11, *Building Trades Workers and Hearing Loss*

In 2001 the National Institute for Occupational Safety and Health (NIOSH) did a study with the United Brotherhood of Carpenters to check for hearing loss. They found that the average 25-year old carpenter had the same hearing loss as a 50 year-old man with no occupational noise exposure. Some of the equipment used by carpenters is similar to the equipment used by other trades (e.g. drill.) These early studies tell us that noise on the job is a serious problem for construction workers.



Show slide #12, *Why Is Noise Accepted?*

Construction workers have come to accept too much noise as part of the job. People think they can't do anything about it. With pre planning and coordination noise sources can be identified and limited so workers aren't over-exposed.



Show slide #13, *What's It Like to Lose Your Hearing*

This is the next topic of the training.

## 2) What's It Like To Lose Your Hearing? (20 minutes)

Key points in this session:

- Hearing loss simulation exercise
- Effects of hearing loss
- Warning signs of hearing loss and tinnitus
- (Optional activity): Handout, *What Does Noise-Induced Hearing Loss Sound Like?*

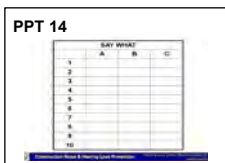
**Handouts:** 1) *Say What* worksheet, and 2) (Optional) *What Does Noise-Induced Hearing Loss Sound Like?*

This next activity is a hearing loss simulation exercise; in this exercise participants experience what it is like to lose your hearing. The class will hear a list of ten words, repeated three times throughout the exercise. The first reading simulates what it would be like to hear the words with severe hearing loss. The second reading simulates what it would be like to hear the words with moderate hearing loss. The third reading is what it is to hear the words with normal hearing.

The aim of this exercise is to give participants the experience of hearing loss. The ten words were picked by an audiologist; they represent the sounds you will have difficulty distinguishing if you suffer hearing loss. The purpose of this training is to help workers prevent noise exposure at work so you don't end up with severe hearing loss when you retire.

### Optional Activity, What Does Noise-Induced Hearing Loss Sound Like?

For training rooms where a computer connection or sound system is not available, trainers can still simulate the effects of noise-induced hearing loss by simply reading with a page of written text, where the high-frequency sounds are gradually deleted. Copy and distribute the handout for everyone. Then read it out loud. The sample sentences demonstrate how you would hear the sentences with hearing loss.



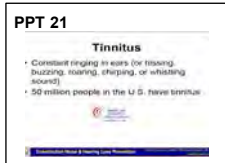
Show slides #14 - #18, *Say What* activity



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. Nothing can be done to fix your hearing once it is permanently damaged. The good news is that it is preventable.

- **Does anyone experience constant ringing in their ears? (This is often an early sign of hearing loss.) If so, how does it affect you?**

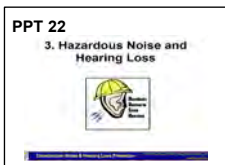
Show slide #21, *Tinnitus*



Symptoms of tinnitus can sound like constant ringing in the ears, 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.

**Additional Information, Tinnitus** (pronounced either ti-NIGHT-us or TIN-i-tus. Both pronunciations are correct.)

- It can be caused by NIHL, and some health conditions including ear and sinus infections, brain tumors, 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.



Show slide #22, *hazardous Noise and Hearing Loss*

This is the next topic of the training.

### 3) Hazardous Noise and Hearing Loss (10-25 minutes)

Key points in this session:

- Hazardous noise
- Causes of hearing loss
- Noise-induced hearing loss (NIHL)
- How we hear
- Types of noise in construction
- Common hearing loss devices
- (Optional) video clip from “The Hearing Video” located on the instructor’s USB flash drive.
- (Optional) paint brush demonstration (made in advance)

**Handouts:** 1) *How You Hear*, and 2) *Hear Today...Hear Tomorrow (Cochlea illustration)*

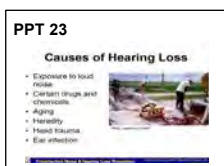
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► **What is hazardous noise?**

Noise is unwanted sound. Noise that is loud enough to harm your hearing is called hazardous noise, and it can cause temporary or permanent hearing loss.

► **What are some common causes of hearing loss?** (Wait for a response. Then show the next slide.)

Show slide #23, *Causes of Hearing Loss*



The most common cause of hearing loss is exposure to hazardous noise that is loud enough to damage your hearing (called Noise-Induced Hearing Loss. We will cover this in greater detail.) It can also be caused from ear-damaging chemicals, drugs and medications (called ototoxic, see additional information) aging (approximately one in three people between the ages of 65 and 74 has hearing loss), heredity (from your parents), head injury, and trauma/infection. An injury or infection in the ear can cause temporary or permanent hearing loss. Examples of this are a ruptured eardrum or swimmer’s ear (an infection in the outer ear canal brought on by water that remains in your ear after swimming, creating a moist environment for bacteria to grow.)

### **Additional Information, Ototoxic (pronounced o-tow-tox-ic) Chemicals**

According to NIOSH, many chemicals commonly found in industry, construction and agriculture can cause hearing loss, either alone or in combination with noise exposure. These are called ototoxic (pronounced o-tow-tox-ic) chemicals. The way it affects a person's hearing is different to noise-induced hearing loss, but the consequences for the person are the same.

Ototoxic chemicals that can contribute to hearing loss include: organic solvents like toluene, styrene, xylene, nhexane, and ethyl benzene; asphyxiants like carbon monoxide; metals like lead and mercury; and pesticides like organophosphates.

Ototoxic drugs that can contribute to hearing loss include nicotine, alcohol, some antibiotics, diuretics and analgesics.

### **Additional Information, Conductive and Sensorineural Hearing Loss**

Hearing loss can be categorized by which part of the ear is damaged. There are three basic types of hearing loss: conductive hearing loss, sensorineural hearing loss, and mixed hearing loss.

**Conductive hearing loss** occurs because of a mechanical problem in the outer or middle ear. Selected causes of conductive hearing loss include:

- Fluid in the middle ear from colds, ear infections, allergies
- Punctured eardrum
- Benign tumors
- Impacted earwax
- Presence of a foreign object in the ear

Causes of conductive hearing loss can often be treated and corrected.

**Sensorineural hearing loss (SNHL)** (also known as nerve related hearing loss) occurs when there is damage to the inner ear (cochlea), or to the nerve pathways from the inner ear to the brain. This is the most common type of permanent hearing loss. NIHL is a type of sensorineural hearing loss. Selected causes of this type of hearing loss include:

- Exposure to loud noise
- Head trauma
- Drugs and chemicals that are toxic to hearing (called ototoxic)
- Virus or disease
- Aging
- Tumors

Causes of sensorineural hearing loss are almost impossible to correct because of nerve damage to the cochlea.

**Mixed hearing loss**, is conductive hearing loss that occurs in combination with sensorineural hearing loss (SNHL). There may be damage in the outer or middle ear and the inner ear (cochlea) or auditory nerve.



Show slide #24, *Noise-Induced Hearing Loss (NIHL)*

Noise-induced hearing loss (NIHL) continues to be one of the most common work-related illnesses in the U.S. NIHL can be caused by a one-time exposure to loud sound (over 85dBA) like an explosion or by repeated exposure to loud sounds over an extended period of time, like the noise created on a construction site. The louder the sound, the shorter the amount of time it takes for NIHL to happen. The damage done by noise depends mainly on how loud it is and how long you are exposed to it.

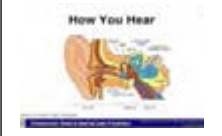
Noise-induced hearing loss can be temporary or permanent. Temporary hearing loss results from short-term exposures to noise, with normal hearing returning after period of rest. Generally, continued exposure to high noise levels over a period of time gradually causes permanent damage. It is the most common form of occupational hearing loss.

To understand how hearing loss occurs, we will discuss how you hear.

### Video Option

You can also show a short video on how you hear instead of discussing the next two slides. We recommend a video clip from “*The Hearing Video*” (5:47 minutes) that is on your USB Flash Drive. It shows how you hear (in your inner ear), how your hearing is damaged, and hearing protection devices. It also shows how to fit ear plugs correctly.

PPT 25



Show slide #25, *How You Hear*

Here is what happens when you hear. 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** (the cochlea) 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.

Typically the high sounds (or frequencies) are affected first because the hair-like nerve cells for those sounds are located at the entry of the cochlea where every sound wave passes by. As we discussed earlier, this can affect hearing women and young children because they have higher voices.

PPT 26



Show slide #26, *The Cochlea*

This slide shows three different cochleas:

- The first one is from a 17-year old girl who had low noise exposure and a cochlea with all the tiny hair-like nerve cells unbroken (no damage).
- The second one is from a 76-year old man who had low noise exposure. He has fewer nerve cells than the 17 year old girl but most of them are complete and are not broken (some damage).
- The third one is from a 59-year old man who was exposed to a lot of noise. You can see that the cochlea is damaged and that many of the hair-like nerve cells have been destroyed. Once these hair

cells are destroyed they do not grow back. This person has permanent hearing loss.

### Optional Paint Brush Activity

Get two identical paint brushes before the training (3" or 4" flat brushes work best). On one of the brushes, cut off the bristles so that only a short stub of the brush remains. The uncut brush represents a healthy ear with no damage to the hair-like nerve cells. They are all intact and move freely with sound. Illustrate this by moving your hand side-to-side across the brush. The bristles bend but recover when the motion stops. Now show the brush with the bristles cut down to illustrate what happens to the nerve endings in your ear (cochlea) if they become damaged. They are not there to receive the sound vibrations. They don't grow back, producing permanent hearing loss.

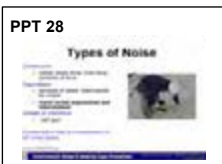


- **How do you know if it's too loud at work?** (Wait for a response. Then show the next slide.)

Show slide #27, *How Do You Know If It's Too Loud?*

These are some simple “rules of thumb” that you may be in a hazardous noisy situation that could cause damage to your hearing.

Show slide #28, *Types of Noise*



Most noise exposures are not constant over time. There are 3 different types of noise and all of these occur in construction work:

**Continuous** – This type of noise is relatively steady over long periods of time. It is more often found in manufacturing industries. Ask for examples in construction.

**Intermittent** – This type of noise has large differences in noise levels throughout the day, along with periods of relative quiet. Intermittent noise may be less hazardous than continuous because your ears have a chance to rest during the quiet periods. Ask for examples in construction.

**Impact/Impulse** – This is a short duration of fairly high level noise. High-level impact noise may be more hazardous to hearing than other types of noise, especially if it is combined with continuous noise. Ask for examples in construction.

## Hearing Devices

Nothing can be done to restore your hearing to normal hearing once it is permanently damaged. There are three basic types of hearing devices.

In simple basic terms, a **hearing aid** is an amplifier that makes sounds louder so you can hear them better. A person consults with a hearing specialist (audiologist) to get a hearing test to determine what kind of hearing loss they have. That information is used to select the right kind of hearing aid.

**Assistive Listening Systems (ALSs)** are sometimes called Assistive Listening Devices (ALDs). Essentially they are amplifiers that bring sound directly into the ear. They can be used with or without hearing aids or cochlear implants. Examples include TV listening devices, conference microphones, and telephone amplifiers. They have been referred to as “binoculars for the ears.”

According to the FDA (who regulates medical devices) a **cochlear (koe-klee-er) implant** is an implanted electronic hearing device, designed to produce useful hearing sensations to a person with severe to profound nerve deafness by electrically stimulating nerves inside the inner ear. These implants usually consist of 2 main components:

- 1) The externally worn microphone, sound processor and transmitter system, and
- 2) The implanted receiver and electrode system, which contains the electronic circuits that receive signals from the external system and send electrical currents to the inner ear.

Currently made devices have a magnet that holds the external system in place next to the implanted internal system (as seen in the slide). An implant does not restore the person’s hearing back to normal but it does allow him or her to perceive sounds.

Hearing devices cannot restore your hearing nor can they prevent the progression of hearing loss. That is why we are focusing on the prevention of hearing loss.

PPT 29

4. Measuring Noise



**Show slide #29, *Measuring Noise***

**This is the next topic of the training.**

## 4) Measuring Noise (10-25 minutes)

**Key points in this session:**

- **How sound is measured**
- **Cal/OSHA noise limits**
- **Noise measurement devices**
- **Construction noise levels**
- **Equipment needed: Sound level meter (SLM)**
- **(Optional) SLM, piece of noisy equipment, and sound enclosure (made in advance)**

**Handouts:** 1) *Construction Noise (CPWR Hazard Alert)*, and 2) *Common Noise Levels In Construction*

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While there are some simple signs that may alert you to hazardous noise (Slide 27), the only way to accurately know noise levels is to monitor noise while it's happening.

### ► How is sound measured at the workplace?

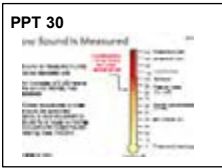
#### **Additional Information, How Sound is Measured**

Sound is measured in three ways:

1) **Frequency** is measured as the number of sound vibrations in one second. A healthy ear can hear sounds of very low frequency, 20 Hertz (or 20 cycles per second), to a very high frequency of 20,000 Hertz.

2) **Intensity** is 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, not a linear scale. It is similar to the Richter earthquake rating scale: a small increase in dBA numbers represents enormous changes. Sound energy that is twice the level of 83 dBA is not 166 dBA, it is 86 dBA.

3) **Duration**, or how long the exposure lasts, is measured in hours and minutes, referred to as the Time Weighted Average (TWA). In a time-weighted average (TWA), greater noise levels require shorter exposure times, and lower noise levels allow longer exposure times.



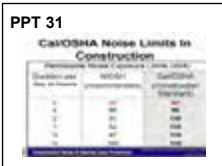
Show slide #30, *How Sound Is Measured*

Decibels (dB) are used to measure loudness. Decibels are measured on a logarithmic scale which means that a small change in the number of decibels results in a huge change in the amount of noise and the potential damage to a person's hearing.

An increase of 3 dB means the sound intensity has doubled. For example the sound doubles between 83 and 86 dB.

► **What is the Cal/OSHA Noise Limit in Construction?** (Wait for the class to respond. Then show the next slide.)

Cal/OSHA is the state agency in charge of making sure employers create safe workplaces. Cal/OSHA has set a limit for how noisy a work environment can be.



Show slide #31, *Cal/OSHA Noise Limits in Construction*

The chart in the slide shows the limits set by Cal/OSHA on the amount of noise workers can be exposed to on the job. This is Cal/OSHA's PEL (**P**ermissible **E**xposure **L**imit) for noise. PELs are the legal limits (averaged over an 8-hour workday) for exposure to a workplace hazard unless you use special protection or controls.

Cal/OSHA's PEL for noise in construction is 90 dBA. Cal OSHA states: "If you are exposed to an average of 90 decibels for 8 hours, Cal/OSHA says that "feasible" administrative and engineering controls must be used. If these fail to reduce sound levels to the PEL, workers must wear HPDs and be trained on how to properly use them."

#### **Additional Information: Hearing Conservation Program**

Cal/OSHA requires employers in general industry to have an effective hearing conservation program whenever noise levels exceed 85dBA for 8 hour time weighted average (TWA).

An effective hearing conservation program includes noise monitoring, worker hearing testing each year, training and recordkeeping. Construction is exempt from these aspects of the hearing conservation program (GISO section 5097 – GISO 5100). Employers must still have an effective IIPP program in California.

Next we are going to look at how sound is measured. It is one way to assess how much noise you are being exposed to at the workplace.

Workers don't have to be experts to measure noise they are exposed to at the workplace.

► **What kind of equipment is used to measure sound?**



Show slide #32, *Noise Measurement Devices*

Pass around a sound level meter for the class to see. (*See the following optional activities using a sound level meter.*)

There are two commonly used methods to monitor noise levels at the workplace: 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. A person has to be trained to use a dosimeter correctly.
- 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:
  - Spot-check noise levels
  - Determine an employee's noise levels whenever a noise dosimeter is unavailable or is inappropriate
  - Aid in determining the feasibility of engineering controls for individual noise sources
- There are also free **applications (apps) for cell phones** you can download for sound level meters. Recent studies show that these apps are fairly accurate. There are two apps listed in the Resource Guide, one for iPhones and one for Android phones.
- 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 this type of device.

### **(Optional Activities: Using a Sound Level Meter)**

#### Move Away From the Source of Noise

Make sure you have the following equipment for this activity in advance: a sound level meter and a piece of noisy equipment (like a hammer or electric drill).

The instructor hammers or does another noisy operation for a few seconds while one student measures the sound level with the noise level meter. A second student records the dBA on the flipchart. The noise monitor walks 10 feet away and takes another measurement. Repeat the procedure. Point out and discuss the reduction in noise due to moving away from the source.

Tell the class:

For this next activity I will need two volunteers. One to record the flipchart and one to measure noise with a sound level meter. We are going to measure and record the noise at the source. Then the noise monitor will walk 10 feet away and measure the noise again. We will see how much the noise is reduced each time we move away from the source. (Every time the distance is doubled the noise level should fall by 6 dBA, under ideal conditions).

#### Block the Source of Noise With a Barrier

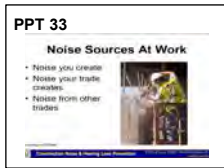
You will need to make a barrier in advance. Select a piece of loud equipment. Set up a noise barrier. For example, you can build a small box out of plywood to put over an electric drill.

The instructor uses a noisy tool (or does a noisy operation) for a few seconds while a student measures the noise. Then the instructor puts a barrier over the tool or noisy operation. The student takes another measurement.

Tell the class:

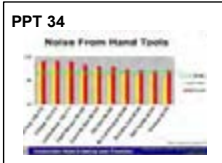
In this next activity we are going to take noise measurements with and without a barrier. (Avoid doing this near reflective walls because the noise can bounce back and alter the demonstration.)

► **What did you learn from this demonstration?**



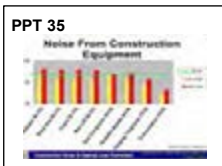
Show slide #33, *Noise Sources At Work*

This slide shows the three main sources of noise on the job. Knowing what noise to anticipate, and when, will help you plan accordingly. You should consider all three noise sources when you plan how you are going to protect yourself from the noise.



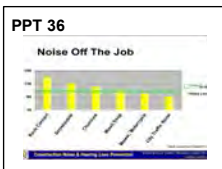
Show slides #34, *Noise From Hand Tools* and slide #35, *Noise From Construction Equipment*

► **What hand tools and construction equipment do you use on your job?**



Referring to the two slides discuss the noise levels people could possibly be exposed to.

► **What recreational activities could put you at risk for NIHL?** (Wait for a response. Then show the next slide.)

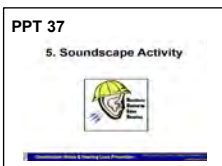


Show slide #36, *Noise Off The Job*

It is important to protect your hearing both on and off the job. Hearing protection should be used when using power tools or noisy equipment.

However it is important to remember what damages hearing: both noise levels and how long you are exposed. Non-occupational noise levels are not usually as long as occupational exposures.

Work exposure accounts for the majority of total noise exposures. Therefore, although it is difficult to distinguish between job-related hearing loss and off-the-job loss, the employer is still responsible for providing protection and, if need be, compensation under Workers' Compensation.



Show slide #37, *Soundscape Activity*

This is the next topic of the training.

## 5) Soundscape Activity (40 minutes)

Key points in this session:

- Work in small groups
- Create a noise map (Soundscape), report back to the class
- Materials needed for session:
  - Sets of 4 flipchart markers for each small group (black, red, blue, and green)
  - Flipchart paper
  - Masking tape
- (Optional) Noise walkaround inspection and toolbox training

**Handouts:** *1) Protecting Yourself From Noise In Construction (OSHA pocket guide), 2) (Optional) SBCTC-LOHP Noise Safety Walkaround Checklist and 3) (Optional) SBCTC-LOHP Noise Training Guide)*

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Explain to the class:

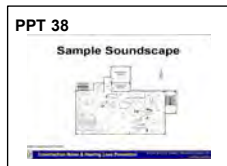
In this activity you are going to identify the sources of noise at a construction job site. You are going to create a *Soundscape* of the noise.

Creating a Soundscape involves drawing a simple map or floor plan of the construction site you are assigned. Then show where the sources of noise are at that construction site.

Each small group will be assigned one phase of a construction site to analyze from the following list:

- 1) Site clearing, excavation and earthwork site preparation.
- 2) Building the concrete foundation and concrete walls.
- 3) Erecting the structure (walls, floors, ceiling, etc.)
- 4) Completing the finishing work (sheet metal, cabinetry, electrical, etc.)

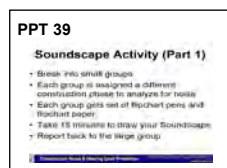
Each group will have a set of markers and flipchart paper. Use the **black** marker to draw the assigned site/floor plan on the flipchart



paper. The plan should show the work area, major machinery, equipment, and vehicles used in that operation.

Show slide #38, *Sample Soundscape*

This is a slide of a sample Soundscape of an office. This is a sound map created by an OSHA inspector using a sound level meter to record the dBA in various locations. You don't have to estimate the decibel rating on your Soundscape. Just mark the sources of noise you might find in your assigned construction site in another color. Make sure to include noise produced by other trades (and equipment) who might be working in the same area.



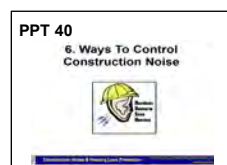
Show slide #39, *Soundscape Activity (Part 1)*

- Divide the class into small groups of 3-5 participants. Assign each small group a different phase of construction to map.

Tell the group:

You will have about 15 minutes to create your Soundscape. Each group should select someone to present their Soundscape to the class later. Be prepared to describe the sources of noise identified in your construction phase to the rest of the class. Ask each group to identify the main sources of noise in the construction phase they were assigned.

- Give each group a blank sheet of flipchart paper and a set of markers.
- While people are creating their Soundscapes, walk around among the various groups and answer any questions they may have. Be sure the groups choose two or three main sources of noise, and tell them to be ready to explain why they chose those particular noise sources. Give each group a "two minute warning" when time is almost up.
- Bring the class back together and have the small groups present their Soundscape. Have one group volunteer to go first, briefly explaining the construction phase they illustrated and the two or three main sources of noise they identified. They should hold up their Soundscape or tape it to the wall as they explain it. Then continue until all of the groups have presented.



Show slide #40, *Ways To Control Noise*

This is the next topic of the training.

### **Optional Activities: Conducting a Walkaround Inspection and Tailgate Noise Training**

(All companies must have a written Injury and Illness Prevention Program (IIPP) that meets all Cal/OSHA requirements. The IIPP must include identification of noise hazards on the site, regular inspections, accident investigation, and correction of hazardous conditions. [1509])

#### **Preparation**

Conduct a walkaround inspection of the job site first, using the **Safety Walkaround Noise Checklist** (located in Tab 4 of your binder). It will help you identify the noisy jobs on site. It summarizes Cal/OSHA regulations related to noise, as well as some good safety practices. You will use the information recorded on your Checklist to prepare for your Tailgate meeting.

There is also a **Training Guide on Noise** (located in Tab 4 of your binder) with a lesson plan. You should take time before the Tailgate meeting to become familiar with the Training Guide. Read it over and fill in the blanks. You'll need information from the Noise Checklist you completed earlier, as well as from your own knowledge of the job. Adding these details to the Training Guide helps ensure that the safety meeting deals with actual conditions on the job site.

#### **Hold The Tailgate Meeting**

Throughout the Training Guide you will find instructions directed to you as the trainer (they appear in *italics*.) Ask the numbered discussion questions in in sequence. After you ask each question, allow time for the crew to answer. After the crew members have given their answers, discuss them, and then use the information in the Training Guide to add any points you think are important.

Remember to document any hazards they crew reports to you during the meeting. Make a plan for correcting the hazards that are under your control. If the hazards are outside your control, report them immediately to your supervisor so they can be corrected.

**Equipment needed:** samples of hearing protection devices (earplugs and/or earmuffs) used on the job site to show the crew during the meeting.

## 6) Ways to Control Construction Noise (40 minutes)

Key points in this session:

- How to eliminate or control noise hazards
- Small groups show how to control noise on their Soundscapes
- Materials needed for session:
  - Sets of 4 flipchart markers for each small group (black, red, blue, and green)
  - Flipchart paper
  - Masking tape
- (Optional) Discussion card activity

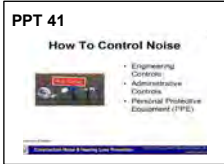
**Handouts:** 1) *Buy Quiet- Hearing Loss Is Preventable*, and 2) *Controlling Noise on Construction Sites*, and 3) (Optional) *Laminated Cards*

- 
- On a flipchart page, draw two columns. Head the left column **Construction Noise** and the right column **Possible Solutions**. (see chart below for example)
  - Under **Construction Noise**, write “Compressor.” (Or choose a tool or piece of equipment that commonly creates noise for your trade, phase of construction, or current jobsite.)
- **What are all the ways you can think of to solve the problem of a noisy compressor?**

As participants suggest answers, write them in the **Possible Solutions** column next to the hazard.

Construction Noise	Possible Solutions
Compressor	<ul style="list-style-type: none"><li>▪ Buy generator designed to emit low noise</li><li>▪ Enclose compressor with damping cladding</li><li>▪ Move compressor away from workers.</li><li>▪ Workers wear HPDs</li></ul>

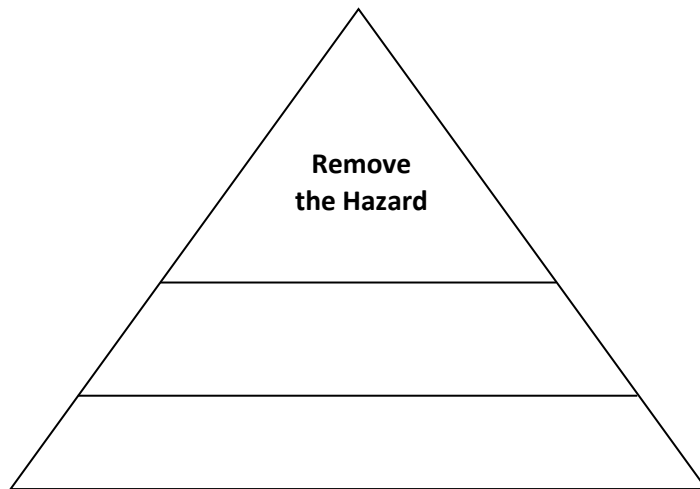
Explain to the class:



As we've seen, there are a number of ways to protect workers from noise. But not all solutions are equally effective. We can think in terms of a pyramid or "hierarchy" of possible solutions, with the most effective kind of solutions at the top.

Show slide #41, *How To Control Noise at Work*

- Draw a large pyramid on a flipchart page (dry erase board, chalkboard or whatever you have available). Divide the pyramid into three sections as shown below. Write "Remove the Hazard" in the top section.



Explain possible ways to "remove the hazard":

The best way to protect workers is to remove the hazard from the workplace altogether or at least keep the hazard away from workers.

► **What Are Some Examples of Removing the Hazard to Control Construction Noise?**

Write what the class says on the flipchart.

Possible answers include:

- Substitute quieter process or equipment (e.g. Buy Quiet, see Additional Information box below)
- Eliminate or minimize noise at the source
- Isolate/enclose the process or operator
- Increase distance from the source of noise

**Additional Information: Buy Quiet, (see handout):**

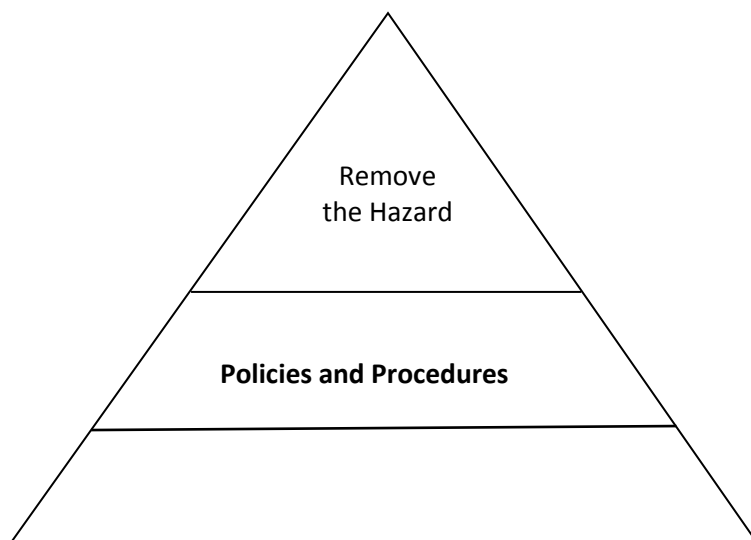
- Provides information on equipment noise levels, so companies can buy quieter products that make the workplace safer.
- Encourages companies to purchase or rent quieter machinery and tools to reduce worker noise exposure.
- Encourages manufacturers to design quieter equipment by creating a demand for quieter products.

This is a new initiative and is in the initial stages. Manufacturers are starting to develop quieter equipment.

These are called **Engineering Controls**. They are considered most effective because they get rid of the hazard at the source, they don't rely on people to follow procedures, and they don't allow for shortcuts.

An easy way to remember controls for hazardous noise is, "Reduce It--Movie It—Block It."

Write "Policies and Procedures" in the middle section of the pyramid.



- **What are possible ways to use "policies and procedures" to control noise?**

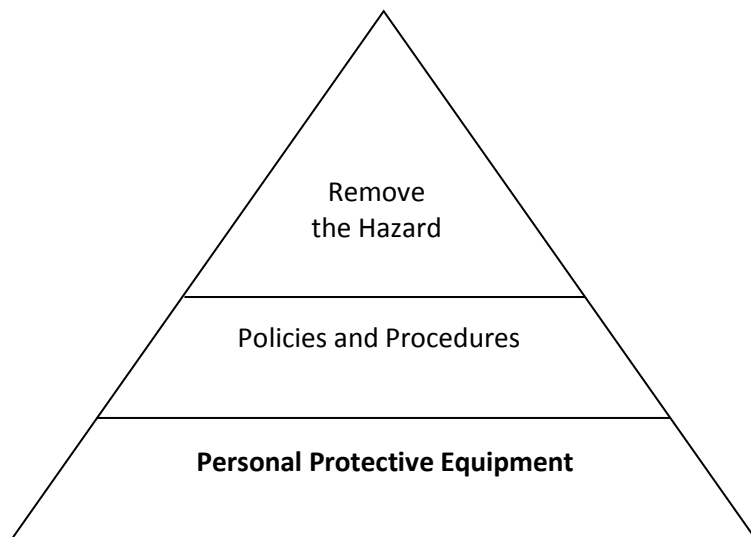
Write what people say on the flipchart.

Possible answers:

- Do a Job Safety Hazard Analysis (JSHA) in the planning stage. Identify the noisy tasks and ways to control them before work begins
- Create a noise perimeter zone to limit exposure to noisy processes or equipment
- Schedule noisy tasks off hours in advance
- Ask the employer to monitor noise levels of different tasks, use that information to inform how the work is done
- Training

These are called **Administrative Controls**. They are second in the pyramid because they don't remove the hazard, they limit or prevent people's exposure to the hazard through policies or procedures.

Write "Personal Protective Equipment" in the bottom section of the pyramid.



Tell the class about **Personal Protective Equipment**:

Personal protective equipment, or PPE, is worn on the body and protects you from exposure to a hazard. It includes gloves, goggles, respirators, earplugs, hard hats, coveralls, safety shoes, etc. Workers wear PPE when other methods of controlling

hazards aren't possible or don't give enough protection. PPE is the least effective. Try to remove the hazard or change work policies or procedures first.

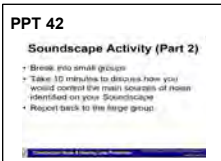
► **Why are hearing protection devices (HPDs) less effective than the other methods?**

Possible answers include:

- It doesn't get rid of the hazard itself.
  - Workers may not want to wear them because they are uncomfortable and may make it hard to communicate.
  - HPDs have to fit properly to work, and in some cases must be cleaned and inspected to work properly.
  - Workers must be trained on how to use HPDs properly.
  - One size, style, model doesn't fit all workers
- Have the class look back at the list of controls for the hazard "noisy compressor" and have them categorize each control.
  - Summarize key points about the different control methods.

Explain to the class

Sometimes you may need a combination of methods to control a hazard. Even when engineering controls are used, you usually need training programs and other workplace policies and procedures. There may also be situations where PPE is essential even though it's the least effective method. For example, you will have to wear hearing protection devices in construction if the noise cannot be eliminated or controlled at the source.



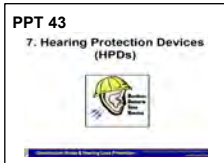
Show slide #42, *Soundscape Activity (Part 2)*

- Tell the class:

You will have about 10 minutes to figure out ways to control the sources of noise identified in your Soundscape. Focus on the main sources of noise you identified earlier. Try to find engineering solutions to remove the hazard. Each group will present their ideas back to the class.

Ask each group to explain the controls they chose to address the main sources of noise identified in their Soundscape.

- Refer participants to the Factsheet, *Controlling Noise on Construction Sites*, in their binder. Tell them that this factsheet provides background information on ways to eliminate or reduce construction noise.



Show slide #43, *Hearing Protection Devices (HPDs)*

This is the next topic of the training.

#### Optional Activity: **Discussion Card Activity**

You will find a set of 8 1/2 by 11 inch laminated plastic cards in the pocket of your binder. Each one illustrates a different topic related to controlling construction noise and other noise topics. They can be used in Tailgate Training (or any other training) as discussion triggers or talking points.

The cards are designed for the instructor to show the crew. A photo or questions appear on the front of the card. The answers and prompts for the instructor are written on the back of the card.

Review the cards in advance and select the ones that are appropriate for your audience.

## 7) Hearing Protection Devices (HPDs) (20 minutes)

Key points in this session:

- Demonstrate five types of hearing protection devices
- Demonstrate how to use an earplug correctly.
- Materials needed for this session:
  - o Foam (formable) plugs (for each participant)
  - o Reusable earplugs
  - o Custom molded plugs
  - o Banded or semi-aural
  - o Earmuffs

**Handout:** *Don't Let Noise Steal Your Hearing*

---

Have different types of hearing protection devices available to show as you discuss them. Have a pair of disposable ear plugs available for each student.



Show slide #44, *Types of Hearing Protection Devices (HPDs)*

► **What kind of hearing protection do you use?**

Show an example of each type of HPD as you discuss it. Ask people to explain the pros and cons of using each device.

► **What is the main consideration for you when selecting a HPD?**  
(Wait for a response. Then show the next slide.)



Show slide #45, *Selecting Hearing Protection*

There are basically seven factors to consider when selecting hearing protection. Convenience and comfort are typically the most important considerations, although the other factors can either rule out or require a certain type.

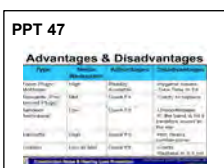
In a NIOSH study, workers cited communication as an important reason for not using HPDs. The HPD (headset with microphone) in this slide allows the wearer to communicate with another worker.



Show Slide #46, *Noise Reduction Rating (NRR)*

Hearing protection devices are tested in a laboratory to determine how much noise they block from reaching your ears. This is called the NRR (**Noise Reduction Rating**) and should be listed on the HPD package.

Since lab conditions are not the same as workplace conditions, the actual noise reduction is at least 7 dBA less than the printed NRR. Many experts say actual protection is only half the NRR rating on the package.



Show slide #47, *Advantages and Disadvantages*

This slide summarizes the advantages and disadvantages of each type of HPDs. Foam plugs and ear muffs provide the highest level of protection when used and maintained properly.

- **Do you have additional advantages or disadvantages you would like to add?**



Show slide #48, *Ear Muffs and Safety Glasses*

- **What is the problem in this photo? How would you address it?**

If workers have to wear earmuffs over safety glasses, choose thin frames. Thinner frames cause the least problem getting a seal against the ear to reduce the noise.



Show slides #49 & #50, *Care and Maintenance*

These slides show the basic care that is needed for HPDs. Your employer should train you on ways to properly care for this equipment.



Remember that formable foam ear plugs should be replaced after each use.



Show slide #51, *How Much Protection Do These Earplugs Provide?*

- **How much protection do you think each of these earplugs provides the worker (on the slide)?**

The amount of protection will be shown on the slide when the instructor advances the slide. It will show 0 dB for ear #1, 0 dB for ear #2, and 33 dB for ear #3.

- **Why is ear #2 not protected?**

Explain that the second earplug is not fitted properly and it is also worn around the edges so it doesn't give a good fit. That is why we are going to discuss how to fit an ear plug correctly.

- **Who has been *trained* to fit an ear plug properly?** (Ask for a show of hands. Then ask who trained them to use an ear plug.)

Show slide #52, *Fitting An Earplug*

Pass out a set of ear plugs to each trainee. Tell the class to do the following (instructor also demonstrates how to fit an ear plug):

- Roll foam plug tightly. Make sure there are no creases.
- Pull the ear back gently at the top to straighten the ear canal.
- Insert the plug.
- Release your ear while holding the plug in for 10 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.

- **What should a worker do to check for hearing loss?** (Wait for a response. Then show the next slide)

Show slide #53, *Hearing Test*

Professional hearing tests are called audiometric tests. You should get one every year to monitor your hearing and see if you are being protected well enough from noise. The test takes about 10 -15 minutes and is done by a professional healthcare worker. Hearing tests will identify small changes in your hearing that you will not be able to notice.

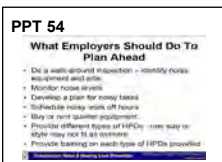
Construction employers are not required to provide hearing tests in California. So it is a good idea to monitor your own hearing.

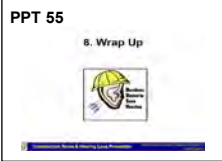
- **What should an employer do to address noise before a project begins?** (Wait for a response. Then show the next slide.)

Show slide #54, *What Employers Should Do Before Work Begins*

- **Is there anything else you would add to this list?**

Refer students to our Noise Walkaround Safety checklist and Training Guide on Noise. They are located in the tab 4 of the binder, under factsheets.





Remember, workers have the right to see and copy the results of any noise monitoring that the employer does in their work area. Workers also have the right to see the results of their own hearing tests.

Show slide #55, *Wrap Up*

This is the final topic of the training.

## 8) Wrap Up (5 minutes)

### Key points in this session:

- **Conclude workshop**
- **Participants evaluate workshop**

**Handout:** *Workshop Evaluation*

---



Show slide #56, *Hear Today...Hear Tomorrow*

This concludes our presentation on noise and hearing loss in construction. Remember, workers have the right to workers' compensation if their hearing loss was caused by work and is severe enough. Workers' compensation includes: disability payments, payment for hearing aids, and coverage of ongoing medical care needed for hearing damage.

The goal of this training is to prevent hearing loss before it happens. Only employers and employees working together can ensure that hearing is protected.

### ► **Will you please complete the workshop evaluation?**

Distribute the workshop evaluation to participants and thank them for attending the workshop.



# Construction Noise & Hearing Loss Prevention

State Building & Construction Trades Council of California, AFL-CIO  
Funded by Federal OSHA, 2015

# Training Topics

- 1) Introduction
- 2) What's It Like To Lose Your Hearing?
- 3) Hazardous Noise and Hearing Loss
- 4) Measuring Noise
- 5) Soundscape Activity
- 6) Ways to Control Noise
- 7) Hearing Protection Devices
- 8) Wrap Up



# 1. Introduction



**Construction Noise & Hearing Loss Prevention**

STATE BLDG & CONST TRADES COUNCIL OF CA  
[safety.sbctc.org](http://safety.sbctc.org)

## Funded by OSHA

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# Acknowledgements

- American Speech-Language-Hearing Association (ASHA)
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- Laborers' Health and Safety Fund of North America (LHSFNA)
- The National Institute on Deafness and Other Communication Disorders (NIDCD), NIH
- WISHA (Washington Industrial Safety and Health Act)
- Worksafe (Canada)
- The Commission on Health and Safety and Workers' Compensation, California, Department of Industrial Relations, Worker Occupational Safety and Health (WOSH) Specialist Training Program



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## State Building and Construction Trades Council of California (SBCTC), AFL-CIO

- Umbrella organization for 160 unions
- Represents 350,000 skilled construction workers in California
- Developed and presented seven OSHA funded health & safety programs since 2000



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# Training Objectives

1. Discuss what it is like to experience simulated hearing loss.
2. Explain the effects of hearing loss, warning signs of hearing loss and tinnitus.
3. Discuss hazardous noise, causes of hearing loss, noise-induced hearing loss, how we hear, types of noise and common hearing loss devices.
4. Describe how sound is measured, Cal/OSHA noise limits in construction, and devices used to measure noise.
5. Identify sources of noise at a construction site.
6. Discuss ways to control construction noise.
7. Review the types of hearing protection devices used in construction and demonstrate how to use an earplug correctly.



# Why Care About Hearing Loss?



Photo courtesy of The International Brotherhood of Boilermakers



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## How Big Is The Problem?

- 30 million workers in the U.S. are exposed to hazardous noise at work
- 50% of construction workers suffer hearing loss
- \$242 million is spent annually on workers' compensation for hearing loss disability



Source, CDC



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# Building Trades Workers and Hearing Loss

- The Average 25 Year Old Carpenter Has 50 Year Old Ears!

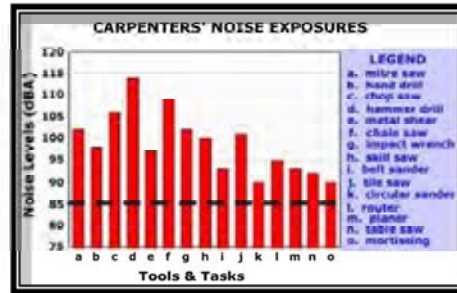


Chart courtesy of NIOSH



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## Why Is Noise Accepted?

- Can't do anything about it
- Poor planning
- Lack of coordination



Photo courtesy of OSHA



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## 2. What's It Like To Lose Your Hearing?

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SAY WHAT			
	A	B	C
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			




<b>First Reading</b>	SAY WHAT			15	
		A	B		C
	1				
	2				
	3				
	4				
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	6				
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	8				
	9				
	10				
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<b>Second Reading</b>	SAY WHAT			16	
		A	B		C
	1				
	2				
	3				
	4				
	5				
	6				
	7				
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	9				
10					
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<b>Third Reading</b>	SAY WHAT			17	
		A	B		C
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
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SAY WHAT			
	A	B	C
1			Fill
2			Catch
3			Thumb
4			Knee
5			Wise
6			Bath
7			Fish
8			Shows
9			Bed
10			Juice


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## Effects of Hearing Loss

- Difficulty communicating with loved ones
- Loneliness and depression
- Low self-confidence
- Increased stress, blood pressure, hypertension and cardio vascular disease



## Warning Signs

### Do You Have Any of the Following Problems:

- ☐ Have trouble hearing people talk when there is background noise
- ☐ People sound like they are mumbling
- ☐ Often have to ask people to repeat what they say
- ☐ Turn up the radio or TV a lot
- ☐ Have difficulty hearing people on the phone
- ☐ Have constant ringing in your ears



# Tinnitus

- Constant ringing in ears (or hissing, buzzing, roaring, chirping, or whistling sound)
- 50 million people in the U.S. have tinnitus



### 3. Hazardous Noise and Hearing Loss



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# Causes of Hearing Loss

- Exposure to loud noise
- Certain drugs and chemicals
- Aging
- Heredity
- Head trauma
- Ear infection



Photo, courtesy of OSHA



# Noise Induced Hearing Loss (NIHL)

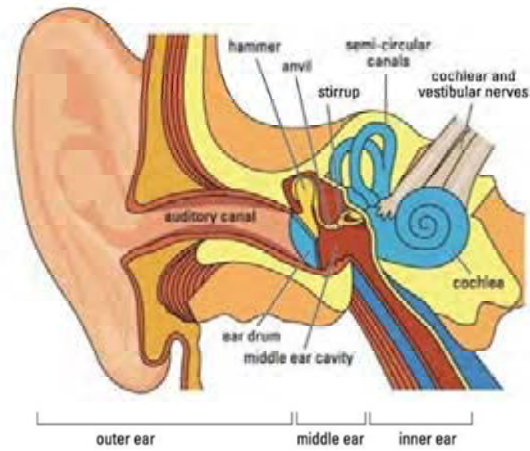
- Most common work-related illness
- Damage to hearing depends how **loud** the noise is, and
- How **long** you are exposed to it



Photo courtesy of NIOSH



# How You Hear



Slide courtesy of Howard Leight, Honeywell



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# The Cochlea



Slide courtesy of Howard Leight, Honeywell



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## How Do You Know It's Too Loud?

At work you have to:

- Shout to be heard an arm's length away (2-3 feet)
- Turn equipment off to talk
- Move to a quieter area to talk

After work you:

- Hear ringing or humming in your ears
- Experience temporary hearing loss



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# Types of Noise

## Continuous

- same noise level over long periods of time

## Intermittent

- periods of quiet, interrupted by noise
- **most noise exposures are intermittent**

## Impact or impulsive

- nail gun



Construction has a combination of all noise types

Slide courtesy of Build It Smart



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## 4. Measuring Noise



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# How Sound Is Measured

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- Sound is measured in units called **decibels (dB)**
- An increase of 3 dB means the sound intensity has **doubled**
- Worker exposures to noise should be controlled below a level equivalent to 85 dB for 8 hours to minimize occupational noise-induced hearing loss. (NIOSH)

Construction noise levels are often above 85 dB

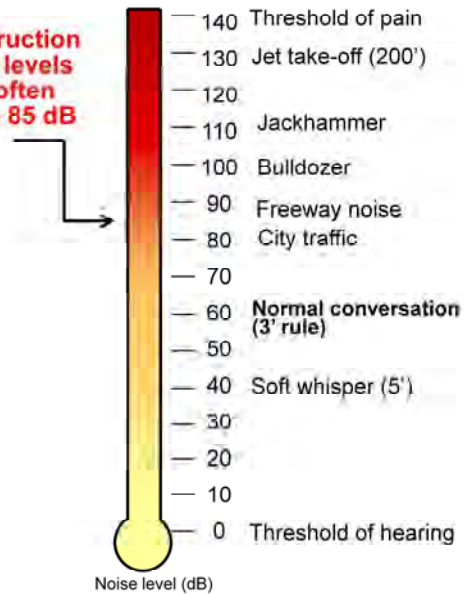


Illustration courtesy of WISHA



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## Cal/OSHA Noise Limits In Construction

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



# Noise Measurement Devices



**PERSONAL  
DOSIMETER**

Photo courtesy of Wikipedia



**SOUND LEVEL  
METER**

Photo courtesy of Howard Leight,  
Honeywell



**IN-EAR  
DOSIMETER**

Photo courtesy of Howard Leight,  
Honeywell



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STATE BLOG & CONST TRADES COUNCIL OF CA  
[safety.sbctc.org](http://safety.sbctc.org)

## Noise Sources At Work

- Noise you create
- Noise your trade creates
- Noise from other trades



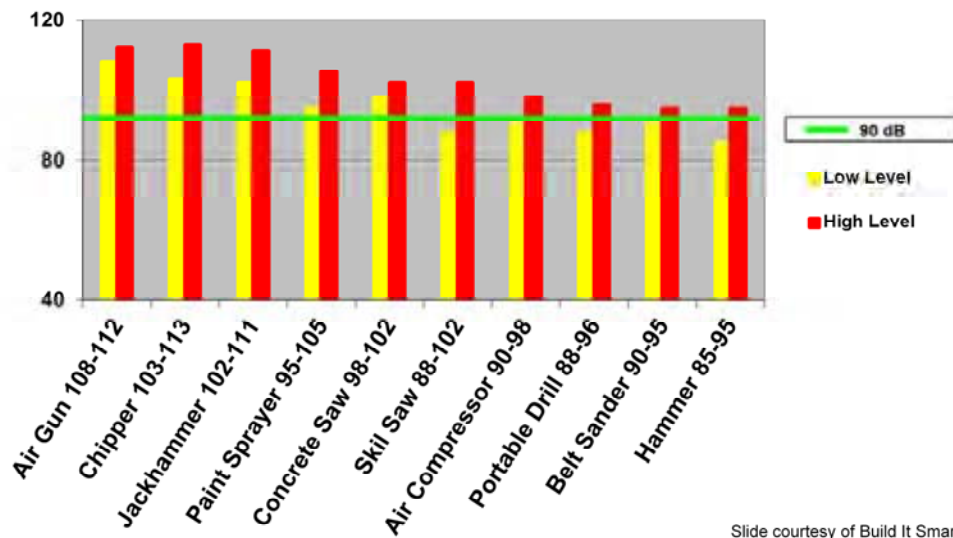
Photo courtesy of LHSFNA



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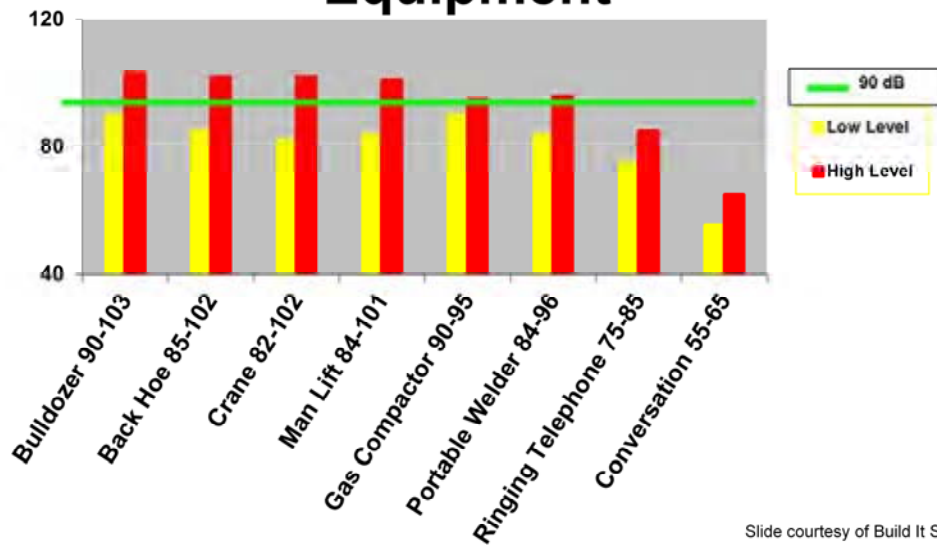
## Noise From Hand Tools



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# Noise From Construction Equipment



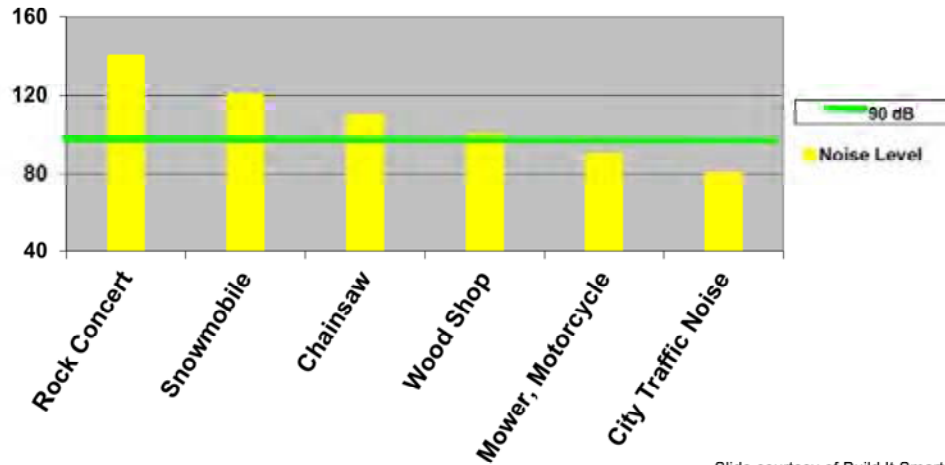
Slide courtesy of Build It Smart



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## Noise Off The Job



Slide courtesy of Build It Smart



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## 5. Soundscape Activity



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# Sample Soundscape

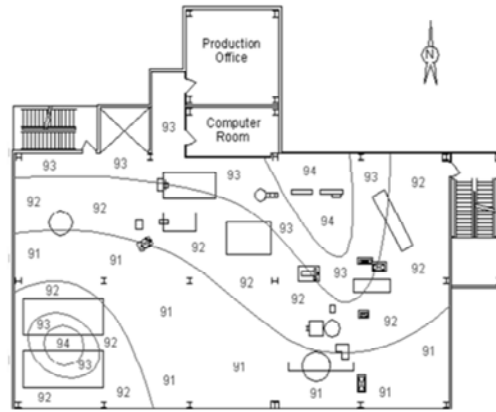


Illustration courtesy of OSHA



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## Soundscape Activity (Part 1)

- Break into small groups
- Each group is assigned a different construction phase to analyze for noise
- Each group gets set of flipchart pens and flipchart paper
- Take 15 minutes to draw your Soundscape
- Report back to the large group



## 6. Ways To Control Construction Noise



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# How To Control Noise



- Engineering Controls
- Administrative Controls
- Personal Protective Equipment (PPE)

Photo courtesy of NIOSH



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## Soundscape Activity (Part 2)

- Break into small groups
- Take 10 minutes to discuss how you would control the main sources of noise identified on your Soundscape
- Report back to the large group



## 7. Hearing Protection Devices (HPDs)

43



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# Types of Hearing Protection Devices

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



Slide courtesy of Build It Smart



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## Selecting Hearing Protection

- Convenience
- Comfort
- Communication needs
- Hygiene
- Noise reduction needed
- Hearing ability of worker
- Noise level



Slide courtesy of Build It Smart



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# Noise Reduction Rating (NRR)

- NRR is measured in decibels
- The **NRR** is found on the earmuff or earplug package
- Higher the number, greater the protection



Slide courtesy of WISHA



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## Advantages & Disadvantages

Type	Noise Reduction	Advantages	Disadvantages
Foam Plugs/ Moldable	High	Readily Available	-Hygiene Issues -Take Time to Fit
Reusable (Pre-formed Plugs)	Mid	Quick Fit	-Costly to replace
Banded/ Semi-aural	Low	Quick Fit	-Uncomfortable -If the band is hit it transfers sound to the ear
Earmuffs	High	Quick Fit	-Hot, heavy, cumbersome
Custom	Low to Mid	Quick Fit	-Costly -Replace in 3-5 yrs



# Ear Muffs and Safety Glasses



Photo courtesy of Howard Leight, Honeywell



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# Care and Maintenance

## Foam roll plugs

- ✓ dispose of foam roll plugs after each use

## Reusable plugs

- ✓ clean with soap and water, replace when damaged

## Custom plugs

- ✓ wash in mild soapy water



Photos courtesy of Howard Leight, Honeywell



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# Care and Maintenance

## Banded or semi-aural

- ✓ Clean and replace pods regularly



## Earmuffs

- ✓ Wipe down with damp cloth, or remove cushions and wash in soapy water
- ✓ Replace cushions if torn or cracked



Photos courtesy of Howard Leight, Honeywell



## How Much Protection?



Slide courtesy of Howard Leight, Honeywell



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# Fitting An Ear Plug



Slide courtesy of Howard Leight, Honeywell



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# Hearing Test

- First test is a “baseline” test
- Test once a year
- Future tests are compared to baseline



Photo courtesy of Wikipedia



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## What Employers Should Do To Plan Ahead

- Do a walk-around inspection – identify noisy equipment and jobs
- Monitor noise levels
- Develop a plan for noisy tasks
- Schedule noisy work off hours
- Buy or rent quieter equipment
- Provide different types of HPDs - one size or style may not fit all workers
- Provide training on each type of HPDs provided



## 8. Wrap Up



## Hear Today...Hear Tomorrow

You only have one  
set of ears.

Protect them.



State Building & Construction Trades Council of California, AFL-CIO  
Funded by Federal OSHA, 2015

## **Section 5: Worksheets – Factsheets**

### **Worksheets**

- Say What activity worksheet
- (Optional) What Does Noise-Induced Hearing Loss Sound Like?

### **Factsheets**

- Noise (CPWR Hazard Alert)
- How You Hear
- Hear Today...Hear Tomorrow (cochlea)
- Construction Noise (CPWR Hazard Alert)
- Common Noise Levels in Construction (chart)
- Protecting Yourself from Noise in Construction (OSHA Pocket Guide)
- Hearing Loss is Preventable – Buy Quiet (NIOSH)
- Controlling Noise on Construction Sites
- Don't Let Noise Steal Your Hearing

# SAY WHAT?

	A	B	C
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

# What Does Noise-Induced Hearing Loss Sound Like?

Brad Witt, Director of Hearing Conservation, Howard Leight / Sperian Hearing Protection, LLC

The best way I can explain what it's like to lose hearing due to noise exposure is to give each of you a noise-induced hearing loss – no worries, we'll just make it temporary.

The part of the ear most susceptible to damage from loud noise is the high-frequency range – 3000, 4000, 6000 Hz. When you lose hearing in the high frequencies, you no longer hear many of the consonant sounds of speech – S, T, K, CH, F, TH, SH, P ...

I'll slowly take away these sounds from my speech. First, the S, SH and CH.

"At first, the change will be very hard to notice. You may notice certain words are harder to understand, but you can fill in what's missing from the context of the conversation."

Now, I'll take away the T and TH.

"Gradually, the words are harder to understand, especially if there's any background noise. Many workers with a high-frequency hearing loss don't realize they can hear fine when they can hear a speaker's voice. But if they can't hear the speaker's voice, or if there's any background noise, they're lost. They don't understand the joke, they don't understand the instructions, they just don't understand."

Now I'll take away the K and F.

"Now my speech may be very difficult to understand. You have a severe high-frequency hearing loss, but I've given it to you in just two minutes, and I warned you what I was going to do. Imagine what it's like for the noise-exposed worker who slowly experiences this loss of hearing, not over the course of two minutes, but two or ten or twenty years. And nobody warned him it was coming.

The worker can very literally wake up one morning and realize his hearing has slowly deteriorated, and there is nothing ... nothing he can do to get it back!

# HAZARD ALERT

CPWR [●]  
THE CENTER FOR CONSTRUCTION  
RESEARCH AND TRAINING

# NOISE



## What?

### Noise!

It's the most common hazard in construction!

Do you ask others to repeat themselves? That's no surprise. You work around loud equipment.



- Pneumatic chippers
- Pile drivers
- Nail guns
- Grinders
- Front end loaders
- Concrete saws
- Chopsaws
- Drills
- Screwguns
- Compressors
- Compactors
- Generators

**A 25-year-old construction worker has the hearing of a 50-year-old** who is not exposed to high noise levels at work.\*

What are **you** exposed to?

## What will you lose when you lose your hearing?

Hearing a child's first words. Talking on the phone. Listening to music. Talking to friends and family. Listening to speakers at meetings or church.



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

**Everything you enjoy now can be lost to you** if you have trouble hearing.

\*Noise and Hearing Loss Prevention, NIOSH, 2011.

## Find out more about construction hazards.

Get more of these Hazard Alert cards – and cards on other topics.

**Call 301-578-8500**

## When you work around noise ...



*Quiet jackhammer and quiet generator*

### 1 Ask for controls

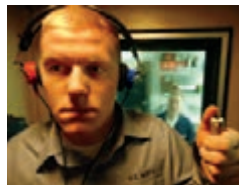
Ask your foreman to rent or buy "quiet" equipment. Many new products on the market are marked "**Buy Quiet.**" They will reduce the noise level. Put a sound-absorbing barrier around equipment like compressors.

Check out CPWR's Construction Solutions ([www.cpwrconstructionsolutions.org](http://www.cpwrconstructionsolutions.org)) for information on quiet tools.



### 2 Wear hearing protection

Your employer should provide you with hearing protection and training. Make sure you get protection that fits and is comfortable. New hearing protection is available that makes it easier to communicate. The louder the job, the more protection you need.



### 3 Get tested

Get your hearing tested regularly to check for hearing loss. An annual test will let you know how your hearing has been affected. Ask about better ways to protect your hearing. Take steps to conserve your ability to hear.

## Noise is bad for your health – and safety.

- You may not hear warnings
- Noise can distract you
- Years of noisy job sites can permanently damage your hearing

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



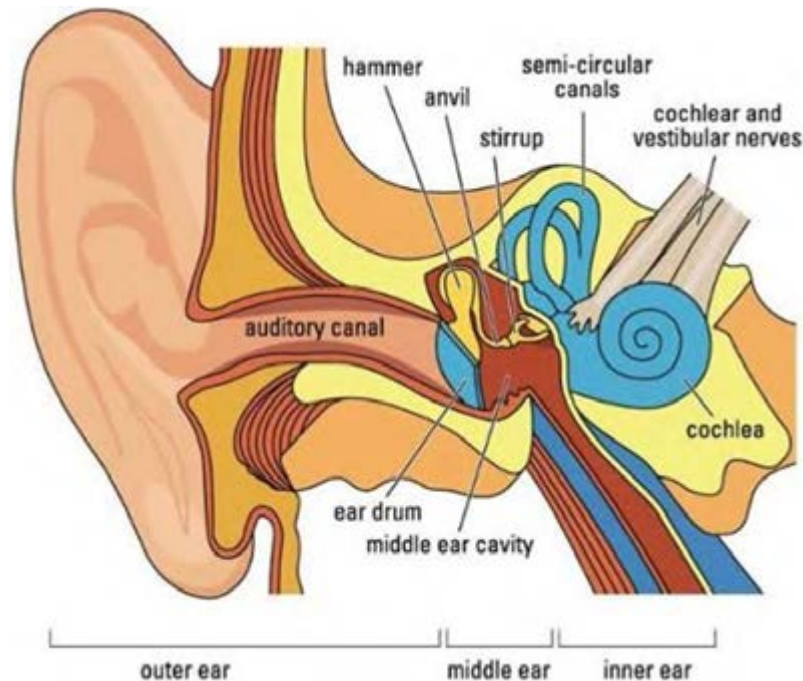
**If you have to raise your voice to be heard by someone 3 ft. away, your hearing is in danger.**

### If you think you are in danger:

**Contact your supervisor. Contact your union.**

**Call OSHA  
1-800-321-OSHA**

# How You Hear



The ear is made up of three basic parts: 1) outer ear 2) middle ear and, the 3) inner ear.

Sound travels down the outer ear (auditory) canal, hits the eardrum and makes it vibrate (move back and forth). The vibrations pass through little bones (hammer, anvil and stirrup) which creates motion in the inner ear that is filled with fluid. The movement of fluid in the inner ear (the cochlea) 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.

Typically the high sounds (or frequencies) are affected first because the hair-like nerve cells for those sounds are located at the entry of the cochlea where every sound wave passes by. This can affect hearing women and young children because they have higher voices. It can also affect hearing warning sounds on the job.

Noise exposures that are loud enough and last long enough can damage nerves in the inner ear (cochlea), causing permanent and irreversible hearing loss. Once you lose your hearing it never comes back. Preventing hearing loss is key to protecting your hearing.

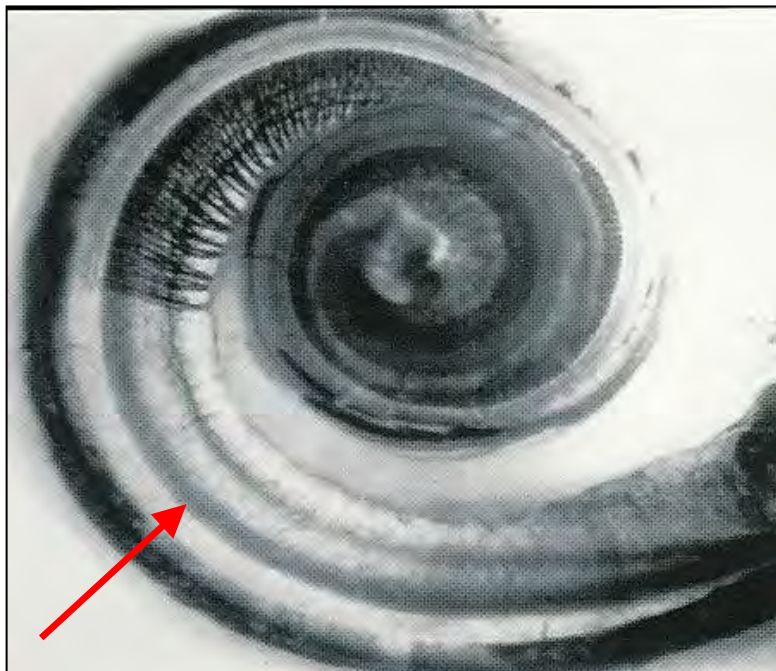
(Illustration courtesy of Howard Leight, Honeywell)

# HEAR TODAY..... HEAR TOMORROW



## Normal Inner Ear

The inner ear houses thousands of hair cells as shown in the picture above.



## Noise-Induced Hearing Loss

Noise-Induced hearing loss will begin at the first bend of the cochlea (3000 Hz - 6000 Hz) and then spread to the surrounding hair cells

# Construction Noise

## Hazard Alert



Most construction workers lose a lot of their hearing. You lose hearing slowly, so you may not notice. But if you can't hear, you may be in danger on the job.

Noise doesn't just hurt your hearing. You can also get tinnitus, a ringing sound in your ears. Too much noise can make you tired and nervous. It can raise your blood pressure and add stress that can help lead to heart disease.

### Exposure Levels

Noise levels are measured in decibels (dBA). We talk at about 70 decibels. Decibels are measured on a scale like the one for earthquakes. So when the decibels go up a little, the noise goes up a lot. 73 decibels is 2 times as loud as 70. OSHA has rules about how long you may be exposed to a noise level, before you must wear hearing protection:

Allowed to be unprotected	At this noise level
Up to 8 hours	90 decibels
Up to 4 hours	95 decibels
Up to 1 hour	105 decibels

When the noise is 95 decibels, OSHA says you may work with no hearing protection for only 4 hours. Even so, this noise level is not safe; 1 in 5 people exposed regularly to 90 decibels (as OSHA allows) will lose some hearing. Short, very loud (impact) noises can do the most harm.

**If you have to raise your voice for someone 3 feet away to hear you, the site may be too noisy and you need hearing protection.**

Most construction noise comes from equipment. These decibel levels have been measured:

Equipment	decibels	Equipment	decibels
Pneumatic chip hammer	103-113	Earth Tamper	90-96
Jackhammer	102-111	Crane	90-96
Concrete joint cutter	99-102	Hammer	87-95
Skilsaw	88-102	Gradeall	87-94
Stud welder	101	Front-end loader	86-94
Bulldozer	93-96	Backhoe	84-93

The noise levels change. The noise from a gradeall earthmover is 94 decibels from 10 feet away. The noise is only 82 decibels if you are 70 feet away. A crane lifting a load can make 96 decibels of noise; at rest, it may make less than 80 decibels.

*(Please turn the page.)*

## Protect Yourself

Try to do five things:

- **Make the workplace quieter.** Ask contractors to buy quieter models when they buy new equipment. Good maintenance, new mufflers, and other changes can make a difference too. Put sources of loud noise, like compressors and generators, as far away from the work zone as possible. Also, plywood or plastic sheeting set up around machinery can shield noise.
- **Cut the time you spend around loud noises.** Ask to have workers rotated from noisy jobs to quieter jobs, if possible. Take rest breaks away from noisy spots.
- **Wear protective equipment.** OSHA says, if changes the contractor makes do not get noise levels low enough, you must wear hearing protection.\* And you should be trained to use it.

Use hearing protection that is easy to put on and take off. Some hardhats have earmuffs for hearing protection that can be lifted out of the way when you don't need them. Some ear plugs have neckbands so you don't lose them if you take them off.

- **Have your hearing checked each year.** Ask for at least a standard pure-tone test. Tell them your work is noisy, so they will know you may have lost some hearing.
- **Measure the noise on site.** Your local union can buy a low-cost sound meter.

## You Should Know

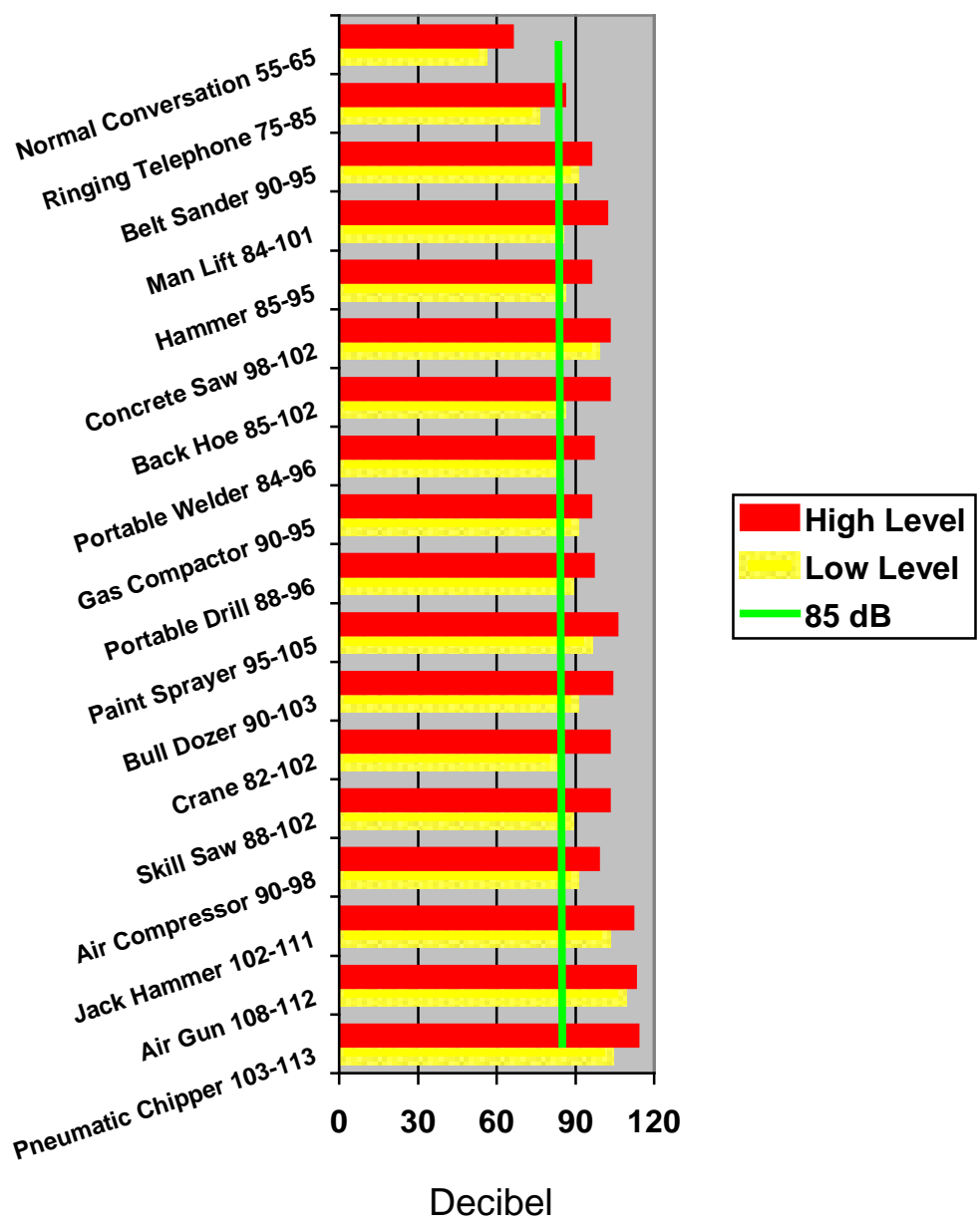
Many workers don't want to use hearing protection. They are afraid they won't hear warning signals, like backup alarms. But some new protectors can let in voices and block other noises. You may not need the hearing protection designed for the loudest noises – just something comfortable that lets you hear talking and takes away some of the noise around you.

**For more information,** call your local union, the Center to Protect Workers' Rights (CPWR) (301-578-8500 or [www.cpwr.com](http://www.cpwr.com)), the National Institute for Occupational Safety and Health (1-800-35-NIOSH or [www.cdc.gov/niosh](http://www.cdc.gov/niosh)), or OSHA (1-800-321-OSHA or [www.osha.gov](http://www.osha.gov)). Or go to [www.elcosh.org](http://www.elcosh.org).

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\*The OSHA standard (1926.52) says, it "shall be provided."

# Common Noise Levels in Construction





Occupational Safety and Health Administration

[www.osha.gov](http://www.osha.gov)

# **Worker Safety Series**

## **Protecting Yourself from Noise in Construction**



If you are a construction worker, this pocket guide is written for you. Small contractors should also find this information helpful. You are encouraged to go to the references in this document and to the OSHA website for more information.

This guidance document is not a standard or regulation, and it creates no new legal obligations. The guidance is advisory in nature, informational in content, and is intended to help construction workers and supervisors understand and reduce noise exposure on job sites. Employers are required to comply with safety and health standards as issued and enforced by either the Federal Occupational Safety and Health Administration (OSHA), or an OSHA-approved State Plan. In addition, Section 5(a)(1) of *The Occupational Safety and Health Act*, the General Duty Clause, requires employers to provide their workers with a workplace free from recognized hazards likely to cause death or serious physical harm. Employers can be cited for violating the General Duty Clause if there is such a recognized hazard and they do not take reasonable steps to prevent or abate the hazard. However, failure to implement these guidelines is not, in itself, a violation of the General Duty Clause. Citations can only be based on standards, regulations, and the General Duty Clause.

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# Why is job site noise control important to me?

Exposure to high levels of noise can cause permanent hearing loss. Neither surgery nor a hearing aid can help correct this type of hearing loss. Construction sites have many noisy operations and can be a significant source of noise exposure.

Loud noise can also reduce work productivity and contribute to workplace accidents by making it difficult to hear warning signals. Hearing loss from loud noise limits your ability to hear high frequencies, understand speech, and reduces your ability to communicate, which can lead to social isolation. Hearing loss can affect your quality of life by interfering with your ability to enjoy socializing with friends, playing with your children or grandchildren, or participating in other activities.

Damage to your hearing **can be prevented**, but once permanent noise-induced hearing loss occurs, it **cannot be cured** or reversed. Hearing loss usually occurs gradually, so you may not realize it is happening until it is too late.

Noise can also **affect your body in other ways**. A recent study found that workers persistently exposed to excessive occupational noise may be two-to-three times more likely to suffer from serious heart disease than workers who were not exposed.<sup>1</sup>

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<sup>1</sup>Gan, W. et al., Exposure to Occupational Noise and Cardiovascular Disease in the United States: NHANES 1999-2004, Occup Environ Med doi: 10.1136/oem.2010.055269.

You may have hearing loss if:

- You have a hard time hearing people in groups or meetings or if there is background noise.
- People sound as if they are mumbling.
- You have to ask people to repeat what they say.
- You have trouble understanding others on the telephone.
- You have ringing or noises in one or both ears.
- You have trouble hearing back-up alarms or the ringing of a cell phone.

## How does hearing damage happen?

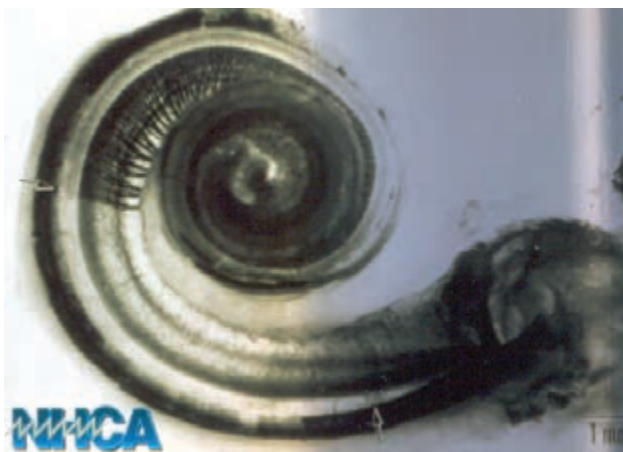
A one-time exposure to a sudden powerful noise, such as an explosion, may damage your hearing instantly. Prolonged exposures to loud noise can lead to a gradual, but permanent, loss of hearing.

Damage can occur within the ear at noise levels similar to that of running a lawn mower for eight hours. At first, this may cause a temporary loss of hearing that may last as long as 14-16 hours. With repeated exposure to high noise levels and periodic exposures to very high noise levels (e.g., with the use of nail guns), as is common at most construction job sites, your hearing may not fully recover. More often, the loss of hearing occurs slowly over time from exposure to moderate levels of noise. When that happens, the hearing loss becomes permanent. This is why workplace noise is sometimes referred to as a stealth long-term hazard – because it is a painless, gradual process.

Hearing loss occurs when cilia, tiny hair cells that line the inner ear, are damaged. At first, the damage happens to the cilia that receive the higher frequencies. Gradually, noise damages more of the ear and affects how speech is heard. If you hear muffled or distorted speech sounds, that may be an indication that a substantial hearing loss has already occurred.



Healthy inner ear lined with cilia, tiny hair cells that help you hear.



Inner ear showing damage to the cilia.

In addition to hearing loss, you also may experience ringing in the ears. This is called *tinnitus*, and can occur even without other apparent hearing loss.

Graphics courtesy of National Hearing Conservation Association

# How do I know if my tools or job site are too noisy?

Sound intensity is measured in decibels. When decibels are adjusted for how the ear senses sound, the sound level intensity is measured as dBA. Decibels are measured on a logarithmic scale, which means that a small increase in the number of decibels results in a huge change in the amount of noise and the potential damage to a person's hearing. So, if the level increases by 3 dBA this doubles the amount of the noise and reduces the recommended amount of exposure time by half.

## Sound Level Meter and Noise Dosimeter

Safety and health inspectors measure sound or noise levels using a device called a *sound level meter*. The microphone is positioned at the user's ear level. Equipment that is determined to be loud can be labeled with a hazardous noise sticker.

OSHA uses *noise dosimeters* to document the average noise exposure over your working day or of a particular task for part of your workday.

**OSHA recommends** that workplace noise levels be kept below 85 dBA as an 8-hour time-weighted average. As the noise level increases, it damages your hearing more quickly.



Sound level meter



Dosimeter

Images courtesy of Casella CEL Inc., Amherst, NH.

Research indicates that your hearing can be damaged by regular 8-hour exposures to 85 dBA. When noise is as loud as 100 dBA (like a jackhammer or stud welder), it can take repeated exposures of as little as 1 hour per day to damage your hearing.

The National Institute for Occupational Safety and Health (NIOSH) has recommended that all worker exposures to noise should be controlled below a level equivalent to 85 dBA for eight hours to minimize occupational noise-induced hearing loss. NIOSH has found that significant noise-induced hearing loss occurs at the exposure levels equivalent to the OSHA PEL based on updated information obtained from literature reviews. NIOSH also recommends a 3 dBA exchange rate so that every increase by 3 dBA represents a doubling of the amount of the noise and halves the recommended amount of exposure time.

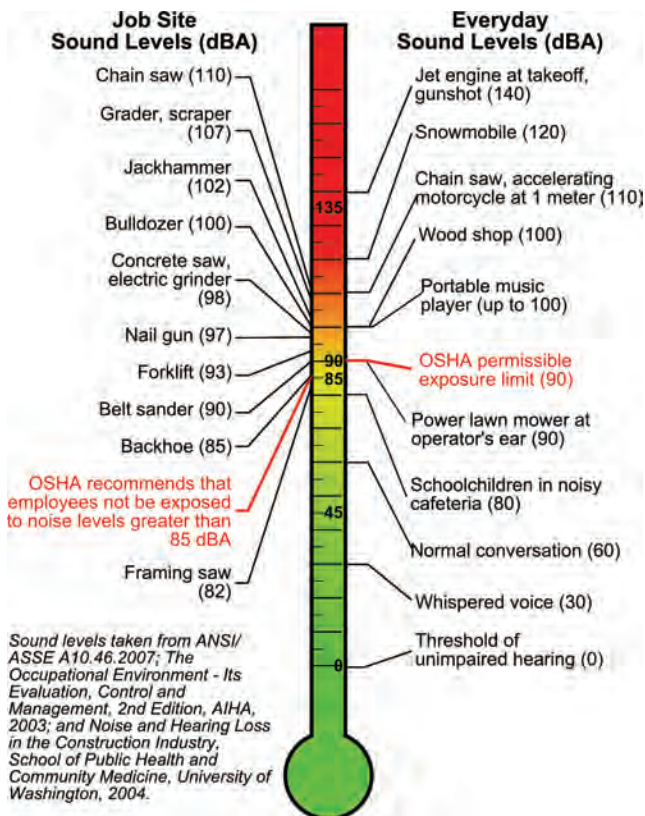
### **2-3 Foot Rule and Noise Indicator**

When a sound level meter is not available, you should use the 2-to-3 foot rule: Stand about an arm's length away from your coworker: If you have to raise your voice to be heard 2-3 feet away, you should assume that the sound level is at or above 85 dBA.

A *personal noise indicator* is a warning device. It indicates if your immediate exposure is less than or greater than 85 dBA. It flashes green if the sound level is under 85 dBA and red when above 85 dBA.

## Sound Level Chart

Equipment and daily activities at construction job sites can expose workers to high levels of noise. Sound levels on the chart below are listed in decibels (dBA) – the larger the number, the higher the volume or decibel level. How loud the noise is (volume), how long the noise lasts, and how close you are to the noise are all important in determining the hazard.



# What can be done about job site noise levels?

## Plan Ahead

One of the best ways to reduce exposure to hazardous noise on a work site is by planning for potential exposure before activities start. When jobs produce high noise levels, there are ways to reduce your exposure other than or in addition to hearing protectors.

For instance, your employer or supervisor can buy materials to build sound barriers or schedule noisy activities during hours when fewer people are working. Your employer can also rent or buy quieter equipment.

Your employer should hold daily or weekly safety meetings to discuss ways to limit high noise levels and other hazards. During safety meetings, the general contractor can ask sub-contractors to describe the planned tasks for the day or week where hazardous noise might be generated, as well as what equipment will be used; you can use these opportunities to talk about ways to limit exposure.

Even changes in the noise level that seem small (e.g., 3 dBA) are actually significant reductions in the noise.

Here are some specific ways to limit exposure:

- Plan to make or use prefabricated noise barriers.
- Ask your employer to buy or rent quieter equipment/tools.
- Limit the hours you work in hazardous noise areas.

- Identify equipment and work areas where signs can be posted to make other workers aware of high noise areas.
- Use hearing protection to supplement noise reduction.

### **Noise Control at the Job Site**

The work site is where workers can have the most impact by working with employers to identify hazardous equipment, conduct hazard assessments, and apply the control process explained below. Employer support for providing supplies (acoustical insulation, extension cords, pre-fabricated noise barriers), hand tools, and sufficient set-up time are essential.

### **Noise Hazard Control Process**

The easiest way to help lower noise levels at your work site is to remember a three-step noise hazard control process:

**Reduce It:** Reduce the noise by using the quietest equipment available. For example, choose a smaller, quieter generator.

**Move It:** Move the equipment farther away with the use of extension cords, additional welding leads, and air hoses (following current OSHA standards). Noise levels go down as we increase our distance from a noisy object. Move the generator farther away or face it in a direction that is away from where most people are working. If you are not required to be in a high noise area, move to a quieter area.

**Block It:** Block the noise by building temporary barriers of plywood or other on-site materials to keep the noise from reaching

workers. Place a five-sided, oversized wooden box over the generator. Add fire-resistant acoustical absorbing material (foam) inside the box. If the generator sits on soil or sand, that will help absorb some of the noise.



Photo courtesy of Build It Smart

**Building a plywood barrier**

### **Maintain and Retrofit Equipment**

Proper maintenance of equipment and tools can result in lower noise levels. Changing seals, lubricating parts, using sharp blades and bits, installing mufflers, and replacing faulty or worn equipment or parts can reduce the noise levels significantly on the job site.

Do you know of equipment on your job site that could benefit from regular maintenance to reduce noise levels? Your employer should ensure that there is a regular maintenance program and that everyone follows the maintenance schedule.

With some ingenuity, even older, noisier equipment can be modified by adding mufflers, new seals, or insulated panels. Employees can use noise reduction equipment accessories when made available by the employer. Employers can look for ways to reduce the sound intensity of tools in their current inventory.

Employers can reduce job site noise levels by following OSHA recommendations:

- Identify major noise sources and possible control solutions.
- Plan ahead and limit worker exposure as much as possible.
- Perform regular maintenance.

### **Reminder**

OSHA currently allows your employer to rely on any combination of (1) hearing protective devices with a hearing conservation program, (2) engineering controls, and (3) administrative controls to effectively reduce worker exposures below 90 dBA.

OSHA also recommends that your employer provide – and that you use – hearing protective devices any time site exposures meet or exceed 85 dBA.

# What can be done if engineering and administrative controls are not enough?

## **Proper Selection and Use of Hearing Protection**

If other control strategies to reduce noise levels can't be used or fail to reduce noise levels below OSHA's permissible exposure limits (PELs), wear a hearing protective device (29 CFR 1926.52). There are many different types of hearing protection. Each type is designed for certain noise conditions. They include the types listed in the following table. But remember – unless you wear them properly and wear them all the time in high noise areas, the devices will not be effective.

**Convenience and comfort** are important for frequent use of hearing protective devices. Earmuffs and foam earplugs in most cases offer the most noise reduction. However, preformed plugs or canal caps may be more convenient where construction work generates moderate daily average noise levels. There is no one device that is the best type for all situations.

**Your employer is responsible for selecting, fitting, and maintaining hearing protective devices and must provide them to you at no cost and train you in their use (29 CFR 1926.101).**

If you are not provided hearing protection for high noise work tasks, ask for it. If the employer refuses to provide hearing protectors, you can request an OSHA inspection.

Contractors and workers should consider the following when selecting and wearing protective gear: the noise level of the task, communication needs, convenience, comfort, hygiene, noise reduction of the hearing protective devices, and hearing ability.

Each type of hearing protection has manufacturer's directions for use and maintenance. Follow these directions and replace or fix the devices when they appear worn, dirty, or broken. Always wear hearing protection to protect yourself from high noise exposures, both on the work site and at home.






**Neither portable music player headphones nor hearing aids are substitutes for hearing protective devices.**

### **Regular Hearing Screenings**

If you are routinely exposed to hazardous levels of noise, your employer should provide yearly hearing tests to monitor your hearing loss over time. If your employer does not provide these tests, you should have your hearing tested by an audiologist. The initial test (baseline) will be used as the reference test. Future tests should be compared to the baseline to see if you need to do more to protect your hearing.

These hearing tests can detect small shifts in hearing ability that have taken place since previous tests. When changes in hearing ability are detected, a retest is common to determine whether the change is permanent or temporary. Tests are relatively inexpensive and take about 20-30 minutes to conduct and get results.

## Hearing Protective Devices

Type	Features	Concerns
<b>Roll down foam</b> 	Fits many differently shaped ear canals. Provides good protection for most noisy environments. Convenient, disposable.	Must be inserted properly to get the highest possible protection. If the plug doesn't make a good seal, it won't protect your hearing.
<b>Reusable earplugs</b> 	Many have flanges and handles. Come in different sizes. Come with cords, convenient to carry. Reusable. Washable.	Preformed so may not fit as wide a variety of ear canals as foam plugs. May require a different size for each ear. Must keep them clean.
<b>Custom molded</b> 	Molded to user's ear. Always comfortable. Long-term wear. Best for difficult-to-fit ears.	Must be made by a licensed hearing protection provider.
<b>Canal caps</b> 	On a band, can be worn under chin, over head, or behind neck. Can be put on and taken off quickly.	Not as comfortable as other devices. Not as much protection as other devices.
<b>Earmuffs</b> 	Easy to use and wear. Fit most people. Easy to keep clean.	Can be hot and heavy. May be more difficult to get a good fit with glasses and/or may interfere with other protective gear.
<b>New Types</b> <b>Flat</b> <b>Attenuated</b> <b>Communication</b>	Flat reduction of noise over all frequencies. Have a baffle to reduce impact noise. Radio Communication while still reducing noise.	Can be expensive. Must be custom fitted.

Photos: NIOSH; Howard Leight; Aearo Technologies, a 3M Company; Bilsom; WorkSafe BC; Northern Safety and Industrial.

### Remember:

***The best hearing protective device is the one you'll actually wear.***

When looking at your hearing test, levels greater than 25 dBA indicate impairment. Furthermore, losses in the higher frequencies (3000, 4000, 6000 hertz) are more significant and you should discuss them with your audiologist.



You also can do daily monitoring of your hearing with a simple self-test. This works best if you drive yourself to work. When you reach your job site and are turning off the car engine, turn the radio on so it is just barely loud enough to hear (talk radio stations work well for this exercise) and go on with your day. When you return at the end of the work shift, check to see if you can still hear the radio with the power on, but the engine off. If you can't hear the radio, think about what may have damaged your hearing and how you could better protect your hearing.

Remember the 3 steps to noise control:

**Reduce it:** Use the quietest equipment available.

**Move it:** Locate noisy equipment away from workers.

**Block it:** Erect temporary barriers to block noise from reaching workers.

**YOU ONLY HAVE ONE SET OF EARS –  
PROTECT THEM**

# My job site is too noisy. What can I do?

First, if you feel comfortable, speak with your supervisor. If you are a union member, raise the issue with your union representative. You can also call or write OSHA.

## **How do I file a complaint with OSHA?**

- Mail, e-mail, or fax the nearest OSHA office (visit [www.osha.gov](http://www.osha.gov) or call 1-800-321-OSHA (6742) for the address of the nearest OSHA office) and request an inspection.
- File a complaint by phone – call (800) 321-OSHA (6742); the teletypewriter (TTY) number is (877) 889-5627.
- File online from OSHA's home page:  
[www.osha.gov/as/opa/worker/complain.html](http://www.osha.gov/as/opa/worker/complain.html).

Most online and phone complaints may be resolved informally over the phone with your employer. **Written complaints that are signed by a worker or representative and filed with OSHA are more likely to result in an OSHA inspection.**

Complete the OSHA complaint form, then fax or mail it back. Include your name, address, and telephone number so that we can contact you. All complaints are kept confidential.

# Am I protected if I call OSHA?

The Occupational Safety and Health Act (OSH Act) prohibits employers from discriminating against their employees for using their rights under the OSH Act. These rights include filing an OSHA complaint, participating in an inspection or talking to the inspector or raising a safety and health issue with the employer.

If you believe that your employer has discriminated against you because you exercised your safety and health rights, contact your local OSHA office right away. Under the OSH Act, you only have **30 days** to report discrimination.

Call 1-800-321-OSHA (6742) and ask to be connected to your local office.

Discrimination can include:

- Firing or laying off
- Denying benefits
- Blacklisting
- Intimidation
- Denying overtime or promotion
- Reducing pay or hours
- Disciplining

# Additional OSHA Assistance

## **Compliance Assistance Specialists**

OSHA has compliance assistance specialists throughout the nation who can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. Contact your local OSHA office for more information.

## **OSHA Consultation Service for Small Employers**

The OSHA Consultation Service provides **free assistance** to small employers to help them identify and correct hazards, and to improve their injury and illness prevention program. Most of these services are delivered on site by state government agencies or universities using well-trained professional staff.

Consultation services are available to private sector employers. Priority is given to small employers with the most hazardous operations or in the most high-hazard industries. These programs are largely funded by OSHA and are delivered at no cost to employers who request help. Consultation services are separate from enforcement activities. To request such services, an employer can phone or write to the OSHA Consultation Program. See the Small Business section of OSHA's website for contact information for the consultation offices in every state.

## **• Safety and Health Achievement Recognition Program**

Under the consultation program, certain exemplary employers may request participation in OSHA's Safety and Health Achievement Recognition Program (SHARP). Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit,

correcting all identified hazards, and developing an effective injury and illness prevention program.

### **OSHA Educational Materials**

OSHA has many types of educational materials available in print or online, including:

- **Brochures/booklets** cover a wide variety of job hazards and other topics;
- **Fact Sheets** and **QuickFacts** contain basic background information on safety and health hazards;
- **Guidance documents** provide detailed examinations of specific safety and health issues;
- **Online Safety and Health Topics Pages**;
- **Posters**;
- **QuickCards™** are small, laminated cards that provide brief workers' rights and safety and health information; and
- **QuickTakes** is OSHA's free, twice-monthly online newsletter. To sign up for QuickTakes visit OSHA's website at [www.osha.gov](http://www.osha.gov) and click on QuickTakes at the top of the page.

To view materials available online or for a listing of free publications, visit OSHA's website at [www.osha.gov](http://www.osha.gov). You can also call 1-800-321-OSHA (6742) to order publications, to ask questions or to get more information.

### **NIOSH Health Hazard Evaluation:**

#### **Getting Help on Health Hazards**

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify and correct potential health hazards in the workplace through its Health Hazard Evaluation (HHE) program.

Workers, union representatives and employers can request a NIOSH Health Hazard Evaluation.

An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources.

To request a NIOSH Health Hazard Evaluation, or find out more about the program:

- Call the NIOSH toll-free Information Service at 1-800-CDC-INFO (1-800-232-4636); or
- Go online at [www.cdc.gov/niosh/hhe/Request.html](http://www.cdc.gov/niosh/hhe/Request.html).

# OSHA Regional Offices

## **Region I**

Boston Regional Office

(CT\*, ME, MA, NH, RI, VT\*)

JFK Federal Building, Room E340

Boston, MA 02203

(617) 565-9860 (617) 565-9827 Fax

## **Region II**

New York Regional Office

(NJ\*, NY\*, PR\*, VI\*)

201 Varick Street, Room 670

New York, NY 10014

(212) 337-2378 (212) 337-2371 Fax

## **Region III**

Philadelphia Regional Office

(DE, DC, MD\*, PA, VA\*, WV)

The Curtis Center

170 S. Independence Mall West

Suite 740 West

Philadelphia, PA 19106-3309

(215) 861-4900 (215) 861-4904 Fax

## **Region IV**

Atlanta Regional Office

(AL, FL, GA, KY\*, MS, NC\*, SC\*, TN\*)

61 Forsyth Street, SW, Room 6T50

Atlanta, GA 30303

(678) 237-0400 (678) 237-0447 Fax

## **Region V**

Chicago Regional Office

(IL\*, IN\*, MI\*, MN\*, OH, WI)

230 South Dearborn Street

Room 3244

Chicago, IL 60604

(312) 353-2220 (312) 353-7774 Fax

## **Region VI**

Dallas Regional Office

(AR, LA, NM\*, OK, TX)

525 Griffin Street, Room 602

Dallas, TX 75202

(972) 850-4145 (972) 850-4149 Fax

(972) 850-4150 FSO Fax

**Region VII**

Kansas City Regional Office  
(IA\*, KS, MO, NE)  
Two Pershing Square Building  
2300 Main Street, Suite 1010  
Kansas City, MO 64108-2416  
(816) 283-8745 (816) 283-0547 Fax

**Region VIII**

Denver Regional Office  
(CO, MT, ND, SD, UT\*, WY\*)  
1999 Broadway, Suite 1690  
Denver, CO 80202  
(720) 264-6550 (720) 264-6585 Fax

**Region IX**

San Francisco Regional Office  
(AZ\*, CA\*, HI\*, NV\*, and American Samoa,  
Guam and the Northern Mariana Islands)  
90 7th Street, Suite 18100  
San Francisco, CA 94103  
(415) 625-2547 (415) 625-2534 Fax

**Region X**

Seattle Regional Office  
(AK\*, ID, OR\*, WA\*)  
300 Fifth Avenue, Suite 1280  
Seattle, WA 98104-2397  
(206) 757-6700 (206) 757-6705 Fax

\*These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at [www.osha.gov](http://www.osha.gov) or call us at 1-800-321-OSHA (6742).

## Appendix: More Information on Noise Protection

Here are some online references on noise control and hearing conservation:

***Construction Noise in British Columbia, by the Workers' Compensation Board:***

<http://hearingconservation.healthandsafetycentre.org/pdfs/hearing/ConstructionNoise.pdf>

***eLCOSH, the Electronic Library of Construction Occupational Safety and Health:***

<http://www.elcosh.org/en/browse/49/noise.html>

***How Loud Is Too Loud? A guide you can download with decibel levels:***

<http://www.nidcd.nih.gov/health/hearing/pages/sound-ruler.aspx>

***Laborers' Health and Safety Fund of North America (LHSFNA):***

<http://www.lhsfna.org/noise>

***National Institute for Occupational Safety and Health (NIOSH) Noise Meter:***

<http://www.cdc.gov/niosh/topics/noise/noisemeter.html>

***NIOSH Power Tools Database:***

<http://wwwn.cdc.gov/niosh-sound-vibration>

***OSHA's Field Operations Manual:***

[http://www.osha.gov/OshDoc/Directive\\_pdf/CPL\\_02-00-148.pdf](http://www.osha.gov/OshDoc/Directive_pdf/CPL_02-00-148.pdf)

***OSHA Hearing Conservation for the Hearing-Impaired Worker:***

<http://www.osha.gov/dts/shib/shib122705.html>

***OSHA Noise and Hearing Conservation eTool:***

<http://www.osha.gov/dts/osta/otm/noise/index.html>

***OSHA Noise and Hearing Conservation Safety and Health Topics Page:***

<http://www.osha.gov/SLTC/noisehearingconservation/index.html>

**Standards for States with OSHA-approved State Plans:**

<http://www.osha.gov/dcsp/osp/statestandards.html>

**The personal hearing protection devices chart on page 14 was adapted from *Toolbox Talks: Hearing Conservation in the Shipbuilding Industry*, developed through the Alliance Program, an OSHA Cooperative Program:**

[http://www.shipbuilders.org/Portals/Shipbuilders/PP PDFs/Tool Box Talk series - hearing conservation in Shipbuilding - FINAL - 042409.pdf](http://www.shipbuilders.org/Portals/Shipbuilders/PP%20PDFs/Tool%20Box%20Talk%20series%20-%20hearing%20conservation%20in%20Shipbuilding%20-%20FINAL%20-%20042409.pdf)

***What Causes Tinnitus?:***

<http://www.nidcd.nih.gov/health/hearing/tinnitus.htm#2>



**If you have  
questions, call OSHA.  
We can help.**

**For more information:**



**Occupational  
Safety and Health  
Administration**

**U.S. Department of Labor  
[www.osha.gov](http://www.osha.gov) (800) 321-OSHA (6742)**

Nearly

50%

of construction workers  
suffer hearing loss

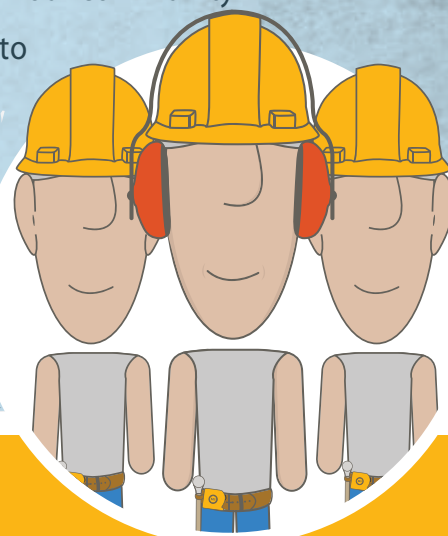
# HEARING LOSS IS PREVENTABLE

and you can do something about it...

## BUY QUIET

A commitment to buying quieter equipment:

- Reduces your risk of hearing loss
- Reduces the noise impact on our community
- Encourages manufacturers to design quieter equipment



## What You Can Do

Even with quieter equipment, it is important that you continue to protect your hearing:

- Wear protective earmuffs or earplugs
- Move sources of loud noise such as compressors away from the work zone
- Take breaks when operating loud equipment
- Get your hearing checked regularly

DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health  
[www.cdc.gov/niosh/topics/buyquiet](http://www.cdc.gov/niosh/topics/buyquiet)



DHHS (NIOSH) Pub. No. 2014-128

SAFER • HEALTHIER • PEOPLE™

# **Controlling Noise on Construction Sites**

**(Written by: Laborers' Health and Safety Fund of North America (LHSFNA)**

**[Modified by State Building & Construction Trades Council of California, 2015)**

## **Controlling Construction Noise**

Controlling construction noise can pose special problems for contractors. Unlike general industry, construction activities are not always stationary and in one location.

Construction activities often take place outside where they can be affected by weather, wind tunnels, topography, atmosphere and landscaping. Construction noise makers, e.g., heavy earth moving equipment, can move from location to location and is likely to vary considerably in its intensity throughout a work day

High noise levels on construction worksites can be lowered by using commonly accepted engineering and administrative controls. This booklet is filled with tips other contractors and have used to lower the noise levels on construction worksites. Normally, earplugs and other types of personal protective equipment (PPE) are used to control a worker's exposure to noisy equipment and work areas. However, as a rule, engineering and administrative controls should always be the preferred method of reducing noise levels on worksites. Only, when these controls are proven unfeasible, earplugs as a permanent solution should be considered.

### **Engineering Controls**

Engineering controls modify the equipment or the work area to make it quieter. Examples of engineering controls are: substituting existing equipment with quieter equipment; retro-fitting existing equipment with damping materials, mufflers, or enclosures; erecting barriers; and maintenance.

### **Administrative Controls**

These are management decisions on work activities, work rotation and work load to reduce workers' exposure to high noise levels. Typical management decisions that reduce worker exposures to noise are: moving workers away from the noise source; restricting access to areas; rotating workers performing noisy tasks; and shutting down noisy equipment when not needed.

### **Personal Protective Equipment**

Earplugs are the typical PPE given to workers to reduce their exposure to noise. Earplugs are the control of last resort and should only be provided when other means of noise controls are infeasible. As a general rule, workers should be using earplugs whenever they are exposed to noise levels of 85 dB (A) or when they have to shout in order to communicate.

## Construction Sites Can Be Quieter

Although many in the construction industry believe that construction sites are inherently noisy, there are many ways in which they can be made quieter.

- Sometimes a quieter process can be used. For example: Pile driving is very loud. Boring is a much quieter way to do the same work.
- New equipment is generally much quieter than old equipment. Some equipment manufacturers have gone to great lengths to make their equipment quieter. Ask equipment manufacturers about the noise levels of their equipment and consider these levels when making your purchase. For example, noise-reducing saw blades can cut noise levels in half when cutting masonry blocks.
- Old equipment can be made quieter by simple modifications, such as adding new mufflers or sound absorbing materials.
- Old equipment is also much quieter when it is well maintained. Simple maintenance can reduce noise levels by as much as 50%.
- Noisy equipment can be sited as far away as possible from workers and residents. Noise levels drop quickly with distance from the source.
- Temporary barriers/enclosures (e.g. plywood with sound absorbing materials) can be built around noisy equipment. These barriers can significantly reduce noise levels and are relatively inexpensive.



## The Major Noise Sources on Construction Worksites

On construction worksites there are many different noise sources and these sources exhibit many differing types of noise such as background noise, idling noise, blast noise, impact noise, rotating noise, intermittent noise, howling, screeches and squeals that need to be controlled.

Fortunately, the noise levels of common construction noise sources are well-known. Below are the noise levels of common construction.

Equipment	Sound Level at Operator	
	Average	Range
<i>Background*</i>	86	
<i>Earth Moving:</i>		
Front End Loader	88	85-91
Back Hoe	86.5	79-89
Bull Dozer	96	89-103
Roller	90	79-93
Scraper	96	84-102
Grader	<85	
Truck	96	89-103
Paver	101	100-102
<i>Material Handling:</i>		
Concrete Mixer	<85	
Concrete Pump	< 85	
Crane	100	97-102
Derrick	<85	
<i>Power Units:</i>		
Generators	<85	
Compressors	<85	
<i>Impact:</i>		
Pile Driver (diesel and pneum.)	98	82-105
Pile Driver (gravity, bored)	82.5	62-91
Pneumatic Breaker	106	94-111
Hydraulic Breaker	95.5	90-100
Pneumatic chipper	109	
<i>Other Equipment:</i>		
Poker Vibrator	94.5	87-98
Compressed Air Blower	104	
Power Saw	88.5	78-95
Electric Drill	102	
Air Track Drill	113	
<b>Noise Standards</b>		<b>Noise Level</b>
OSHA (at workers ear)		90 dB (A)
Day Time Community (at property line)		65 dB (A)

\* British Columbia,  
“Construction Noise,” Workers  
Compensation Board of BC

Bystander exposure to worksite noise is common in construction. Workers are as likely to be exposed from noise generated by other workers or trades, as they are to be exposed to noise generated by their own work. Society of Automotive Engineers\* ranked the basic construction equipment in order of noise severity and ranked the equipment by noise severity and proximity to workers and people. The noise levels were measured 50 feet from the equipment. The results of SAE's noise impact ranking (NIR) are presented below. Ranking of 1 is more hazardous than 2.

Reviewing the tables, *Impact* equipment was the biggest noise hazard to operators and workers nearby while *Earth Moving* equipment exposed a greater number to noise hazards.

**NIR by Noise Level & Proximity to People**

Equipment	Ranking
Trucks	1
Scrapers	1
Tractors	1
Back Hoes	1
Front End Loaders	2
Graders	2
Compactors	2
Cranes	3
Generators	3
Pumps	3
Compressors	3
Concrete Pumps	3
Pavers	3

\*SAE, Noise Abatement techniques for Construction Equipment, Cambridge 1979.

## **Effective Practical Solutions to Controlling Noise on Construction Worksites**

Every construction project is different and constantly changing. Therefore, noise control solutions have to be tailored for the situation. Fortunately, there are a variety of ways by which construction equipment and worksite noise can be controlled. The following is a list of ways to control noise level your worksites.

- **Quieter Equipment**
- **Modifying Existing Old Equipment**
- **Barrier Protection**
- **Maintenance**
- **Noise Perimeter Zones**
- **Work Activity Scheduling**

### **Quieter Equipment**

A cost-effective way to reduce noise at a construction worksite is to buy quiet equipment. When buying equipment always ask if there is a quieter way of doing the job. All things being equal most contractors would choose a quieter machine or process. Quieter machines or processes can cost more. Manufacturing tolerances are tighter, gears mesh better, quieter cooling fans are used, etc. Because of this, when contractors buy quieter equipment the final determination often depends on whether the noise reduction justifies the extra expense. Looking at this decision another way, if the quieter machine costs \$100 more and is 5 dB quieter, the extra cost of \$20 per decibel reduced can be considered cheap noise control when compared to cost of establishing a hearing conservation program or medical cost associated with noise induced hearing loss.

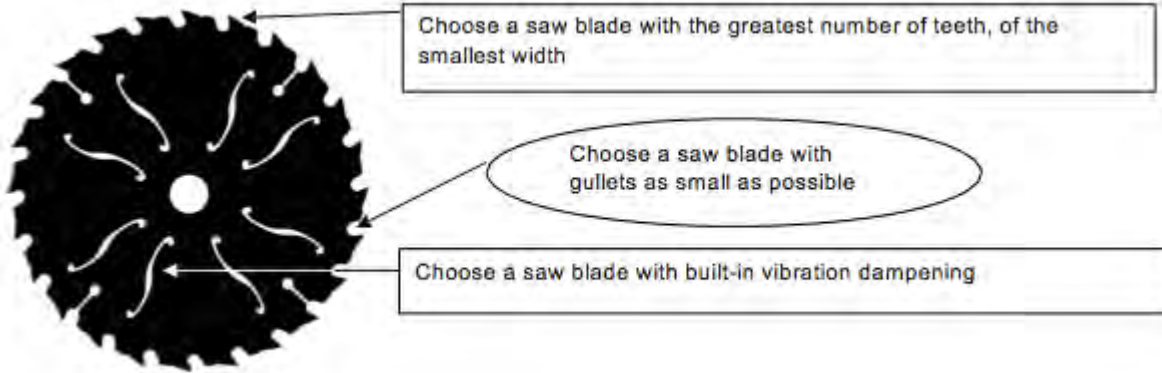
In addition, equipment in use should be the most suitable for the job. Avoid using equipment that is over-powered and, conversely, avoid using under powered equipment. Whenever possible the quietest equipment alternative should be used. In general, electronic powered equipment is quieter than diesel powered equipment and hydraulically powered equipment is quieter than pneumatic power. Below are examples of ways quieter construction equipment can be introduced into the worksite to reduce noise levels.

## Buying Quiet Saw Blades

### Problem:

Sound level tests on different saw blades under comparable conditions reported sound levels at the operator position between 91 and 97 dB (A).

### Solutions:



### Results:

#### Sound level tests on different saw blades under comparable conditions

#### Sound Level -dB(A) at Operator Position

##### Tooth Number and Size

Cutting lengths of aluminum

- 350mm dia. TCT blade, 84 teeth, 3.5mm wide **97**
- 350mm dia. TCT blade, 108 teeth, 3.2mm wide **91**

Decibel Reduction **6**

##### Vibration Dampening

Cutting bricks

- 350mm dia. "standard" masonry blade, 20 teeth **94**
- 350mm dia. "damped" masonry blade, 20 teeth **84**

Decibel Reduction **10**

##### Air Noise

"Dummy cut" (run up to 3400 rpm, run down), without cutting

- 350mm dia. TCT blade, 84 gullets, 10mm x 7mm **91**
- 350mm dia. TCT blade, 108 gullets, 8mm x 4mm **84**

Decibel Reduction **7**

### Reference:

WorkSafe Western Australia Engineering Noise Control Reports No's. ENC-2-93, ENC-4-93

## Buying Quieter - Diesel Generators

### Problem:

Compressors and generators rank second behind trucks of all onsite construction equipment in terms of daily sound energy produced.



Newer heavy duty diesel generators are designed to emit low noise and vibration. Some units are up to 15 dB (A) quieter than older diesel-powered generators and quieter than most gasoline sets. The units are totally enclosed and damped, including cooling, exhaust and intake systems.

### Built-In Solutions:

- Improved intake/muffler system
- Suitable enclosure with damping cladding
- Improved cooling fan

### Benefits:


- Up to 15 dB(A) noise reduction

### Reference:

OR-OSHA, "Guide for Controlling Hazardous Noise on Construction Jobsites," 1/03

## Modifying Existing Old Equipment

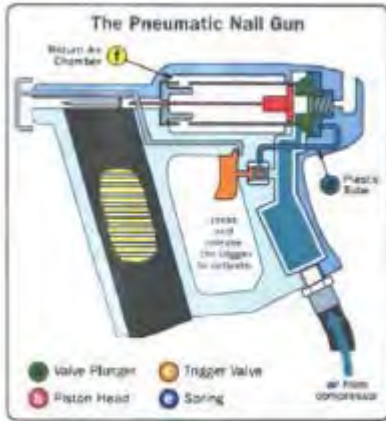
The most common way to reduce the noise levels of common construction equipment is through worksite modifications. Some common worksite modifications consist of retro-fitting existing equipment with damping materials and mufflers. Below are examples of ways common construction equipment and worksites can be modified to reduce noise levels.

Modifying - Front End Loader		
<b>Problem:</b>  Typical noise level of 95-102 dB(A) (at operator position with no noise control cab)		
 <p>Not actual vehicle from study</p>		
<b>Solutions:</b> <ul style="list-style-type: none"> <li>• Noise control cab w/ air conditioning</li> <li>• Add sound suppression to existing cab</li> <li>• Replace exhaust system</li> </ul>	<b>Benefits:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> 82-90 dB(A)</li> <li><input type="checkbox"/> 82-90 dB(A)</li> <li><input type="checkbox"/> 90-100 dB(A)</li> </ul>	<b>Costs:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> \$12-15,000, 60-140 h</li> <li><input type="checkbox"/> \$500-1000, 30-80 h</li> <li><input type="checkbox"/> \$200-400, 2 h</li> </ul>
<b>Acoustically Treated Noise Level:</b> <ul style="list-style-type: none"> <li>• 82-90 dB(A) for the operator</li> </ul>		
<b>Reference:</b>  U.S. Bureau of Mines, Mining Machinery Noise Control Guidelines, 1983		

## Modifying - Pneumatic Nail Gun

### Problem:

Sound level from pneumatic nail guns 94.5 dB(A) (at muffler)



### Solutions:

- Improving the existing muffler
- Incorporating some type of "return" or exhaust line

### Acoustically Treated Noise Level:

- Avg. Sound Pressure Level With Treatment - **75.5 dB**
- Avg. Sound Pressure Level Without Treatment - **94.5 dB**

### Costs:

Item	Retail Cost (\$)	Number Required	Cost per Unit (\$)
Viton O-Ring	6.50	0.02	0.13
PVC Housing	1.15	1.0	1.15
8mm Bolt	1.07	1.0	1.07
Hose Plug	1.26	2.0	2.52
<b>Total Goods</b>			4.87
<b>Mass Production (1/3 Retail Cost)</b>			1.62
<b>Estimated Production Cost per Unit</b>			0.50
<b>Total Cost per Unit</b>			2.12

### Reference:

NIOSH, "Student Presentations - Pneumatic Nail Guns," 2002,  
<http://www.cdc.gov/niosh/topics/noise/CollegeStudents/nailgun/index.html>

## Excavator

### Problem:

A Warner and Swasey excavator, equipped with a Detroit Diesel 4-53 engine (115 hp@ 2400 rpm) had a overall noise level of 80.5 dB (A) at 50 feet.



Not actual vehicle from study

### Solution:

In the quietest configuration, with improved exhaust and intake muffling, fan disengaged, and three sound panels around the engine, the overall level was reduced to **71.5 dB (A)**.

### Costs:

- Approximately \$200-400.00

### Reference:

U.S. Bureau of Mines, "Noise Abatement Techniques for Construction Equipment," August 1979

## Barrier Protection

An effective way of reducing noise is to locate noisy equipment behind purpose-built barriers. The barriers can be constructed on the work site from common construction building material (plywood, block, stacks or spoils) or the barriers can be constructed from commercial panels which are lined with sound absorbing material to achieve the maximum shielding effect possible. To be effective, the length of the barrier should be greater than its height. The noise source should not be visible and barrier should be located as close as possible to either the noise source or the receiver.

Decibel level at noise source (dB)	Distance from noise receiver to noise source (feet)	Decibel level at noise receiver (dB)
105	5	102
105	10	96
105	20	90
105	40	84

The distance between a noise source and noise receiver can be considered a barrier as well. Doubling the distance from the noise source lowers the noise level by 6dB. Notice in the table above, that as the distance doubles the noise level at the receiver decreases 6 dB (A). Below are examples of ways barriers and enclosures of construction equipment and can reduce noise levels.

## Creating Noise Barriers

### Problem:

Power pack produced noise levels of 98 dB(A) at 1m



### Solutions:

- Portable screen built with common construction material was placed around a power pack

### Benefits:

- Reduced the noise levels from **98 dB(A)** to **90 dB(A) at 1 m**

### Reference:

Worksafe Western Australia  
[www.safetyline.wa.gov.au/pagebin/pg000150.htm](http://www.safetyline.wa.gov.au/pagebin/pg000150.htm)

## **Work Activity Scheduling**

Work activity scheduling are administrative means to control noise exposure. Planning how noise sources are sited and organized on a work site can reduce noise hazards.

Whenever possible, stationary noise sources like generators and compressors should be positioned as far as possible from noise sensitive receivers (workers, schools, residential buildings). When possible, stacks, spoils, and other construction material can be placed or stored around noise sources to reduce the hazard to receivers. Advantage should be taken of the screening effect any nearby object, such as cooling tanks, trailers or temporary site offices.

Jobs can be rotated so that exposure time is limited. Transferring workers from a high exposure task to a lower exposure task could make the employee's daily noise exposure acceptable. Administrative controls include activity planning, for example, scheduling pavement breaking operations so as to reduce the number of work site workers exposed. In addition noisy equipment should not be run for periods longer than necessary and should be switched off when not in use.

## **Maintenance**

Increased attention to maintenance of tools and equipment will reduce worksite noise levels. Maintaining your plant and equipment in good order not only increases its life, but makes it safer to use and quieter. In many cases, a noise hazard will be created or made worse by a lack of maintenance. Parts may become loose, creating more noise because of improper operation or scraping against other parts. Grinding noises may also occur as the result of inadequate lubrication. It is especially important to provide proper maintenance of noise control devices which are added or built into machinery. Loose and worn parts should be fixed as soon as possible.

Always check and see if there are any problems starting to appear with a machine or equipment. Check for signs of wear or if the machine's performance is down. Some problems will appear as looseness or increased vibration. Listen for new noises, especially tonal ("whining") sounds, repeated impacts, or high frequency ("screech") sounds. Also, slipping belts will cause a screech at start-up, while a damaged bearing may appear as a "clunk" during run-down.

Ideally, the worksite should have a system in place for checking and servicing the various machines and power tools. Below are examples of ways maintenance and servicing can

### **Why Machines Get Noisier With Use:**

1. Worn or chipped gear teeth – will not mesh properly. The shiny wear marks are often visible on the teeth.
2. Worn bearings - bearing wear creates vibration and noise, as flat spots or cracks appear in the balls.
3. Slackness between worn or loose parts – causes rattling noises, squealing from slack drive belts, "piston slap" in motors, air leaks, etc.
4. Poor lubrication – causes squeaking noises due to friction or impact noise in dry and worn gears or bearings.
5. Imbalance in rotating parts – imbalances with fan impellers or motor shaft will show up as excess vibration.
6. Obstruction in airways - a build-up of dirt or a bent/damaged piece of metal in an airway or near a moving part, e.g., a bent fan guard, can cause whistling or other "air" type noises.
7. Blunt blades or cutting faces - blunt or chipped saw teeth, drill bits, router bits etc, usually make the job noisier as well as slower.
8. Damaged silencers - silencers for air-driven machines or mufflers for engines may become clogged with dirt, rusted out or damaged, so losing their ability to absorb noise.
9. Removal of a noise-reducing attachment - mufflers, silencers, covers, guards, vibration isolators etc. which reduce noise should never be removed except during maintenance, and then must be replaced.

## Maintenance

### Problem:

A common type of reciprocating air compressor produced 94 dB (A) at 1m



### Solutions:

- Regrinding the valves to improve the seal resulted in a significant noise reduction of approximately 7 dB (A).
- Introducing an oil additive gave an extra 1 dB(A) reduction

### Benefits and Costs:

The overall noise reduction due to the re-seating of the valves and the introduction of the oil additive is therefore estimated to be approximately 8 dB (A). This is significant, in that the reduction was achieved at minimal cost, using methods which could be adopted by any skilled maintenance trades person.

### Acoustically Treated Noise Level:

**86 dB(A) at 1m**

### Reference:

WorkSafe Western Australia, "Noise Control Case Study: - Reduction of Noise from a Reciprocating Compressor through Maintenance," 1999.

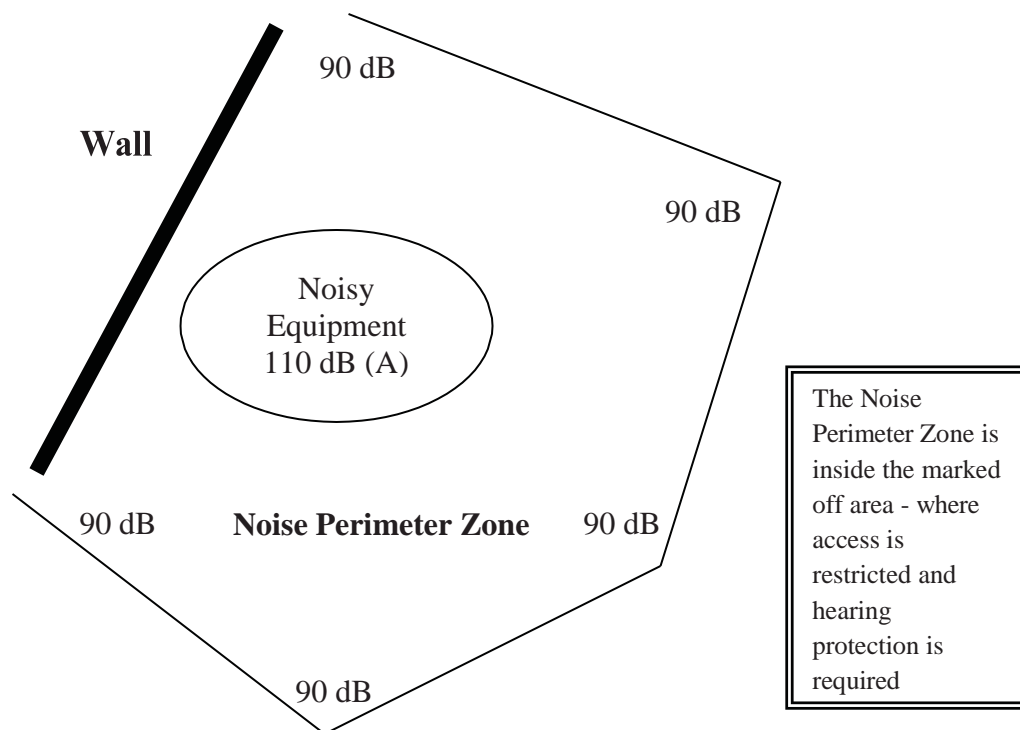
<http://www.safetyline.wa.gov.au/pagebin/pg000153.htm>

## Noise Perimeter Zones

Noise perimeter zones (NPZ) are another administrative control to limit exposure to noisy processes or equipment to as few workers as possible. NPZ are areas where noise levels of 90(85?) dB (A) or more are roped off and marked to keep out all workers who don't have to be there.

NPZ can be set up using a sound level meter to find the safe distance from the source (90 dB (A)) and the NPZ can be set up at that distance. Noise does not radiate from the source at the same level in all directions. Noise from machinery can be higher in one direction than another because the noise can also be either absorbed or reflected from surfaces it contacts, such as the ground or a wall. Therefore, measurements should be taken at several points in an area where people might be working. Once noise levels that are 90 dB (A) or more are determined, rope off this area as the Noise Perimeter Zone.

Exclude all workers who do not need to be in that zone. All workers who need to work within the zone must wear hearing protection. The area can be marked "Noisy Area - Hearing Protection Required" in the same way that a "Hard Hat Area" is marked off.



Of course, the entire site can be inside a Noise Perimeter Zone. Then everyone on site must wear hearing protection.

Another way for the employer to set up a NPZ is to measure the sound pressure level, using a sound level meter, at a distance from a noise source. Then measure the distance between the noise source and measurement point. Convert the sound pressure to the estimated sound power using the tables below and insert in second table to determine safe distances from the noise source.

**Table 1: Converting sound pressure measurement to sound power**

Measured Sound Pressure Level with SLM in dB	Estimated Sound Power Level (dB) at distance from source				
	At 5 ft	At 10 ft	At 15 ft	At 20 ft	At 30 ft
80	95	101	104	107	110
82	97	103	106	109	112
84	99	105	108	111	114
86	101	107	110	113	116
88	103	109	112	115	118
90	105	111	114	117	120
92	107	113	116	119	122
94	109	115	118	121	124
96	111	117	120	123	126
98	113	119	122	125	128
100	115	121	124	127	130

**Table 2: Calculating the Noise Perimeter Zone from the sound power**

Estimated Sound Power Level (dB)	80 dB at distance from source	Noise Perimeter Zone for Target Control Levels (dB)	
		85 dB at distance from source	90 dB at distance from source
90	3 ft	2 ft	1 ft
95	5 ft	3 ft	2 ft
100	9 ft	5 ft	3 ft
105	16 ft	9 ft	5 ft
110	29 ft	16 ft	9 ft
115	52 ft	29 ft	16 ft
120	92 ft	52 ft	29 ft
125	164 ft	92 ft	52 ft
130	292 ft	164 ft	92 ft

## Conclusion

Construction work is inherently noisy. This publication explains why high noise levels on construction worksites are a serious issue that can be controlled. Many of the straight forward controls for common construction activities presented herein can be easily applied because contractors and workers do not have to have an extensive acoustical technical background to quiet equipment. Most often, construction worksite noise problems can be solved by contractors and workers together.

## Resources

### Web

- Blue Angel Program – [www.blauer-engel.de/e-prod/uz/](http://www.blauer-engel.de/e-prod/uz/)
- Laborers Health and Safety Fund of North America – [www.lhsfna.org](http://www.lhsfna.org)
- MSHA Surface Equipment Noise Control – [www.msha.gov/1999noise/Surface/noisesurface.htm](http://www.msha.gov/1999noise/Surface/noisesurface.htm)
- NIOSH Noise Page – [www.cdc.gov/niosh/noise/pg.html](http://www.cdc.gov/niosh/noise/pg.html)
- Noise Pollution Clearinghouse – [www.nonoise.org/](http://www.nonoise.org/)
- Noise Conference Website – [www.lhsfna.org/html/noise\\_home.html](http://www.lhsfna.org/html/noise_home.html)
- Noise Management for the Building Industry – [www.adfa.edu.au/amec/avu/](http://www.adfa.edu.au/amec/avu/)
- OSHA Noise Page – [www.osha-slc.gov/SLTC/noisehearingconservation/index.html](http://www.osha-slc.gov/SLTC/noisehearingconservation/index.html)
- Sound Alert – [www.soundalert.co.uk](http://www.soundalert.co.uk)
- WISE EARS Campaign – [www.nidcd.nih.gov/health/wise/index.htm](http://www.nidcd.nih.gov/health/wise/index.htm)
- WorkSafe Western Australia SafetyLine - [www.safetyline.wa.gov.au](http://www.safetyline.wa.gov.au)



# Don't let noise steal your hearing

You know that the noise levels in your workplace are excessive. You've looked into the problem but realize that controlling noise at the source is not a practical solution. So you buy earplugs and hand them out to workers. Your job is done...right?

Wrong. Hearing-protection devices (HPDs) such as earplugs and earmuffs can be effective if used properly, but all too often they're not. The selection, use, and care of hearing protection is not as easy as many people think. If it's not done right, workers will be overexposed to noise and will eventually experience noise-induced hearing loss (NIHL).

Noise-induced hearing loss is one of the fastest-growing occupational diseases in Ontario. The biggest problem is that by the time workers realize they're losing their hearing, it's too late—the damage is permanent and irreversible.

Exposure to noise may sometimes be unavoidable, but hearing loss is 100 per cent preventable. Use the tips in this pull-out to help ensure that hearing protection devices are used properly at your workplace. On page four, you'll find helpful illustrations that show you how to fit earplugs and earmuffs. Post this pull-out somewhere where workers can see it or present it as a safety talk.



## Workers need to know when hearing protection is required.

Find answers to the following questions:

- How noisy is the workplace?
- Is it noisy all the time or only when certain tools or equipment are used?
- Which workers are exposed to noise? For how long?

Without knowing the answers, you might choose the wrong type of hearing protection, protect workers when they don't need it, or worse, not protect workers when they need hearing protection.

### **TIP one** Assess the noise level of the workplace to determine if or when hearing protection is required.

Assessing noise levels is not necessarily an expensive or highly technical task. As a general rule, if you can't hear someone talking two feet away from you, and that person needs to shout to be heard, hearing protection is required. An inexpensive sound level meter or noise indicator can be used to identify hazardous sound levels caused by certain tasks. Manufacturer or industry data can help you find out how much noise is made by specific tools and equipment.

### **TIP two** Post warning signs in noisy areas to alert workers that hearing protection is needed.

You don't need to be exposed to loud noise all day long and every day to risk hearing loss. Exposure to very loud noise for even relatively short periods repeatedly and regularly over time can result in permanent hearing loss. In addition to posting signs, you can attach warning labels to loud tools or equipment.

## Employers and workers need to choose the right kind of hearing protection.

To find the most effective type of hearing protection, you will need a thorough understanding of the noise characteristics of your workplace (i.e., when and where noise occurs, how long it lasts, etc.).

### **TIP three** Choose an HPD that does not interfere with important communication.

Workers still need to hear important sounds such as alarms or other warning devices, approaching vehicles, etc. Modern HPDs can allow certain warning sounds through while blocking other hazardous noises. Reassure workers that wearing HPDs will not prevent them from hearing other important sounds.

### **TIP four** Choose an HPD that feels comfortable.

A properly fitted (deeply inserted) earplug may feel uncomfortable at first. But after a few uses, workers should start to become used to it. Most suppliers offer a wide variety of HPDs, so involve workers in the selection process by letting them try on different types and styles before you buy them. Purchase at least three or four different models (two or three ear plugs and at least one earmuff).



## Workers need to learn how to use hearing protection properly.

Hearing protection only works when it's used correctly. Wearing HPDs that do not fit properly can give workers a false sense of security—they believe that they're protected when they're not.

### **TIP** five

#### **Provide brief one-on-one training to workers on the proper use of HPDs.**

Workplaces that provide audiometric testing (i.e., hearing tests) can use this opportunity to review the proper techniques for inserting, inspecting, and caring for HPDs with workers. Refer to the illustrations on the next page, or visit IHSA's e-Learning web page to view online presentations on *Basics of Hearing Protection* and *Basics of Noise*. You can also download the "Hearing protection" chapter in IHSA's *Construction Health and Safety Manual* (M029).



### **TIP** six

#### **Always follow the manufacturer's instructions for the proper use of HPDs.**

Consult the manufacturer's guide. Instructions can vary significantly depending on the manufacturer or the type of device (e.g., foam vs. pre-moulded earplugs).

#### **Employers must enforce hearing protection at the workplace.**

Once you have trained your workers in hearing protection and given them HPDs, you must make sure that they follow the correct procedures.

### **TIP** seven

#### **Make sure that workers wear hearing protection at all times, when required.**

A hearing protector that is not used when needed is useless. For example, if an earplug is only used 80 per cent of the time that it should be used, it will provide only seven decibels of protection. Compare that to the 33 decibels of protection that the earplug provides if it's used 100 per cent of the time it's needed. (See table.)

Length of time worn (%)	Maximum protection (dB)
30	1.5
40	2.2
50	3
60	4
70	5
80	7
90	10
95	13
99	20
100	33

### **TIP** eight

#### **Give frequent safety talks to remind workers when hearing protection is needed.**

Five-minute safety talks are a convenient and effective way to reinforce health and safety on the job. Refer to IHSA's *Safety Talks Manual* (V005) for one on hearing protection.

## Workers need to know how to inspect and maintain HPDs properly.

Just like any other type of personal protective equipment, HPDs do not last forever. To make sure they're working properly, HPDs must be inspected and maintained.

### **TIP** nine

#### **Always consult the manufacturer's instructions on proper inspection and maintenance procedures.**

Inspection and maintenance procedures for HPDs can vary significantly depending on the type or manufacturer. For instance,

- earmuff cushions must be inspected for cracks and tears and must be replaced periodically, since the cushions can lose their flexibility
- foam earplugs should be replaced when they get dirty, but reusable earplugs can be washed with mild soap and warm water.

Hearing-protection devices are an important piece of personal protective equipment. If workers are not protected, loud noise can steal their hearing.

# Fitting your earplugs and earmuffs

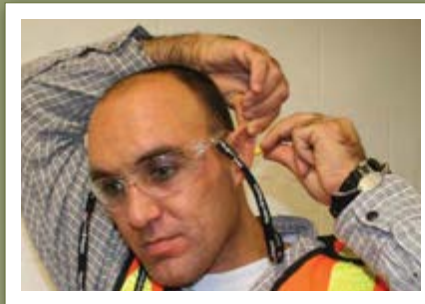
First, wash your hands. Then roll—don't just squeeze—the earplugs between your thumb and two fingers.



Before each use, inspect your earmuffs for damage and ensure that the muff pads have good elasticity.



Reach your other hand behind your head and pull your ear up. This straightens the ear canal so the plug can go in deeply.



Compress the muffs' arms so that the muffs fit snugly against your head.



Insert the plug deeply into the straightened ear canal.



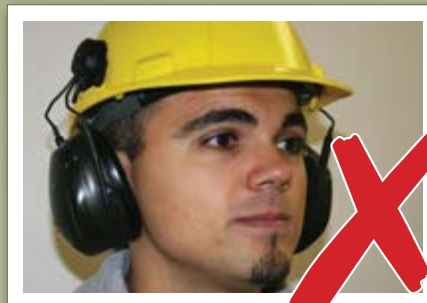
These earmuffs fit well. There's a tight seal between the earmuffs and the head, all the way around the muffs.



If you insert the plug properly, you shouldn't see very much of the plug outside the ear.



These earmuffs don't fit well. Notice that part of the ear is showing. That means the seal isn't good. Adjust the muffs.



**Earplugs and earmuffs won't protect you if you don't wear them properly**

## **Section 6: Training Tips**

- How Adults Learn Best (WOSHTEP)
- Training Steps (WOSHTEP)
- Aim at What is Essential to Know (WOSHTEP)
- Memory and Learning Methods (WOSHTEP)
- Teaching Methods Chart (WOSHTEP)
- Training Evaluation Checklist
- Worksheet: Your Training Plan (WOSHTEP)

# How Adults Learn Best

- **MAKE THE TRAINING RELEVANT.**

Adults need to see that the subject matter and the teaching methods are relevant to their lives and what they want to learn.

Find out beforehand about the participants, and what they're most interested in learning. Use examples and discussions in the training that reflect participants' own experiences, and are relevant to their needs.



- **RESPECT PEOPLE'S EXPERIENCES, KNOWLEDGE, AND SKILLS.**

Adults come to the class with a wealth of prior experience and knowledge. They are more open to learning if treated with respect.

Explain to the class that participants will learn from each other, and plan activities that build on and incorporate participants' own experience.

- **BUILD ON PREVIOUS LEARNING.**

Adults learn best when they can relate new material to what they already know. Learners need road maps, with clear objectives. Each new piece of information needs to build logically on the last.

Avoid presenting large amounts of new information all at once. Use visual aids. Be sure to allow time for breaks and questions. Make sure everyone is ready for the next step before proceeding.

- **USE DIVERSE TRAINING METHODS.**

Adults have different learning styles. Some people learn better if the material is reinforced with visual aids, and some learn better through hands-on activities. Learning works better when information is presented in different ways.

Use a variety of teaching activities, including brainstorming, discussion, visual aids, role plays, games, and case studies. Change the pace and the method frequently, especially when covering difficult and abstract topics.

- **ENCOURAGE CLASS PARTICIPATION.**

When adults are involved in and help direct their own learning, they are more engaged and learn more. People need to practice as they learn, and hear things more than once to remember them.

Encourage questions and discussion during the class. Use hands-on practice, role playing, non-competitive quizzes, and other exercises often. Incorporate information presented earlier into new activities. Remember that an instructor's skill in asking questions and analyzing people's answers is of greater value than flooding the class with a mass of information they can get elsewhere or don't need.

An old proverb says:

*Tell me, I forget.*

*Show me, I remember.*

*Involve me, I understand.*



# Training Steps

1. **DO A NEEDS ASSESSMENT.** Find out about your audience and their training needs. What do they already know, and what do they want to learn?
2. **SET OBJECTIVES.** Objectives help you focus on what is most important. Aim for the bull's-eye: emphasize the essential information.
3. **SELECT TEACHING METHODS.** Training is most effective when you use a variety of methods. People learn in different ways and retain more if they hear, see, and practice. Some useful methods are games, role plays, case studies, demonstrations, small group activities and brainstorming.
4. **DEVELOP A TRAINING PLAN.** A training plan is an outline that spells out what activities and methods you will use, how much time each activity will take, and what materials you will need.
5. **PRESENT THE TRAINING.** Follow your training plan as much as possible, but be flexible in meeting participants' needs.
6. **EVALUATE TRAINING AND REVISE TRAINING PLAN AS NEEDED.** Get participants' feedback on how well the training went and how effective it was. Decide what needs to be changed and improve your training plan for next time.

**Your Training Plan**

Topic: \_\_\_\_\_

Time	Activity	Instructor's Notes	Materials Needed

# Aim at What is Essential to Know

Sometimes trainers try to cover too much material and lose sight of what is most important.

Being selective is critical. Determine whether the material you want to teach is:

- Essential to know,
- Good to know, or
- Nice to know.

Your main aim is to cover what is essential. Since your teaching time is limited, you need to aim carefully.

Aim for the bull's eye. Ask yourself:

- Why am I teaching this?
- In what way will this prepare the person to stay safe at work, or to perform a new skill?
- Could this time be better used to teach something else that's more important, or to teach the same thing in a better way?



Aim your teaching at what is most essential!

# Memory and Learning Methods



20% Retained



30% Retained



50% Retained

**Hear + See + Discuss + Practice**



90% Retained

# Teaching Methods Chart

TEACHING METHODS	STRENGTHS	LIMITATIONS	PREPARATION
<b>Lecture</b>	<p>Presents factual material in direct, logical manner.</p> <p>Can include personal experiences which inspire.</p> <p>Stimulates thinking to open a discussion.</p> <p>Works for large audiences</p>	<p>Experts may not always be good teachers.</p> <p>Audience is passive.</p> <p>Learning is difficult to gauge.</p>	<p>Needs clear introduction and summary.</p> <p>Needs limits on time and content to be effective.</p>
<b>Brainstorm</b>	<p>Allows creative thinking and new ideas.</p> <p>Encourages full participation because all ideas are equally valued.</p>	<p>Can become unfocused.</p> <p>Needs to be limited to 10-15 minutes.</p>	<p>Instructor must select and clearly define the problem or questions, then ask for all ideas (without debate or comment), which are recorded on board.</p>
<b>Large Discussion</b>	<p>Pools ideas and experiences from the group.</p> <p>Effective after a lecture, film, story, or brainstorm that needs to be analyzed.</p>	<p>Not practical with more than 20 people.</p> <p>A few people can dominate, while others may not participate.</p>	<p>Needs careful planning by instructor to guide the discussion.</p> <p>Needs advance preparation of questions and key points to bring out in the discussion.</p>
<b>Small Group Discussion</b>	<p>Allows participation of everyone in small groups (4-6 people).</p> <p>Develops group process skills.</p>	<p>Needs careful thought as to the purpose and task of group.</p>	<p>Needs preparation of specific tasks or questions for group to answer.</p>

# Teaching Methods Chart (CONTINUED FROM PREVIOUS PAGE)

TEACHING METHODS	STRENGTHS	LIMITATIONS	PREPARATION
<b>Risk Mapping</b>	<p>Small groups creates a visual map of hazards, controls, and plans for action.</p> <p>Does not rely on reading or writing skills.</p> <p>Useful as a follow-up tool after discussion.</p>	<p>Works best for workers from the same or similar workplace.</p>	<p>The work areas being mapped need to be chosen carefully to make sure they are relevant to participants.</p>
<b>Case Studies</b>	<p>Develops analytic and problem-solving skills.</p> <p>Allows for exploration of different solutions.</p> <p>Allows students to apply new knowledge and skills.</p>	<p>People may not see the relevance to their own situation.</p>	<p>The scenario must be clearly defined to be effective.</p> <p>Need to pose the right questions for drawing out critical thinking.</p>
<b>Role Playing</b>	<p>Introduces a problem dramatically.</p> <p>Develops analytic and problem-solving skills.</p> <p>Allows people to assume roles of others and understand their views.</p> <p>Allows for exploration of different solutions.</p> <p>Allows for practice in speaking up.</p>	<p>People may be too self-conscious.</p> <p>May not be appropriate for large groups.</p>	<p>Need to define the problem and roles clearly.</p>
<b>Report Back Session</b>	<p>Allows for full class discussion after role plays, case studies, and small group exercises.</p> <p>Gives people a chance to reflect on what happened.</p>	<p>Can be repetitive if each small group says the same thing.</p>	<p>Instructor should prepare questions to focus the discussion, so it is not repetitive.</p>

# Teaching Methods Chart (CONTINUED FROM PREVIOUS PAGE)

TEACHING METHODS	STRENGTHS	LIMITATIONS	PREPARATION
<b>Hands-on Practice</b>	Provides classroom practice of learned behavior (use of equipment, techniques, etc.).	Requires enough time, appropriate physical space, and equipment.	Instructor has to obtain, set up, and check equipment.
<b>Worksheets and Questionnaires</b>	<p>Allows people to think for themselves without being influenced by others.</p> <p>Individual thoughts can then be shared with small groups or the entire class.</p>	<p>Can be used only for a short period of time.</p> <p>Can be isolating since people work alone.</p> <p>May not work if participants have literacy or language limitations.</p>	<p>Instructor has to prepare handouts, select questions, and have a clear idea of the goal.</p> <p>Materials may need to be translated into other languages.</p> <p>Participants should be encouraged to ask for help and work with others.</p>
<b>Audiovisual Materials (videos, DVDs, etc.)</b>	<p>Entertaining way of teaching content and raising issues.</p> <p>Keeps audience's attention.</p> <p>Effective in large groups.</p>	<p>Too many issues may be presented at once to have a focused discussion.</p> <p>Follow-up discussion may not have full participation.</p>	<p>Need AV equipment set up in advance.</p> <p>Effective if instructor prepares questions to discuss after the show.</p> <p>Need to screen material ahead of time to make sure it is relevant and well-organized.</p>

# Training Evaluation Checklist

The trainer:

- ☐ Respects the participants, and the knowledge and experience they bring to the class.
- ☐ Knows the participants' needs and tailors the training to these needs (makes it relevant, builds on what they already know).
- ☐ Uses participatory, interactive methods that actively involve the learners and draw on their own skills and knowledge.
- ☐ Uses a variety of different training methods to keep things interesting and to accommodate diverse learning styles.
- ☐ Uses "hands-on" activities whenever possible.
- ☐ Uses good props, demonstration equipment, visuals, etc.
- ☐ Is careful to do more listening than talking.
- ☐ Demonstrates enthusiasm and commitment to health and safety.
- ☐ Is well-prepared in advance and has a clear training plan.
- ☐ Makes expectations clear from the beginning.
- ☐ Gives an overview of what the training will cover.
- ☐ Avoids giving a talk or lecture for more than 10 minutes at a time.
- ☐ Involves all participants, not just some.
- ☐ Creates a safe learning environment for all participants.
- ☐ Recognizes and accommodates cultural and linguistic differences among participants.

# Your Training Plan

Topic:

TIME	ACTIVITY	INSTRUCTOR'S NOTES	MATERIALS NEEDED

## **Section 7: Resources**

- Resource List

# RESOURCE GUIDE

## SELECTED ORGANIZATIONS

### **SBCTC – *State Building & Construction Trades Council of California***

**Home Page:** <http://www.sbctc.org/>

The State Building and Construction Trades Council of California (SBCTC) works to improve the health, jobs safety and economic conditions of the members of its affiliates, and of all working men, women and minors in the construction industry. SBCTC offers a Health & Safety page with links to information on upcoming classes as well as other health and safety news.

SBCTC Safety and Health Hub :

<http://safety.sbctc.org/>

Training materials developed under Susan Harwood OSHA grants:

<http://safety.sbctc.org/category/training-materials/>

### **LOHP – *Labor Occupational Health Program at UC Berkeley***

**Home Page:** <http://www.lohp.org/>

LOHP is a public service program at the University of California, Berkeley, affiliated with the Center for Occupational and Environmental Health at the School of Public Health. We seek to reduce occupational injury, illness and death by protecting the health and safety of workers worldwide. In addition to hands-on training, LOHP provides technical assistance, develops educational materials, conducts participatory research, and consults on the development of workplace standards and policies.

Tailgate Meetings that Work (available online in English and Spanish)

<http://lohp.org/tailgate-training/>

Multilingual Health & Safety Resources: A Guide to Worker Training Materials on the Web

<http://lohp.org/resources/multilingual-guide/>

### **OSHA – *Occupational Safety and Health Administration***

**Home Page:** <http://www.osha.gov/>

The Occupational Safety and Health Administration (OSHA) is the federal agency responsible for ensuring safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance. OSHA has information available on occupational noise exposure here:

<https://www.osha.gov/SLTC/noisehearingconservation/index.html>

### **Cal OSHA – *California Occupational Safety and Health Association***

**Home Page:** <http://www.dir.ca.gov/dosh/>

Cal/OSHA is a division of California's Department of Industrial Relations whose mission is to protect the health and safety of California's workers. Cal/OSHA Consultation, the part of DOSH that provides technical assistance, has created many free helpful guides to workplace hazards which you can find on their website under the Publications link.

## **NIOSH – *National Institute for Occupational Safety and Health***

**Home Page:** <http://www.cdc.gov/NIOSH/>

The National Institute for Occupational Safety and Health (NIOSH) is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness.

NIOSH page on Noise and Hearing Loss Prevention is available at:

<http://www.cdc.gov/niosh/topics/noise/>

## **CPWR – *The Center for Construction Research and Training***

**Home Page:** <http://www.cpwr.com/>

Formerly known as the Center to Protect Workers' Rights, CPWR conducts research and provides training and service for the construction industry. It was created by the Building and Construction Trades Department, AFL-CIO.

Construction Chart Book—includes a chapter on noise-induced hearing loss

<http://www.cpwr.com/rp-chartbook.html>

## **SELECTED FACTSHEETS AND TRAINING TOOLS**

### **Bricklayers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by bricklayers.

<http://depts.washington.edu/occnoise/content/bricklayersIDweb.pdf>

### **BuildSafe California Tailgate Training Materials** — one on hearing protection

CDPH OHB – *California Department of Public Health, Occupational Health Branch*

<http://www.cdph.ca.gov/programs/ohb/Pages/BuildSafe.aspx>

### **Buy Quiet**

NIOSH

Find information here on equipment noise levels, so companies can buy quieter products to make the workplace safer.

<http://www.cdc.gov/niosh/topics/buyquiet/>

### **Carpenters: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by carpenters.

<http://depts.washington.edu/occnoise/content/carpentersIDweb.pdf>

### **Cement Masons: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by cement masons.

<http://depts.washington.edu/occnoise/content/cementmasonsIDweb.pdf>

### **Construction Solutions database**

CPWR

Designed for owners, contractors, & workers, Construction Solutions is a database of work hazards, & practical control measures to reduce or eliminate hazards. Hazard analysis, work practice, administrative controls, and ppe's for noise for a variety of construction jobs can be found at:

<http://www.cpwrcolutionsolutions.org/hazard/Noise/>

### **Construction Workers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by construction workers.

<http://depts.washington.edu/occnoise/content/generaltradesIDweb.pdf>

### **elcosh (Electronic Library of Construction Occupational Safety and Health)**

CPWR

Click on Hazards, then click on Noise to see a variety of materials that discuss noise in construction. You can also narrow your search to only toolbox talks, training materials, or handouts if you wish.

<http://www.elcosh.org/>

### **Electricians: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by electricians.

<http://depts.washington.edu/occnoise/content/electriciansIDweb.pdf>

### **Hearing Protection: a toolbox talk**

CPWR

[http://www.cpwrc.com/sites/default/files/publications/CPWR\\_Hearing\\_Protection\\_0.pdf](http://www.cpwrc.com/sites/default/files/publications/CPWR_Hearing_Protection_0.pdf)

### **Hearing Protection**

Honeywell Safety Products

[http://www.honeywellsafety.com/USA/Product\\_Catalog/Hearing.aspx](http://www.honeywellsafety.com/USA/Product_Catalog/Hearing.aspx)

### **Hearing Protection booklet**

SCIF – *State Compensation Insurance Fund*

English

<http://content.statefundca.com/pdf/e17482.pdf>

Spanish

<http://content.statefundca.com/pdf/e17483.pdf>

### **Hearing Protector Compendium (2013)**

NIOSH

A comprehensive searchable database of hearing protection devices

<http://www.cdc.gov/niosh/topics/noise/hpdcomp/>

### **How Workplace Noise Can Affect Your Health (short article)**

CCOHS – *Canadian Centre for Occupational Health and Safety*

<http://www.ccohs.ca/newsletters/hsreport/issues/2014/03/ezine.html#oshanwers>

**Howard Leight by Honeywell: Education and Tools**

Honeywell Safety Products

You'll find presentations, posters, videos, and more here to help you with your trainings

<http://www.howardleight.com/hearing-protection>

**Insulation Workers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by insulation workers.

<http://depts.washington.edu/occnoise/content/insulationworkersIDweb.pdf>

**Ironworkers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by ironworkers.

<http://depts.washington.edu/occnoise/content/ironworkersIDweb.pdf>

**Laborers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by laborers.

<http://depts.washington.edu/occnoise/content/laborersIDweb.pdf>

**Masonry Restoration Workers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by masonry restoration workers.

<http://depts.washington.edu/occnoise/content/masonryrestorationIDweb.pdf>

**Noise (web page)**

LHSFNA – *Laborers' Health and Safety Fund of North America*

<http://www.lhsfna.org/index.cfm/occupational-safety-and-health/noise/>

This page has links to regulations, resources, and recent articles, as well as an online Best Practices Guide.

**Noise and Hearing Protection**

CROETWEB: Oregon Institute of Occupational Health Sciences

Collection of links to websites with information on noise and hearing protection

<http://www.croetweb.com/links.cfm?topicID=27>

**Noise Hazard Alert**

CPWR

[http://www.cpwr.com/sites/default/files/publications/Noise%202013\\_1.pdf](http://www.cpwr.com/sites/default/files/publications/Noise%202013_1.pdf)

**Noise Navigator: database of over 1700 sounds (2013)**

3M

<http://bit.ly/1xCjbSm>

**Operating Engineers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by operating engineers.

<http://depts.washington.edu/occnoise/content/operengIDweb.pdf>

**Power Tools Database**

NIOSH

Investigate the noise levels of tools on the job site

<http://wwwn.cdc.gov/niosh-sound-vibration/>

**Products and Vendor Guidance Sheet (2013)**

3M Hearing Conservation

[http://www.nyc.gov/html/dep/pdf/construction\\_guidance.pdf](http://www.nyc.gov/html/dep/pdf/construction_guidance.pdf)

**Removal of hearing protectors severely reduces protection:** even if only for 5 minutes an hour

HSE – *Health and Safety Executive*

<http://www.hse.gov.uk/noise/hearingprotection/index.htm?ebul=gd-cons/jul14&cr=29>

Interactive slider allows users to see what happens if hearing protection is removed for a variety of times

**Sheet Metal Workers: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by sheet metal workers.

<http://depts.washington.edu/occnoise/content/sheetmetalIDweb.pdf>

**Tilesetters: Construction Industry Noise Exposures**

School of Public Health and Community Medicine, University of Washington

A 16 page pamphlet talking about the noise exposures faced by tilesetters.

<http://depts.washington.edu/occnoise/content/tilesettersIDweb.pdf>

**Tools to Educate**

Honeywell Safety Products

<http://www.hearforever.org/educate/tools-to-educate>

**Types, Causes and Treatment**

Hearing Loss Association of America

<http://www.hearingloss.org/content/types-causes-and-treatment>

## VIDEOS, PODCASTS, AND OTHER MEDIA

### Hearing Conservation Videos

3M

<http://bit.ly/1tNbObk>

### The Hearing Video (17 minutes)

WorkSafe BC

In the style of a TV science show; available for Windows, Mac, or iPod.

<http://www2.worksafebc.com/Publications/Multimedia/Videos.asp?reportid=34284>

### Listen Up: Chemical Exposure and Hearing Loss in the Workplace: a free webinar (1 hour)

CCOHS

[http://www.ccohs.ca/products/webinars/chem\\_exposure/](http://www.ccohs.ca/products/webinars/chem_exposure/)

Workplace Noise podcast

<http://bit.ly/1wpl2cS>

### NIOSH Noise Research on Twitter

Get updates on NIOSH noise research as it's released

<https://twitter.com/NIOSHNoise>

### Recommended apps (from April 2014 issue of LifeLines):

LHSFNA

Sound Meter (free--Androids)

<https://play.google.com/store/apps/details?id=kr.sira.sound&hl=en>

SPLnFFT Noise Meter (\$3.99—iPhone, iPad, iPod Touch)

<https://itunes.apple.com/us/app/splnfft-noise-meter/id355396114?mt=8>

According to Laborers': though none are as accurate as a dedicated sound level meter, they can be a good reference and are certainly better than using nothing at all.