Module 2 - Noise Audit Training

Purpose of this module

This module provides training on noise required to conduct a noise audit. It covers the following topics:

- ✓ Noise & hearing loss prevention
- ✓ Hearing protectors
- ✓ Fitting of hearing protectors
- ✓ Washington state noise regulations

Module 3 also provides required training and covers how to take basic noise measurements and hearing loss recordkeeping.

Module 2 - Noise Audit Training

To do noise audits you must have training in the following:

1. Noise and hearing loss prevention
2. Hearing protectors
3. Fitting of hearing protectors
4. Washington state noise regulations
5. Conducting basic noise measurements
6. Hearing loss prevention recordkeeping

This module covers items 1–4. Module 3 covers items 5 & 6.

Definitions

Sound Level

Loudness

Measurements made by a sound level meter

Technically: the intensity of sound pressure waves hitting the ear drum

Photo by Jim Cullenaus in Creative Commons

Definitions

Noise

Often described as “unwanted sound”

Sound that is too loud, disturbs sleep, interferes with conversation, or causes hearing loss.

Community or environmental noise is regulated by local ordinances.

Workplace noise exposure is regulated by L & I - DOSH.

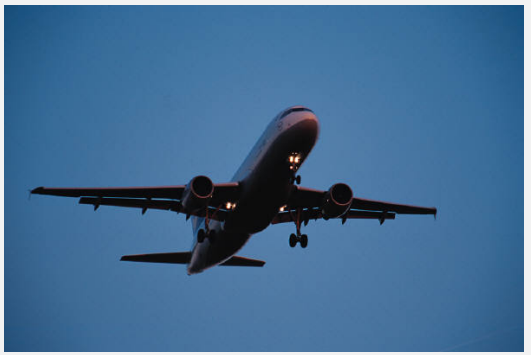


Photo by K. Pusztavari in Creative Commons

Definitions

Noise Exposure

Sound level and duration – how loud and how long a person is exposed to noise.

1 Hour?
8 Hours?

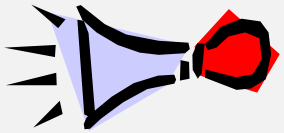
What a person actually experiences at the ear – not just what noise a loud machine makes.

Definitions

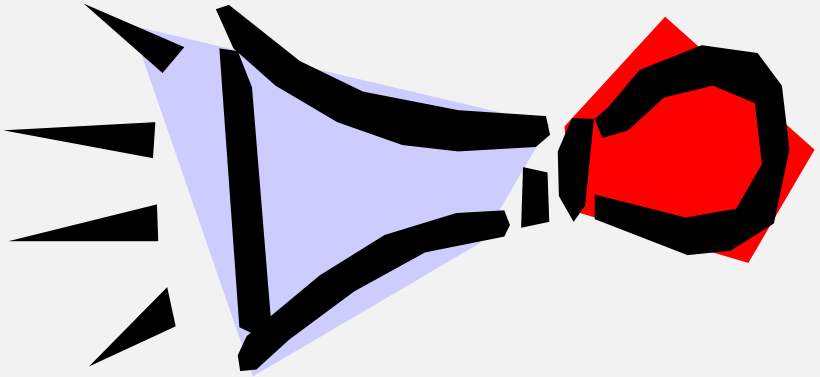
Decibel (dB)

The standard measurement of sound level

A logarithmic scale – 95 decibels is ten times the intensity (or energy) of 85 decibels



85 dB

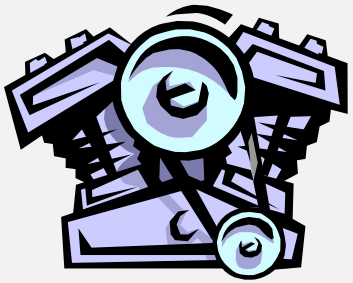


95 dB

Definitions

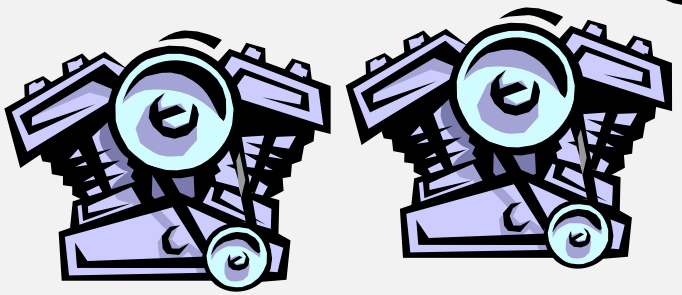
Another View of Decibels & Loudness

One machines generates a noise level of 100 decibels.



100 decibels

Two identical machines in the same room, will generate a noise level of 103 decibels.



103 decibels

Definitions

Time Weighted Average (TWA)

TWA – average noise exposure a worker receives.

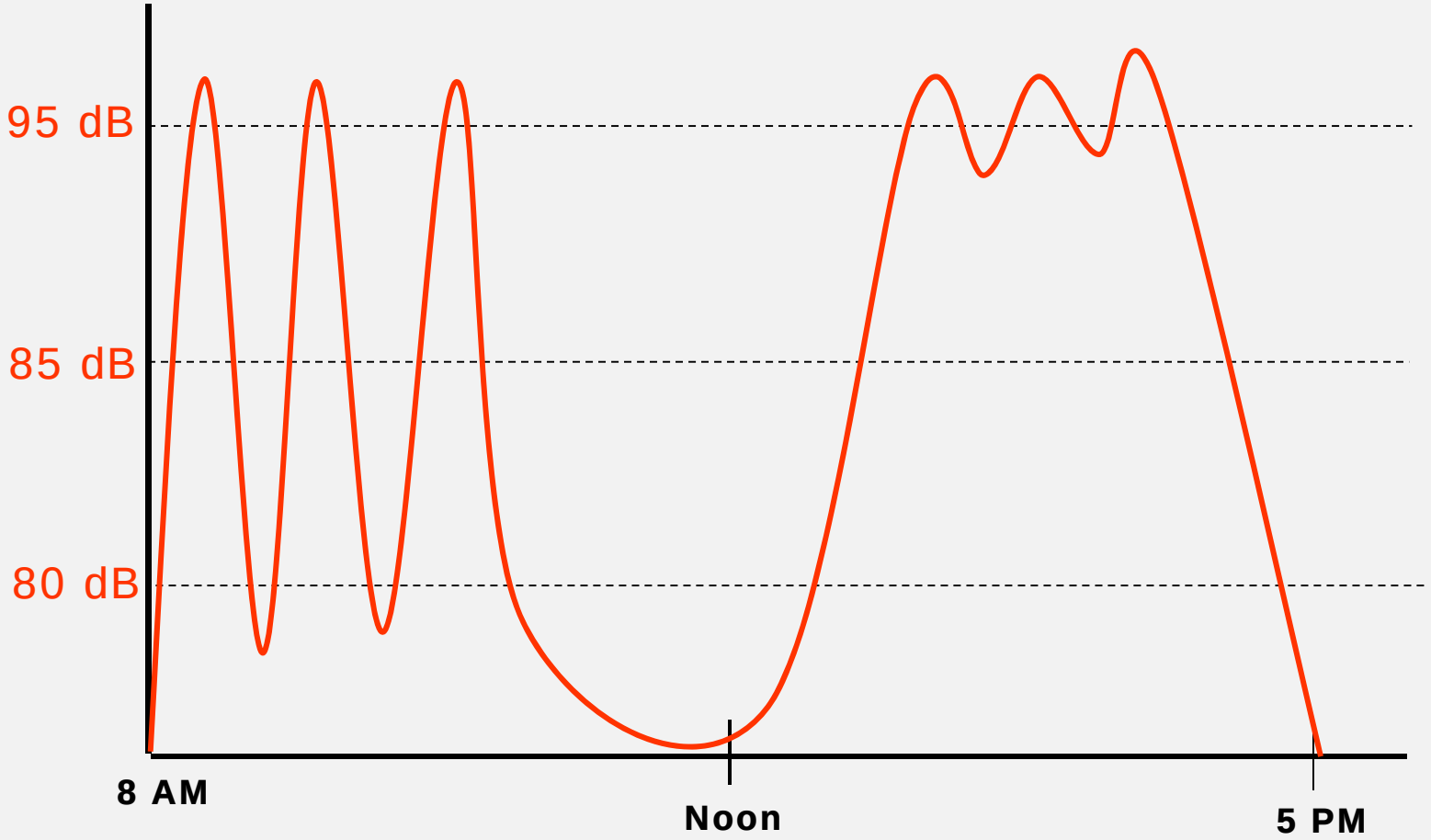
TWA_8 – Noise exposure over an 8-hour day.

The DOSH noise standard is based on an 8-hour average noise exposure.

Highly variable noise levels are common in construction.

Average Noise Levels

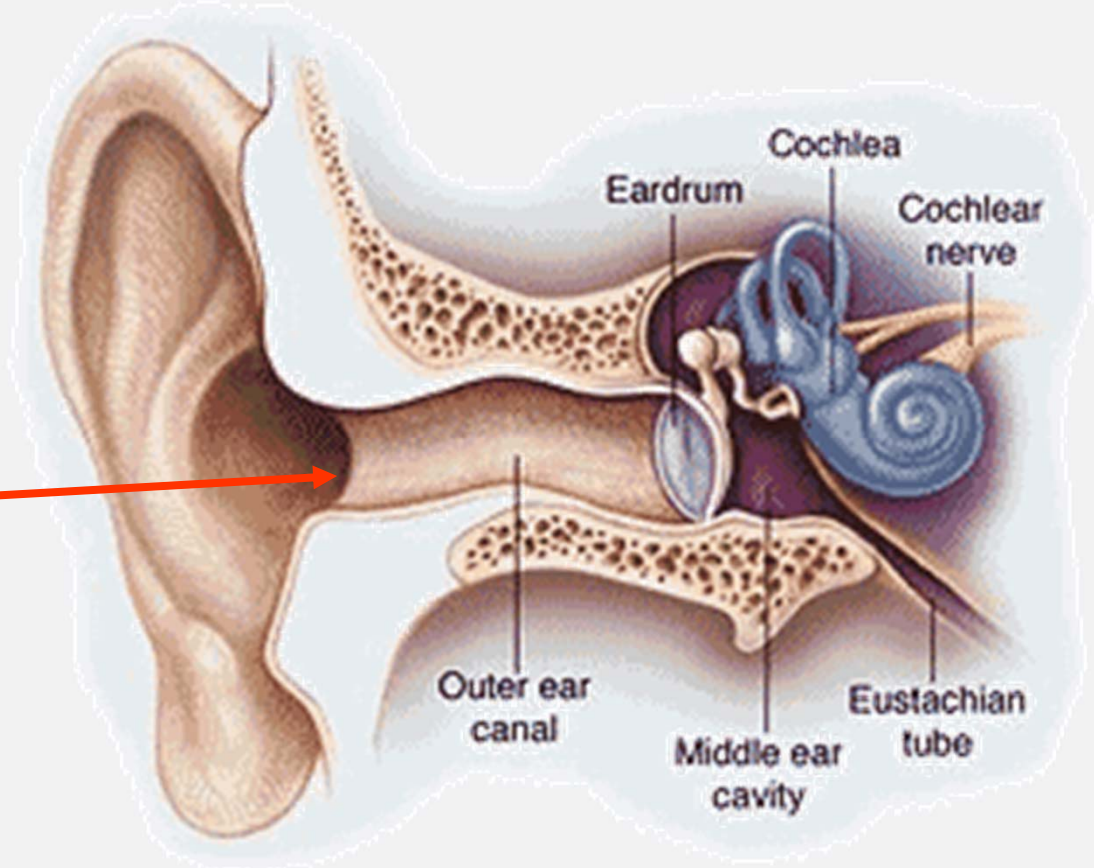
How noise exposure can vary over time



A typical construction worker's day of noise exposure

The Outer Ear

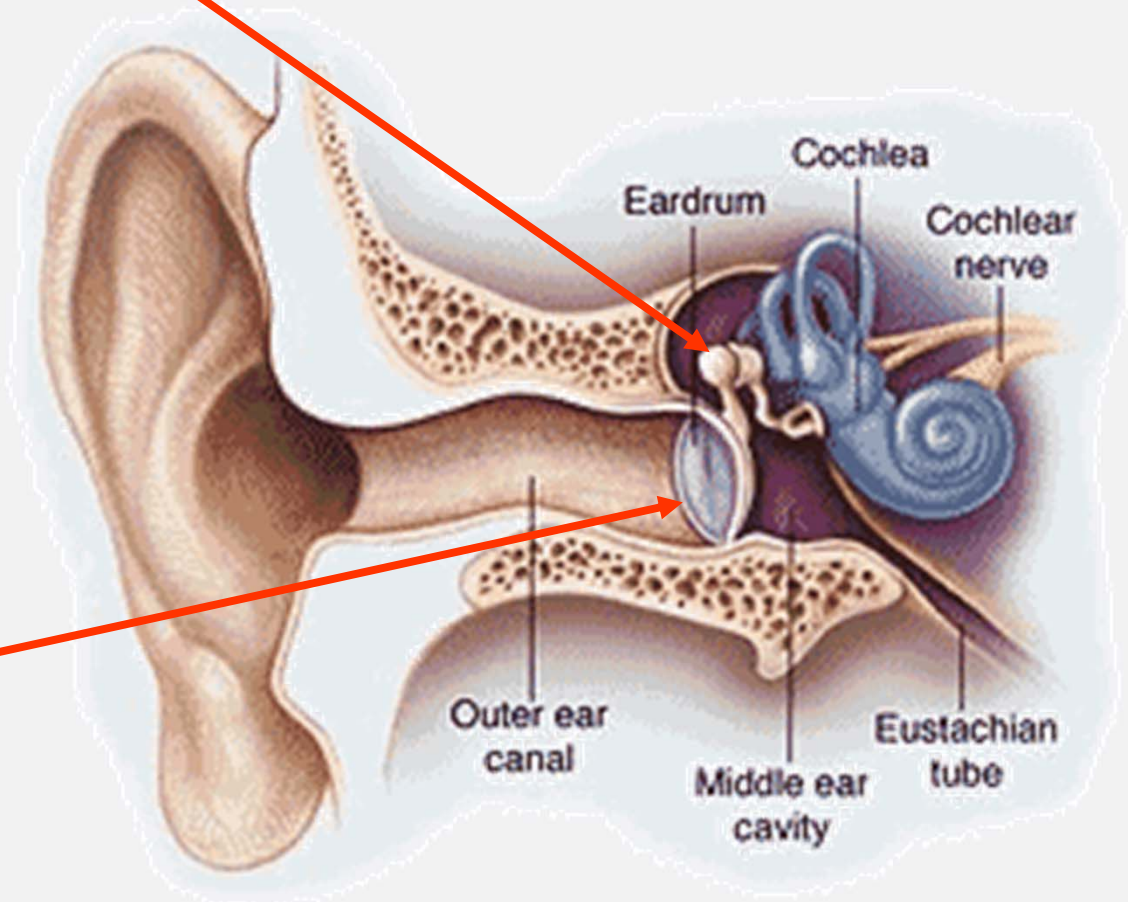
The visible ear and ear canal



The shape of the ear canal can affect how well earplugs fit.

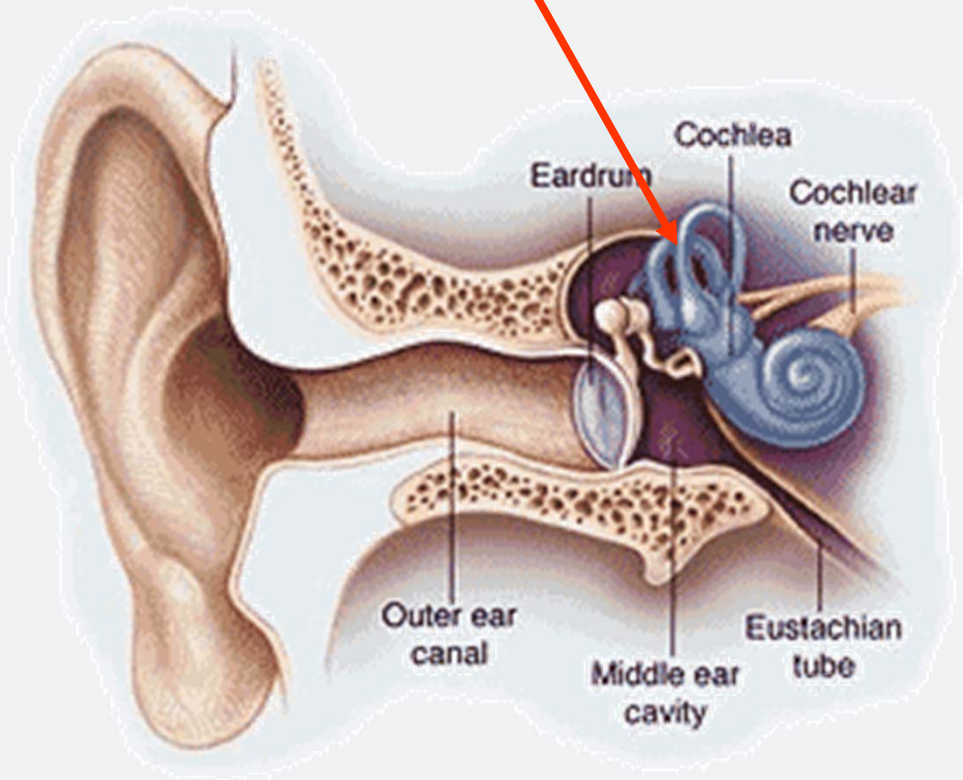
The Middle Ear

The middle ear includes the eardrum and these three tiny bones that transmit sound to the inner ear



The Inner Ear

The inner ear includes the cochlea and nerves



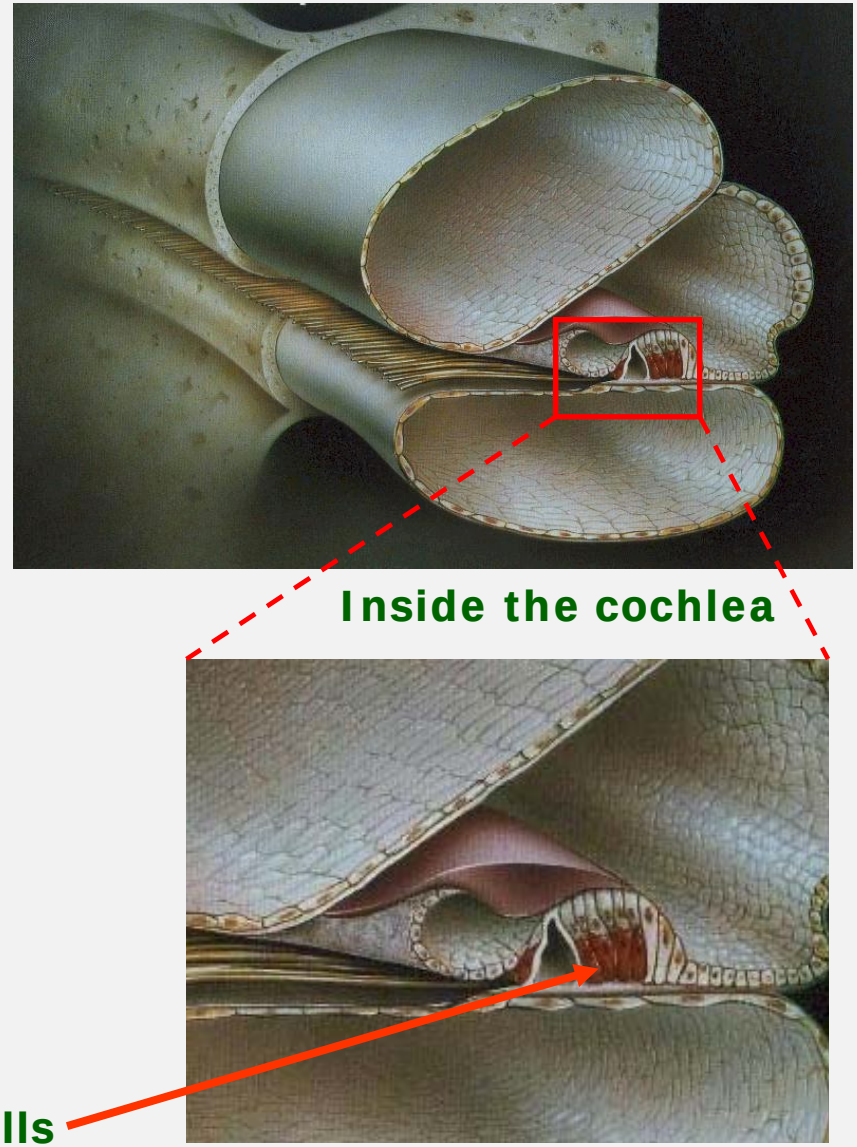
Damage from noise exposure occurs in the inner ear

The Inner Ear - Cochlea

The cochlea contains tiny hair cells which are moved by sound waves.

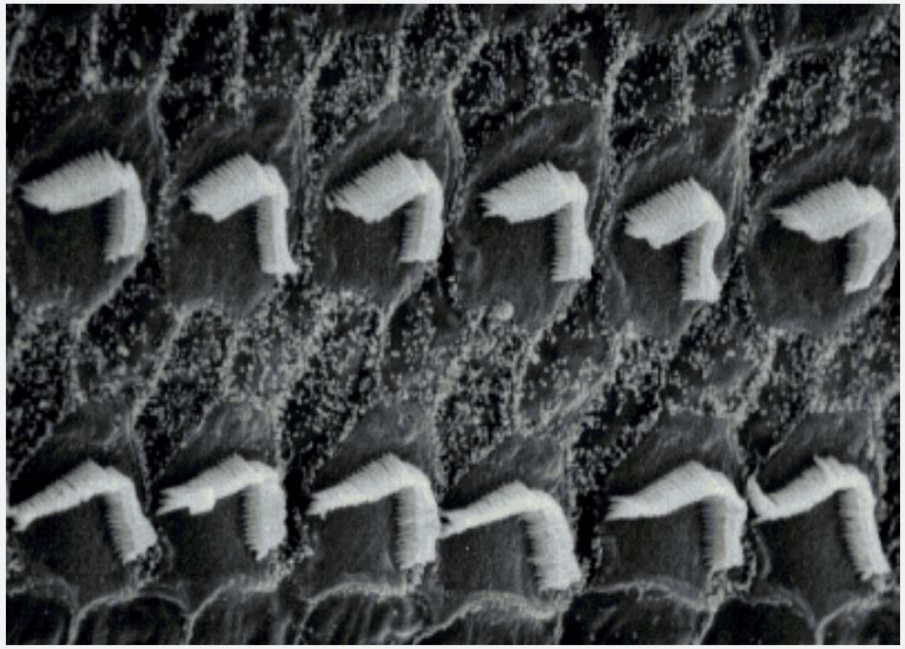
Loud noise knocks these hair cells over.

Eventually they never recover, resulting in hearing loss.

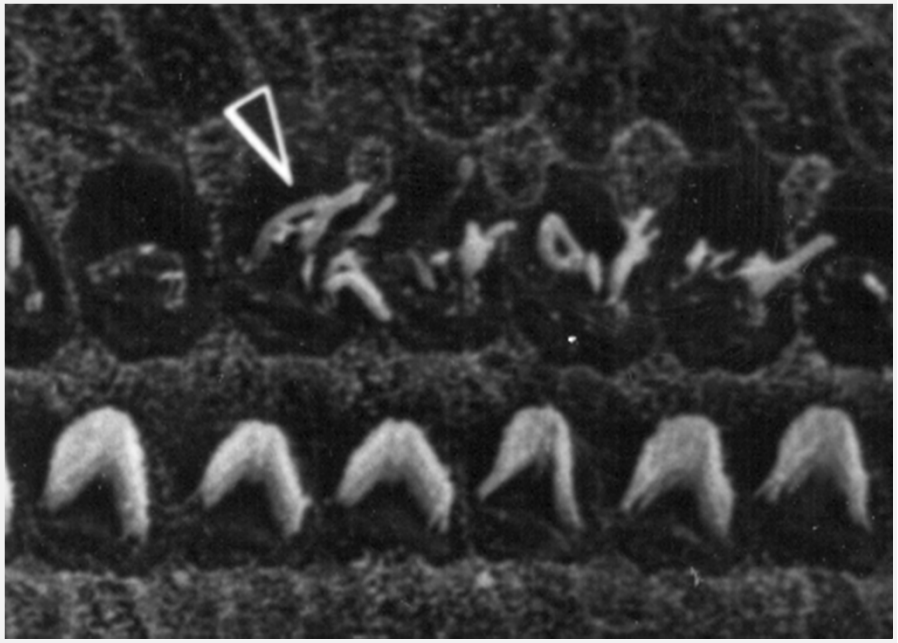


The Hair Cells in the Cochlea

Normal hair cells



Noise damaged hair cells



Long Term Exposure to Noise

Our ears can recover from short exposure to loud noise, but over time nerve damage will occur.

The louder the noise and the longer the exposure, the greater chance permanent damage will occur.

There is really no such thing as “tough ears” or “getting used to it”.

Hearing Loss From Noise Exposure

Hearing loss from noise exposure is often not noticed at first because it is so gradual.

Usually a person loses the ability to hear higher pitches first.

Often the first noticeable effect is difficulty in hearing speech.

Photo by Mike Krzeszak in Creative Commons

Tinnitus From Noise Exposure

Exposure to high noise levels can also cause permanent ringing in the ear or “tinnitus”.

Tinnitus sufferers usually complain of constant whistling, squealing, roaring or buzzing in one or both ears.

Severe tinnitus can disrupt sleep, reduce concentration and cause irritability and depression.

What is Too Much Noise Exposure?

Damage from noise exposure depends on the loudness and length of exposure.

Photo by Ricard York in Creative Commons

Scientific studies have shown that hearing loss will occur when 8-hour average noise exposure exceeds 85 decibels.

What is Too Much Noise Exposure?

The risk of hearing loss increases dramatically as noise levels increase.

Exposure to noise levels above 115 decibels for even 5 minutes is very risky.

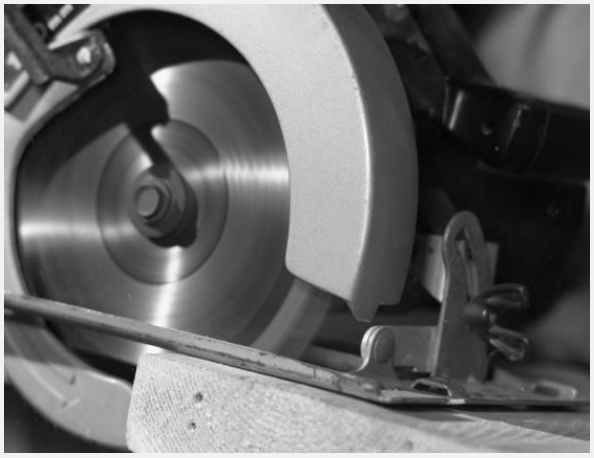
Impact or banging noise above 140 decibels will cause immediate damage to nerves in the ear.

Photo by Tuomas Karppinen in Creative Commons

Noise Levels

Examples of Commonly Used Noisy Equipment

Equipment	Noise Level
Back Hoe	85-95 decibels
Chain Saw	110 decibels
Front-end Loader	90-95 decibels
Gunshot	140 decibels
Jackhammer	112 decibels
Lawn Mower	90 decibels
Tractor	95-105 decibels
Circular Saw	90-100 decibels



Types of Hearing Protection

earmuffs

There are three types of hearing protection – ear muffs, earplugs and ear caps.

Ear muffs and earplugs provide about equal protection, ear caps somewhat less.

earplugs

ear caps

Types of Hearing Protectors

All hearing protectors are designed to reduce the intensity (loudness) of noise to the inner ear.

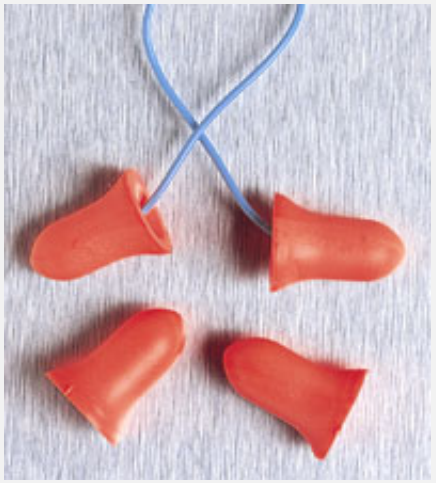
All three types have advantages and disadvantages and people vary on which they prefer to use.

Wads of cotton or cloth are <u>not</u> acceptable as hearing protectors.

Cotton doesn't work!!

Hearing Protection – Ear Plugs

Earplugs are made of foam, rubber or plastic and are either one-size-fits-all or in sizes small, medium and large.



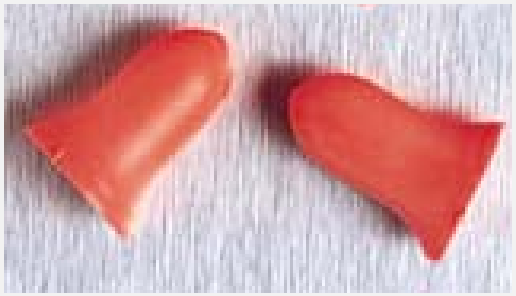
Some are disposable, some are reusable.

They are lightweight, and require no maintenance.

They are inserted into the ear canal.

Ear Plug Comfort

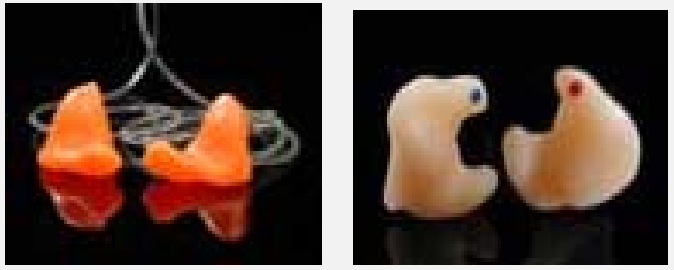
Some people may find ear plugs uncomfortable to wear for long periods at first.



Ear plugs rarely cause infection or prolonged irritation of the ear canal.

Most people can find a comfortable fit by trying several different sizes, types or brands.

Custom-molded earplugs can be obtained for maximum comfort.



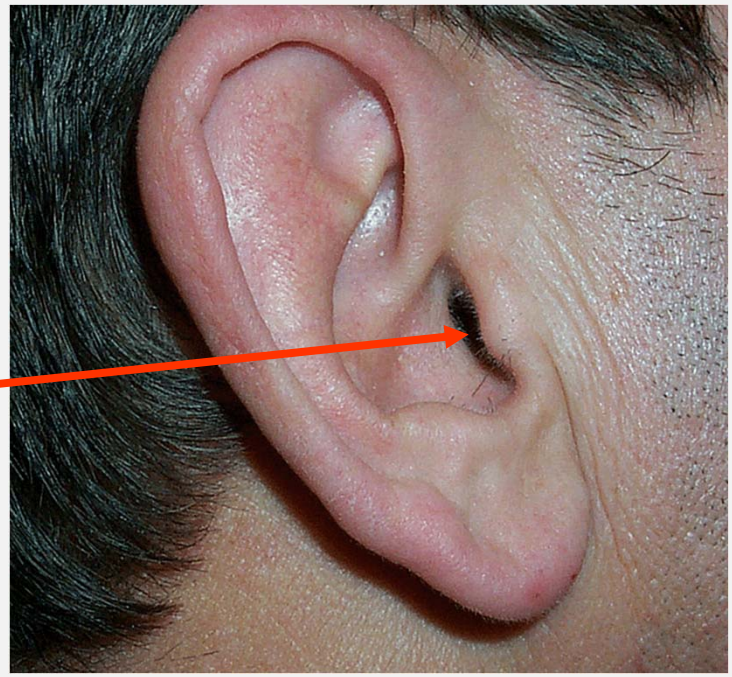
Custom-molded earplugs

Getting a Good Fit With Earplugs

The shape of the outer ear and the ear canal can affect insertion of earplugs.

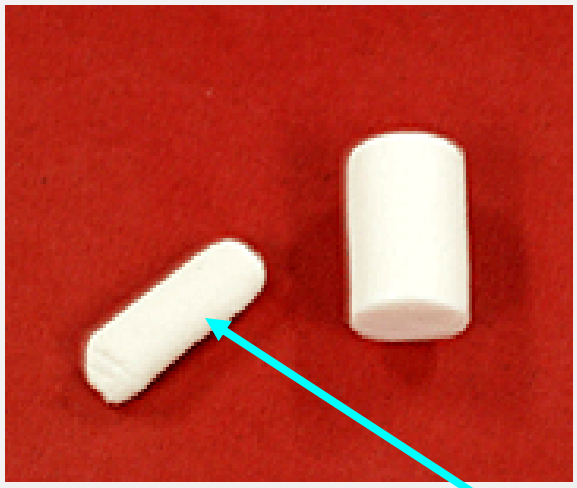
People have different size ear canals.

The shape of the “tragus” on the ear can sometimes interfere with earplug insertion.



Inserting Foam Earplugs

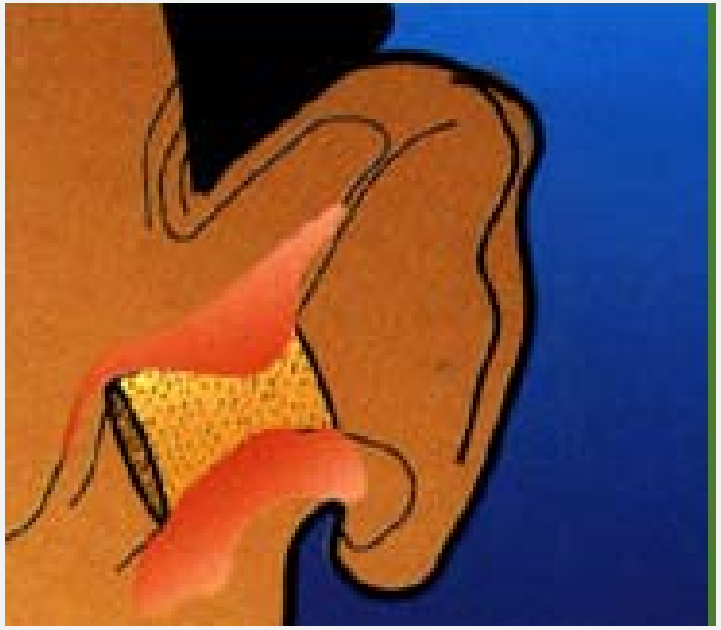
Foam type earplugs must be inserted properly into the ear for complete protection.



Roll earplug into small cylinder first, then insert in ear.

Inserting Foam Earplugs

Earplug incorrectly inserted



Earplug correctly inserted

Pre-formed (Rubber) Earplugs

Preformed earplugs come in several sizes.

Proper seating in the ear is essential.

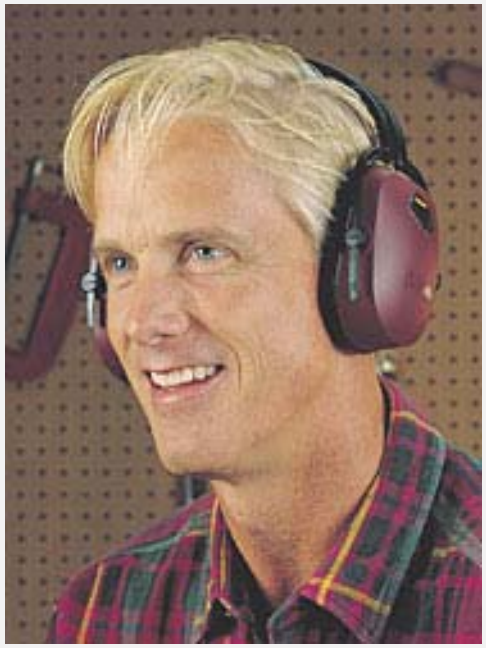
Comfort is important – an uncomfortable plug will not be worn consistently.

Ear Muffs

Ear muffs cover the whole ear and are preferred by some people.

They have replaceable pads and some high-tech styles filter out specific noise pitches.

They last longer than most plugs.



Attached Earmuffs

Some muffs are attached to hardhats or goggles.

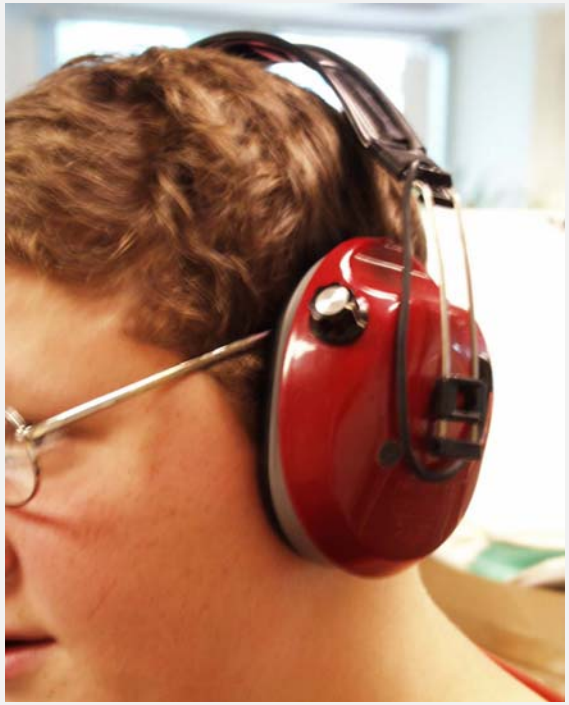
Some high-tech muffs can filter out certain frequencies or have radios inside for communication in high noise areas.

Ear Muff Comfort & Glasses

Muffs can be uncomfortable in hot weather.

Muffs don’t seal well for someone with glasses or heavy sideburns.

Position of the head band will also affect how well the muff is sealed.



Ear Muff Band Position

Some earmuffs are made with bands that can fit behind the neck or under the chin.

The highest protection is on top of the head.

Check directions to ensure muffs are adjustable for other positions.

Ear Caps

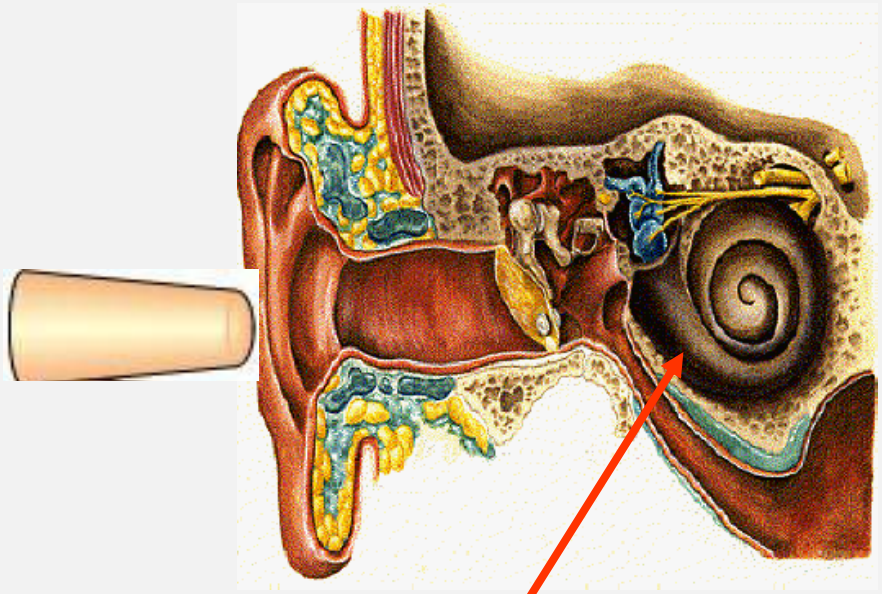
Ear caps are like earplugs, except they do not go into the ear canal, they only block it.

They are good for occasional use or for people who find earplugs uncomfortable.

They are not as protective as earplugs or muffs.

Hearing Protection Attenuation

Definition: How effectively noise protectors reduce noise to the ear



It is the difference between noise out here,

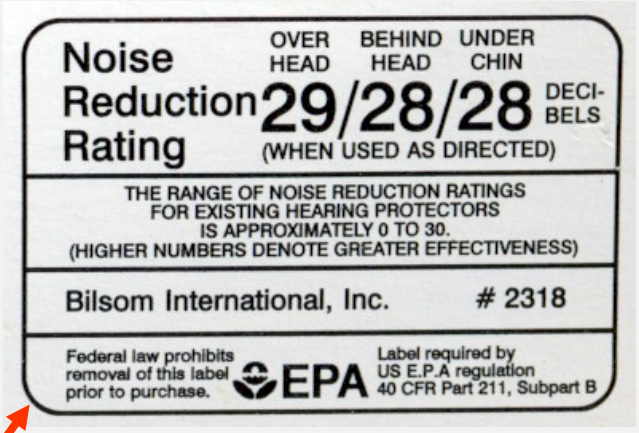
and the noise in here.

Noise Reduction of Hearing Protection

The “noise reduction rating” or “NRR” of hearing protection is measured in decibels.

The NRR is found on the earmuff or earplug package. The higher the number, the greater the protection (attenuation).

The actual effective protection is seven decibels less than rating on package.



Combined Use of Earplugs and Muffs

Dual hearing protection can be worn in extremely high noise areas (above 105 decibels).

Wearing earplugs under earmuffs will provide effective protection two decibels less than the higher NRR rating of the two protectors.

For more information, see Table 2 in the Noise rule

Very Loud Noise & NRR

Hearing protectors must have an NRR rating of at least 20 decibels for noise exposure above 115 decibels.

Exposure to impact or banging noise above 140 decibels also requires using hearing protectors with an NRR of 20 decibels or greater.

Piledriver – impact noise level can be as high as 195 decibels at 30 feet.

Photo by ZeroOne in Creative Commons

How can you hear anything with earmuffs on?

Using earmuffs or plugs in noisy areas can actually make it easier to hear coworkers or machinery.

They are similar to dark glasses that reduce the sun's glare making it easier to see.

Overprotection should be avoided.

Proper Use of Hearing Protection

Earmuffs and plugs provide good protection only when used properly.

Sometimes people will remove hearing protection for “just a minute” in a noisy area.

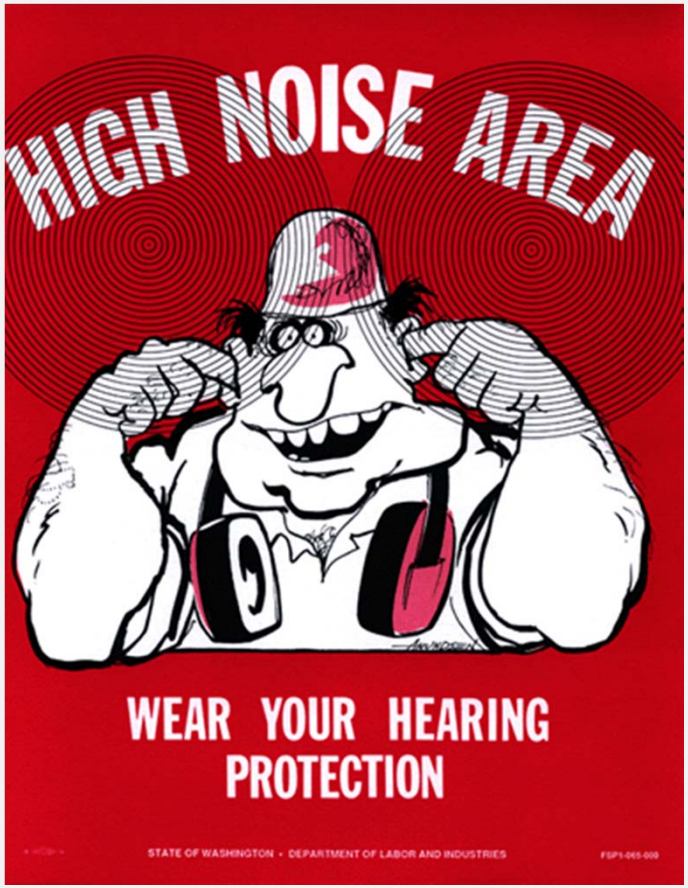
In areas of very high noise exposure, this can quickly result in noise overexposure.

Proper Use of Hearing Protection

It takes just a few minutes of unprotected exposure at noise above 115 decibels to risk hearing damage.

Earplugs not well inserted into the ear canal will not provide complete protection.

Likewise, earmuffs not snug and covering the ear completely will “leak” noise into the ear.



Hearing Aids Are Not Hearing Protection

Hearing aids do not block out enough sound for most workplace noise.

Some hearing aids can actually increase the noise level at the ear.

Just turning off the hearing aids will not prevent further hearing loss from noise exposure.

Portable Radios/CD Players/I-Pods

Standard portable radios, CD players or I-Pods do not provide protection from noise.

The earphones are not earmuffs and the music only adds to other background noise.

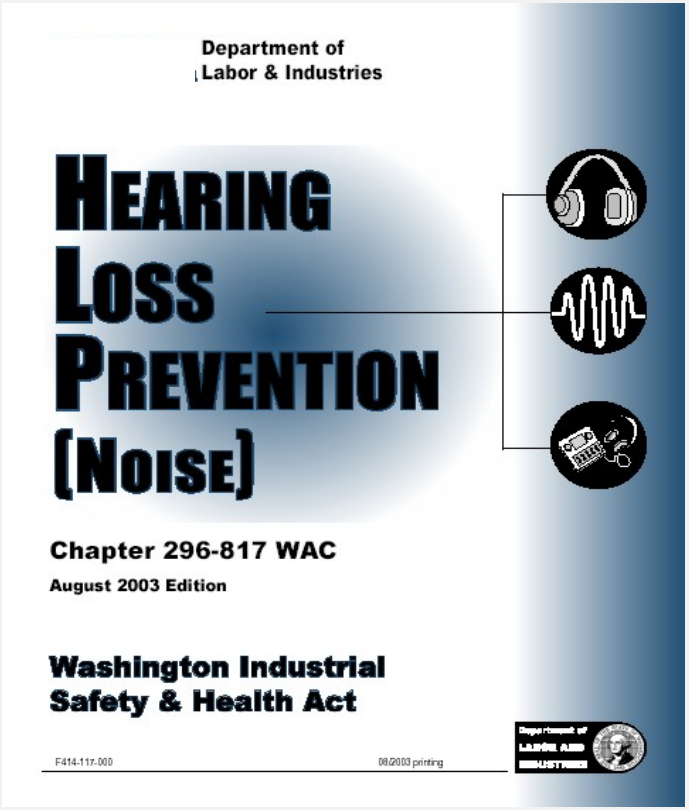
These devices can exceed 85 decibels by themselves.

Photo by Cato Bravo in Creative Commons

Hearing Loss Prevention(Noise) Rule

DOSH adopted a revised rule on Hearing Loss Prevention/Noise in 2003.

This revised rule had no new requirements, but included noise audits as an option to audiometric testing.



To view rule, click here

Hearing Loss Prevention/Noise Rule

The Rule has six main requirements:

1. Conduct employee noise monitoring,

2. Install feasible noise reduction controls when employees are exposed to 8-hour average noise over 90 decibels,

3. Make sure employees wear hearing protection when exposed to 8-hour average noise levels of 85 decibels or greater,

Hearing Loss Prevention/Noise Rule

The Rule has six main requirements (continued):

4. Train employees on effects of noise and use of hearing protection,

5. Periodically check employee's hearing with audiometric testing (or use the noise audit option),

6. Post warning signs at high noise areas.

Noise Rule Requirements

Noise Monitoring

The Noise Rule applies to any employer who has employees exposed to average noise levels of 85 decibels or above.

If workers need to shout to be heard three feet from each other, the noise level is probably above 85 decibels.

Noise levels must be measured with noise instruments.

Noise Rule Requirements

Reduce Noise Levels Where Feasible

If employees are exposed to average noise levels above 90 decibels, you must reduce noise levels with controls such as enclosures, barriers, or mufflers.

Controls are possible for many noise sources.

The DOSH Noise Reduction Ideas Bank has examples of controls.

Click here to go to Noise Reduction Ideas Bank

Enclosed and muffled generator

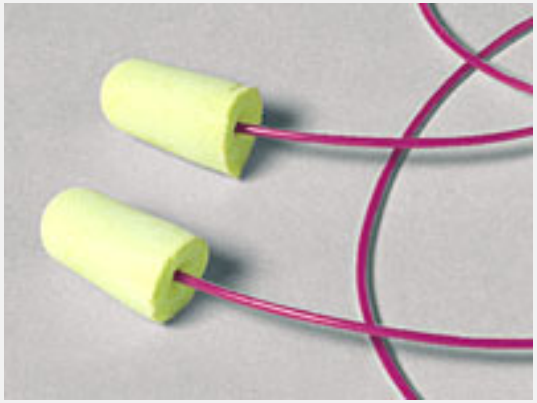
Noise Rule Requirements

Provide Hearing Protection for Employees

When controls are not possible, provide hearing protection for employees.

Employees can select a hearing protector from at least two choices.

Hearing protectors must be appropriate for conditions.



Make sure employees wear hearing protectors whenever they are exposed to excessive noise.

Noise Rule Requirements

Hearing Protection Requirements

The table below shows noise levels and when hearing protection must be worn.

Noise Level	Employee Exposure Time
85 decibels	8 hours or more
90 decibels	4 hours or more
100 decibels	1 hour or more
105 decibels	30 minutes or more
110 decibels	15 minutes or more
115 decibels	Hearing protection always required

Noise Rule Requirements

Audiometric Testing (Hearing tests)

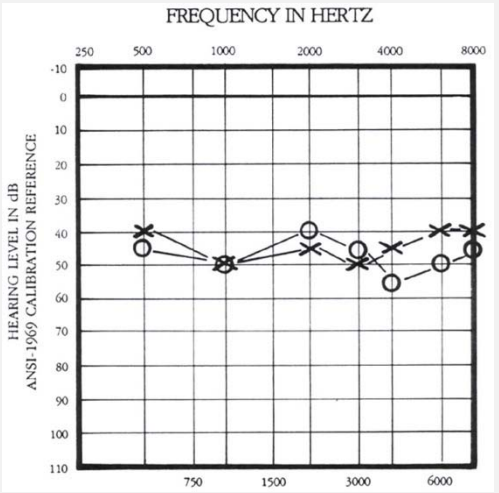
Provide hearing tests to employees who are exposed to average noise levels above 85 decibels.

Provide the hearing tests within six months of first employment or first exposure to noise.

Provide hearing test records to affected employees.

Noise audits are an option to audiometric testing for short-term employees.

Audiometric testing booth



Audiogram

Noise Rule Requirements

Worker Training

Train exposed workers when they are first assigned to a noisy job or position.

Train on the following topics:

- ✓ Effects of noise
- ✓ Noise controls used in your workplace
- ✓ purpose of hearing protection
- ✓ instructions on hearing protection use
- ✓ Purpose & procedures of audiometric testing

To view a worker training module on these topics, click here

Noise Rule Requirements

Noise Warning Signs

Post warning signs at the entrance or edge of areas or rooms where noise levels exceed 115 decibels.

Check Your Understanding

Question 1

Hearing loss will occur when:

a) The noise levels hurt the ears

b) The noise level is above 85 decibels

c) The noise level is above 85 decibels over 8 hours.

Check Your Understanding

Question 2

Exposure to noise for a short time can cause hearing loss when:

a) When the noise level is above 115 decibels.

b) When the noise is right next to the ear.

c) Short exposures will not cause hearing loss.

d) A person is very sensitive to noise.

Check Your Understanding

Question 3

What is the best hearing protection?

a) Ear plugs

b) Ear muffs

c) Either earplugs or earmuffs

d) The one that the employee prefers

Check Your Understanding

Question 4

What is NRR?

a) The noise level of rifles.

b) The noise rating of loud machines.

c) The noise reduction rating of hearing protection.

d) A measure of how well earplugs work.

Check Your Understanding

Question 5

The WISHA noise rule requires the following:

a) Provide hearing protection for all employees

b) Find ways to reduce noise levels first.

c) Wear earplugs when the noise level is above 85 decibels.

d) Provide hearing protection in noisy areas

End of Module 2

Go to Module 3