

SECTION 16

Hearing Protection

SECTION 16: HEARING PROTECTION

Overview

Hearing loss can result from exposure to loud noises over a long period of time and is not typically the result of one single event. Since we don't notice gradual hearing loss, we are often not aware it is occurring. This is why exposure to harmful noise in a shop environment is often overlooked.

Workplace hearing loss can be prevented. You must understand how much exposure to hazardous noise it takes to cause temporary or permanent hearing loss so you can take the right precautions and adjust noise levels appropriately. By recognizing when noise hazards are present, you and your supervisor can implement methods to protect your hearing.

What Is The Difference Between Sound And Noise?

Sounds are vibrations transmitted through the air that are detectable by the human ear. Every day we experience sound in our environment, such as the sounds from television and radio, household appliances, traffic, leisure activities, tools and equipment.

Noise is a loud, disagreeable, or unwanted sound. When we are exposed to harmful noise – sounds that are too loud or loud sounds that last too long – sensitive structures in our inner ear can be damaged, causing noise-induced hearing loss (NIHL). NIHL is preventable.

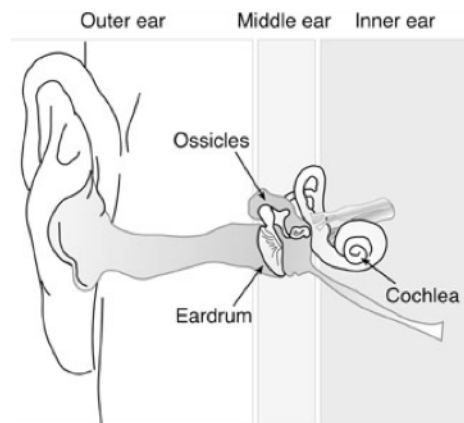


Figure 16.1 - Structure of Ear

How Do We Hear?

The outer ear collects sound waves in the air, and channels them via the ear canal to the eardrum causing it to vibrate. Three tiny bones called ossicles in the middle ear vibrate in response to the ear drum. These vibrations are sent to the cochlea, a snail-shaped structure in the inner ear filled with fluid. Hair cells in the cochlea bend with the vibrations transforming them into electrical impulses sent by the auditory nerve to the brain, which interprets them as sound. Healthy hair cells are the key to good hearing. They are fragile, and can be lost when ears are not protected from harmful noise. They can also be lost or damaged by head injuries, infection, and strong medication. Some naturally die off with age.

How is Sound Measured?

The intensity or loudness of sound is measured in decibels (dB) and weighted by frequencies, where the range that a human ear can hear is measured in dB(A). Since the range of intensities that the human ear can detect is so large, the scale used to measure sound intensity is based on multiples of 10. For example, the sound of normal conversation is measured at 60dBA. A rise of 10dBA from 60dB to 70dBA produces a sound that is 10 times stronger than the original sound. An example of a 70dBA sound is busy street traffic. An increase of another 10dBA produces a sound that measures 80dBA, but is 100 times stronger than the original 60dBA sound. A vacuum cleaner produces an 80dBA sound. See Figure 16.2 for examples of activities and their corresponding sound intensities.

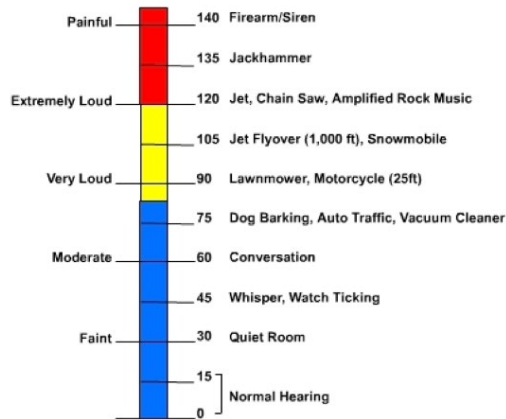


Figure 16.2 - Sound Intensity

Sounds in the workplace vary by intensity. Low intensity sounds are harmless, but excessive exposure to noise above 85dB is dangerous. If the level of noise is high enough, or if you are exposed to loud sounds over a long period of time, you can damage your hearing.

The amount of noise it takes to cause hearing loss depends not only on the intensity of the noise, but also on the length of time that you are exposed to it. Other factors such as sound frequency and your health also affect how much damage noise can inflict on your ears.

Hearing Loss

Effects of Hearing Loss

When you have hearing loss, sounds have to be louder in order for you to hear them. You may also have trouble hearing higher frequencies. Over time, sounds may become distorted or muffled, and it may be difficult to understand human speech.

Different Types of Hearing Loss

If you have work-related hearing loss, it usually results from exposure to noise. This type of hearing loss may be temporary or permanent. However, hearing loss also occurs as part of the aging process.

Temporary Hearing Loss

Exposure to harmful noise may cause only a temporary hearing loss. This type of hearing loss is often accompanied by a ringing, buzzing or humming in the ears or head known as tinnitus. If a person regains hearing, the temporary hearing loss is called a temporary threshold shift. This shift usually disappears 16 to 48 hours after exposure to loud noise.

Permanent Hearing Loss

Unfortunately, exposure to harmful noise may cause permanent hearing loss. The hearing loss may be gradual from noise exposure over an extended period of time, or immediate after a single exposure (painful acoustic trauma). If a person does not regain normal hearing, it is referred to as a permanent threshold shift. Tinnitus often accompanies permanent hearing loss.

Hearing Loss Due to Aging

As we age, the hair cells inside the inner ear begin to die off naturally resulting in a type of hearing loss called presbycusis. Age related hearing loss usually involves high frequency sounds, like a watch ticking or certain consonant sounds in normal speech.

Age-related hearing loss tends to run in families. Repeated exposure to loud noises, smoking, and certain medical conditions and medications also contribute to age-related hearing loss. About half of all people over age 75 have some amount of age-related hearing loss.

How do I determine if my shop is too noisy or if I have hearing loss?

A Hearing Conservation Program includes sampling of the workplace and all employees exposed to hazardous

noise. Noise sampling determines which areas of the workplace have hazardous levels of noise. Hearing tests are given to employees to determine if noise exposure is causing hearing loss.

Noise sampling is done with a sound level meter or with a clip-on dosimeter that indicates how much noise an individual employee is exposed to. Sometimes, noise exposure can be reduced by engineering or administrative controls. If it cannot be reduced, personal protective equipment (PPE), such as hearing protectors may be required.

Hearing tests measure how loud a sound has to be before you begin to hear it. An audiometer sends a series of tones through a set of headphones to each of your ears. You indicate when you hear each tone. Your test results are documented on an audiogram which plots hearing levels in decibels against sound frequency (pitch) in hertz. (Try to avoid high levels of noise for 14 hours before the test. If that's not possible, wear hearing protection.)

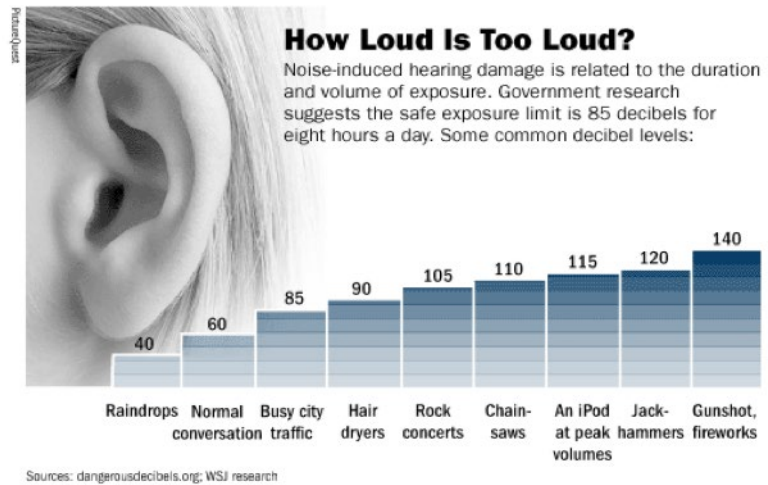


Figure 16.3 - Common Sound Levels

Your baseline test shows your normal hearing level and how much hearing loss you may have. It is also a reference for future tests.

Your annual test results are ongoing checks of your hearing. They are the best way to make sure that your hearing protection program is working.

Retesting and referral to a specialist may be necessary if your annual test shows a significant change in your hearing. A professional medical evaluation determines if your hearing loss is potentially serious and if further action is needed.

Hearing Protection

When you must work in an area exceeding Cal/OSHA permissible noise exposure limits, administrative or engineering controls must be implemented to reduce your exposure. If these interventions do not reduce sound levels below required levels, you must use PPE.

Engineering controls reduce or remove the noise hazard itself. They include changes to equipment or to the work environment. Loud machinery or tools can be modified to reduce the sound levels they produce. Sound barriers or enclosures can reduce noise pollution caused by machinery or tools that cannot be modified.

Administrative controls are used to remove the worker from the hazard. Job rotation can help reduce the time you are exposed to harmful noise. By arranging your work schedule so that you split the operation of loud machinery or tools with coworkers, you can protect your hearing.

The last defense in a hearing protection program is the use of PPE. You must be provided with a selection of suitable hearing protection at no cost whenever necessary.

You must select the appropriate hearing protector and it must fit in order to work properly.

Hearing protection's ability to reduce noise is measured as its Noise Reduction Rating (NRR). Greater NRRs provide better noise attenuation. The NRR is usually listed on the hearing protector's box. EH&S can help determine appropriate types of hearing protectors for specific situations, and can provide training on the proper use of hearing protectors.

How much will noise be reduced by hearing protection?

Use the following formula to estimate the attenuation afforded to a noise-exposed employee when selecting ear protectors:

1. Identify the Noise Reduction Rating (NRR) of the hearing protection device listed on the packaging.
2. Subtract 7 dB from the NRR. (7dB is the standard correction factor.) Then subtract the resulting value from the estimated workplace noise level (i.e., TWA) as follows:

Estimated Exposure = TWA - (NRR - 7)

Example:


TWA=90 dB, muff NRR=19 dB



Estimated Exposure = 90 - (19-7) = 78 dB

The noise reduction rating of 19 means the protector will reduce the noise level by 12 decibels (i.e., the difference between 19 and 12) – often a crucial difference for your ears. This brings the estimated noise exposure down to 78 dB in this example.

Information on hearing protection is presented in [Table 16.1](#).

Table 16.1 – Common Types of Hearing Protection

Type	Description	Fit	Care
 <p>Disposable ear plugs</p>	Disposable foam plugs that expand after placed inside ear canal to block noise. Single size.	Roll and compress the plug lengthwise between your fingertips. Reach one hand around the back of your head and pull up on the outer ear to straighten the ear canal. Insert until you feel it plugging, then hold it in place for a moment until it begins to expand.	Use clean hands to insert. Inspect before re-insertion. If damaged or dirty, replace them. Periodically, check to be sure the fit is still snug.

Type	Description	Fit	Care
 <p data-bbox="261 420 428 447">Reusable plugs</p>	<p data-bbox="509 247 784 453">Usually made of flexible rubber or silicon and are pre-formed to fit the ear. May be flanged or cone-shaped, and joined by a cord to reduce loss.</p>	<p data-bbox="821 247 1110 569">Reach one hand around the back of your head and pull up on the outer ear to straighten the ear canal. Insert the plug until you feel it sealing and the fit is comfortable. Select plugs that are the right size for your ears.</p>	<p data-bbox="1131 247 1406 604">Can be worn safely for one to six months depending on the type. Replace when hard, torn, or deformed. Inspect and clean them often with warm soapy water. Rinse well. Store them in the case supplied by the manufacturer.</p>
 <p data-bbox="293 894 399 921">Ear Muffs</p>	<p data-bbox="509 621 784 869">Resemble stereo headphones with soft plastic cushions, filled with foam or liquid. If exposed to very loud noise, wear earmuffs and plugs together.</p>	<p data-bbox="821 621 1096 978">Check to see that the cushions are flexible and fit tightly around your ears so no sound can penetrate. Keep your hair from underneath the cushions. Don't defeat their purpose by wearing radio earphones under them.</p>	<p data-bbox="1131 621 1406 909">Wipe the cushions clean with a damp rag when soiled. Check the cushions often, and replace them if they're stiff, worn, cut, or torn. Don't modify your muffs in any way.</p>