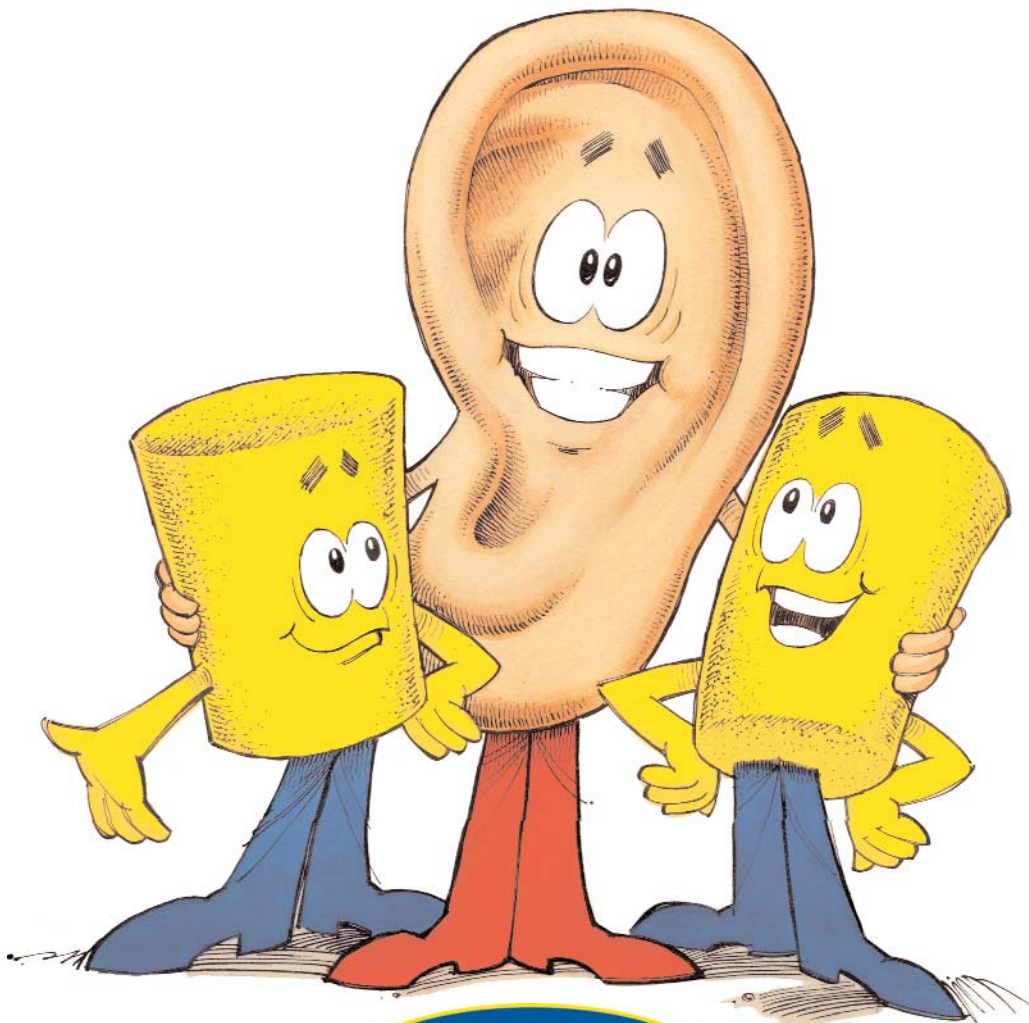


Tracer Protection Services

An Earful Of Sound Advice

About Hearing Protection



Your Hearing Conservation Program

It's a noisy world we live in today — at work and at play. Unfortunately, some of that noise may damage your ears and prevent you from hearing important sounds tomorrow. To help protect your hearing, your employer has established a hearing conservation program. It should include at least **five phases: sound surveys, noise controls, hearing evaluations, hearing protection, and education.** Now it takes your participation to succeed.

Sound Surveys

Sound surveys are used to identify work locations where hazardous noise levels exist. Employee exposures to noise are monitored periodically with a **sound level meter** or with a **noise dosimeter** that you may be asked to wear.

Noise Controls

When possible, noise will be reduced or eliminated by modifying existing machinery and placing noise limit specifications on new equipment.

You can do your share by maintaining equipment in good operation, properly using noise controls when installed, and reporting noisy equipment to your supervisor when it needs attention.



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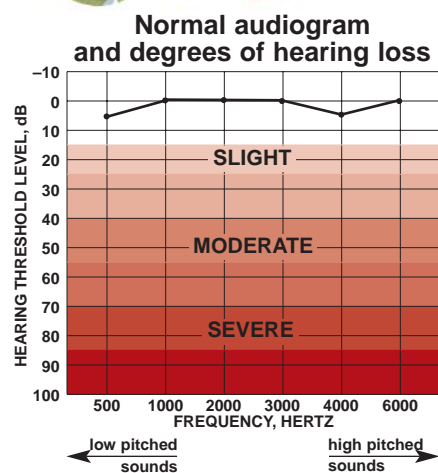
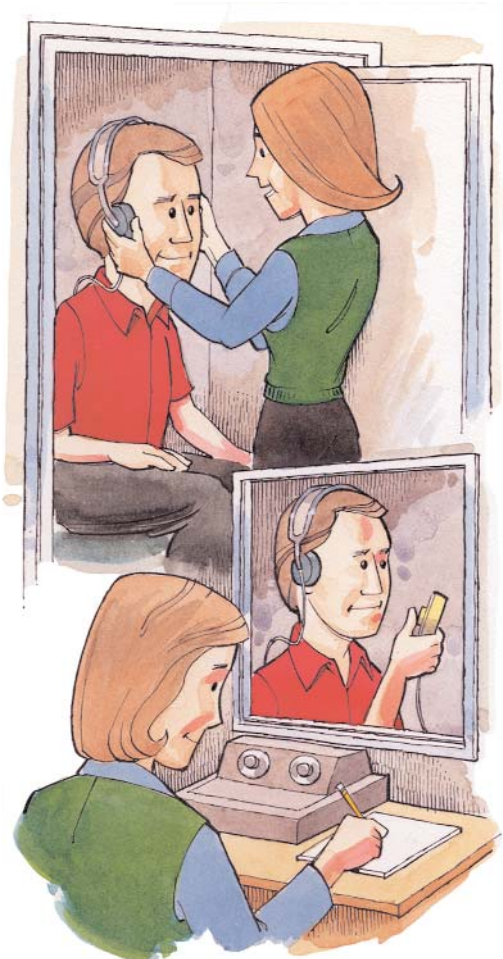
Hearing Evaluations

Hearing is measured with an **audiometer** which sends tones to each ear through headphones. You listen carefully and respond each time you hear a tone. The levels at which you can barely hear the tones are your **hearing threshold levels**.

The audiogram chart records your thresholds (measured in decibels) for tones at different pitches or frequencies (measured in Hertz). Normal thresholds fall within the unshaded area on the chart. When hearing loss occurs the thresholds fall into the shaded areas, meaning sounds must be increased in level for you to hear them.

A **baseline audiogram** shows your initial hearing status, for comparison to future audiograms. **Periodic audiograms** provide an update to determine if your hearing conservation program is doing its job and if non-noise factors are affecting your hearing. A recheck audiogram or a professional referral may be needed if a significant hearing change occurs.

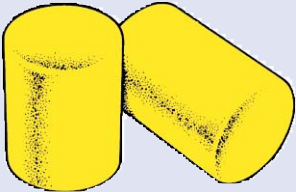
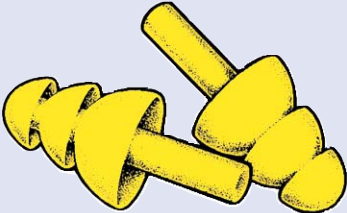
Periodic hearing evaluations show how your hearing compares to normal for your age. They are the only way to determine whether your hearing is being conserved. Unusual changes alert you and your employer to look for noise-related or medical causes before it's too late.



Hearing Protection

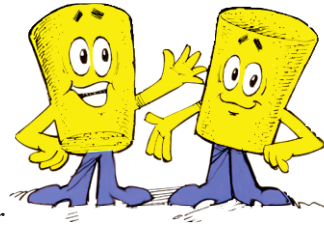
Hearing protectors can be very effective **but only if they fit properly and are worn correctly**. Although labeled Noise Reduction Ratings (NRRs) typically range from 20-35 decibels, in practice the protection that normally can be achieved is about 10-20 decibels.

The more carefully you select and wear hearing protectors, the higher your protection will be. Hearing protectors may feel uncomfortable at first, but give yourself a chance to get used to them, just as you do with a new pair of shoes or glasses.

Protector Type	Description
<h3>Formable Plugs</h3> 	Formable plugs are compressed or shaped prior to insertion. The most popular variety is made of expandable, slow-recovery foam. One size fits most everyone. Once in the ear, foam plugs gently expand to provide a snug and secure custom fit .
<h3>Premolded Plugs</h3> 	Premolded plugs are made from flexible materials that are preformed to fit the ear. They are generally available with a joining cord to prevent loss. Although the version pictured at the left is a one-sized product, many premolded plugs are sold in two or more sizes and must be individually sized for each ear . If after a week or so you've been unable to get used to your earplugs, check with the fitter to try another size, type, or brand of hearing protector.

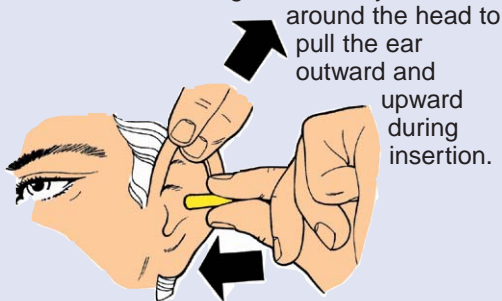
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Earplug Fitting Tip. Press firmly cupped hands over your ears while listening to a steady noise. With properly fitted plugs the noise levels should be about the same whether or not the ears are covered.



How to Use

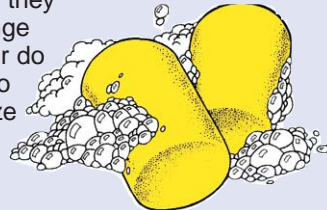
Slowly roll and compress foam plugs into a very thin cylinder. While compressed, insert plug well into the ear canal. Fitting is easier if you reach



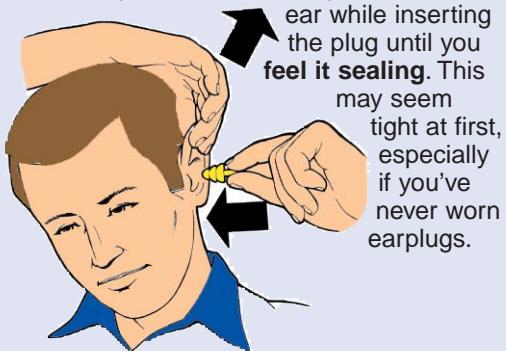
around the head to pull the ear outward and upward during insertion.

Care & Cleaning

Keep the plugs clean and free from material that can irritate the ear canal. They may be washed in mild liquid detergent and warm water. Squeeze excess water from the plugs and air dry. Washing may be repeated several times. Discard plugs if they noticeably change their firmness or do not re-expand to their original size and shape.



Reach around the back of your head and pull outward and upward on the ear while inserting the plug until you **feel it sealing**. This may seem



tight at first, especially if you've never worn earplugs.

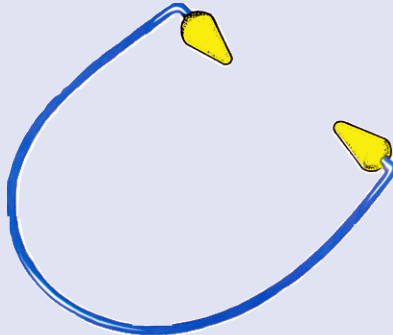

Premolded plugs will normally last several months or more depending upon the type, and upon your work environment, hygiene, and body chemistry. They should be replaced if they shrink, harden, tear, crack, or become permanently deformed. Wash them in warm soapy water and rinse well. When dry, store them in a carrying case.



Hearing Protection

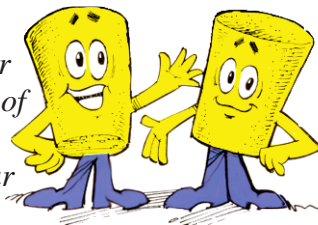
Initially you may be concerned that you'll be unable to hear conversation, machinery sounds, and warning signals while wearing hearing protection. However, unless you already have a significant hearing loss you'll be surprised how well you can hear while in noise. And when you properly wear

hearing protectors you'll be able to hear as well at day's end as when you started in the morning. People with hearing loss also benefit, since without protection noise will continue to damage their hearing until it is difficult to distinguish sounds under even the best of conditions.

Protector Type	Description
<h3>Semi-insert Device</h3> 	Semi-inserts, also called canal caps, consist of pods or flexible tips on a lightweight headband. Because they are quick to put on and take off and easy to store around the neck, they are ideal for intermittent use . They provide less protection than either plugs or muffs and aren't usually recommended for continuous long-term wearing.
<h3>Earmuffs</h3> 	Earmuffs have rigid cups with soft plastic cushions that seal around the ears to block noise. Foam-filled cushions are usually preferred over liquid-filled versions because they are lighter, more durable, and equally protective. For very loud noises, wear muffs and plugs together for an additional 5-10 dB or so of protection.

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Hearing Protector Fitting Tip. When either a plug or muff is properly fitted, the sound of your own voice should change, becoming deeper, hollow, or muffled. If you don't hear the change, or if it isn't the same in both ears, you haven't obtained a proper fit and acoustic seal in either one or both ears.



Tip: Talking in noise. When you wear plugs or muffs in noise you tend to speak less loudly than otherwise because the protector makes your own voice seem louder and the surrounding noises seem quieter. So, you have to **speak up** — speak more loudly than you think you need to. Others will appreciate this, and your message will be better understood.

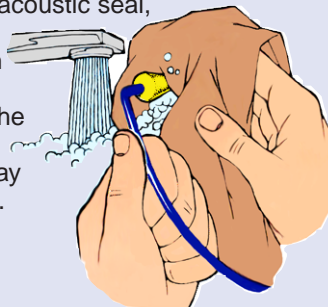
How to Use

Hold the large ends of the pods and swivel them to direct the tips into the ear canal openings. Firmly push and wiggle the pods into the canals until a snug seal is obtained. Pulling on the outer ear while pushing on the pods will be helpful to most wearers.



Care & Cleaning

Most semi-inserts can be cleaned in the same way as premolded earplugs. Since the headband holds the tips in place to provide an acoustic seal, don't tamper with it or the protection the device provides may be reduced.



Muffs must **fully enclose the ears to seal against the head**. Adjust the headband so cushions exert even pressure around the ears to get the best noise reduction. Pull hair back and out from beneath the cushions. Don't store pencils or wear caps under the cushions.



Cushions can be cleaned with warm soapy water and rinsed thoroughly. Do not use alcohol or solvents. Cushions normally need replacing twice a year or more - whenever they become stiff, cracked, or do not seal. Don't modify earmuffs in any way, and especially do not stretch or abuse the headbands as this will reduce your protection.



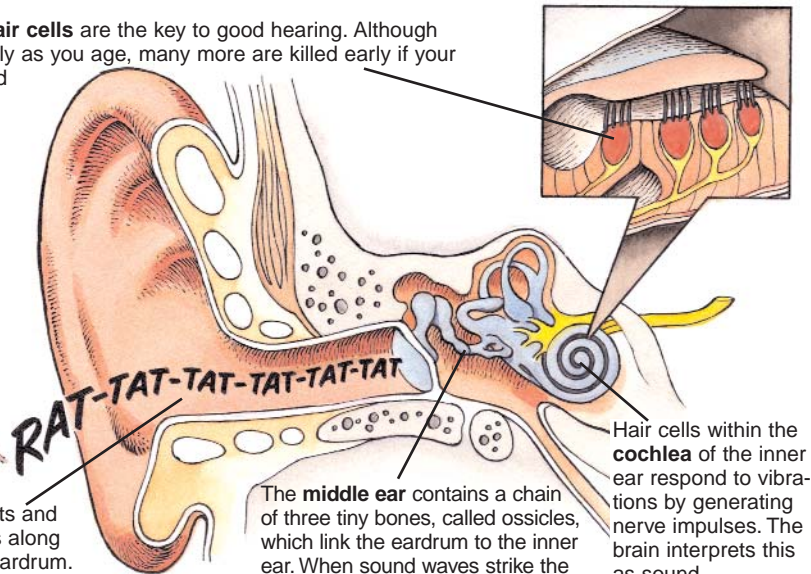
Your Hearing Why and when to protect it

How We Hear

Healthy inner-ear **hair cells** are the key to good hearing. Although some die off naturally as you age, many more are killed early if your ears aren't protected from harmful noise.



The **outer ear** collects and funnels sound waves along the ear canal to the eardrum.



The **middle ear** contains a chain of three tiny bones, called ossicles, which link the eardrum to the inner ear. When sound waves strike the eardrum, the ossicles conduct the vibrations to the cochlea in the inner ear.

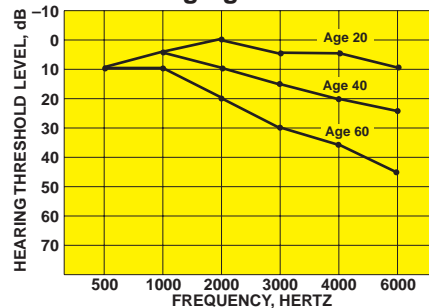
Hair cells within the **cochlea** of the inner ear respond to vibrations by generating nerve impulses. The brain interprets this as sound.

Effects of Age and Noise on Hearing

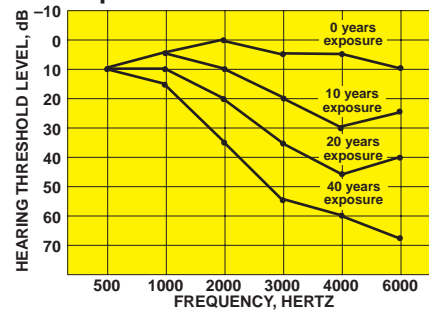
Hearing loss from the natural aging process causes a gradual hearing decline, as shown in the figure to the right. It affects mainly the ability to clearly hear high-pitched sounds such as children's voices, rustling leaves, and some musical instruments.

Although age-effect hearing loss up through age 60 does not usually impair one's ability to hear and understand speech, problems occur when noise-induced loss is added to age loss. With noise damage, even a 30-year-old can have trouble listening in situations in which background sound is present, such as in restaurants and other social situations.

Normal aging effects*



Loss from aging plus noise exposure at 95 dBA*



*The trends are less severe for females.

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You Don't Get "Used to Noise"

Noise does not have to be uncomfortably loud to be damaging. You may even think your ears are "used to the noise," but what has probably happened is that hearing loss has already begun. How quickly hearing loss occurs depends on the **intensity** of the noise, its **duration**, and **how often** the exposure occurs.

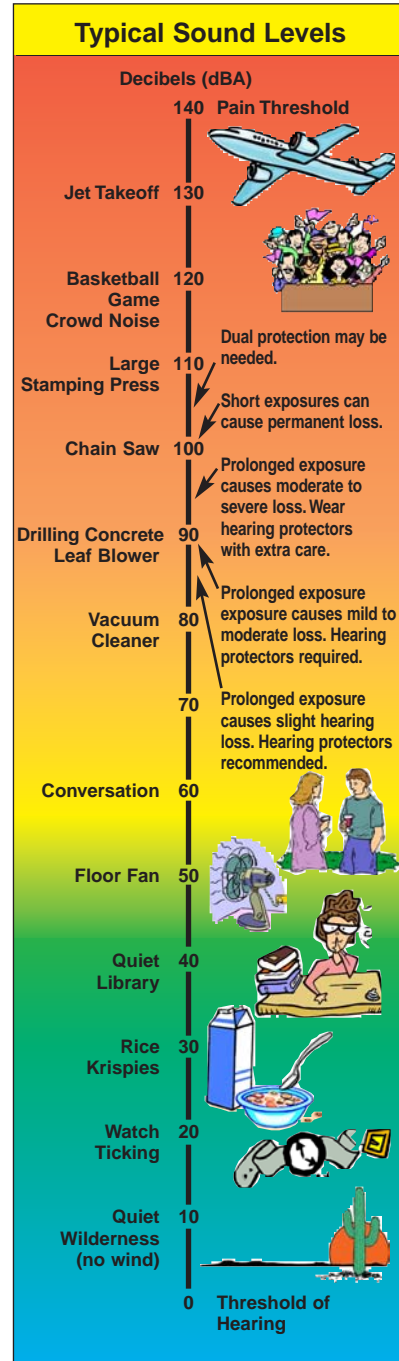
A Rule of Thumb

When you feel the need to shout in order to be heard three feet away, the noise levels are probably 85 dBA or more and hearing protectors are recommended.

Noise Damage Indicators

If sounds seem muffled or softer after noise exposure, your hearing is affected by a **temporary threshold shift** which warns that your ears have been overexposed. If you repeatedly expose your ears without protection, the shift can worsen and become permanent, resulting in untreatable damage to your hearing ability.

Another warning sign is **tinnitus** — a ringing, buzzing, or whistling in your head. It's like a "sunburn" of the hair cells of your inner ear, indicating that they have been irritated and overworked. Tinnitus is especially noticeable in a quiet place, such as when trying to go to sleep at night. If you don't protect your ears from noise, tinnitus can become a permanent, constant annoyance in your life.



Do Yourself A Favor — Save Your Hearing!

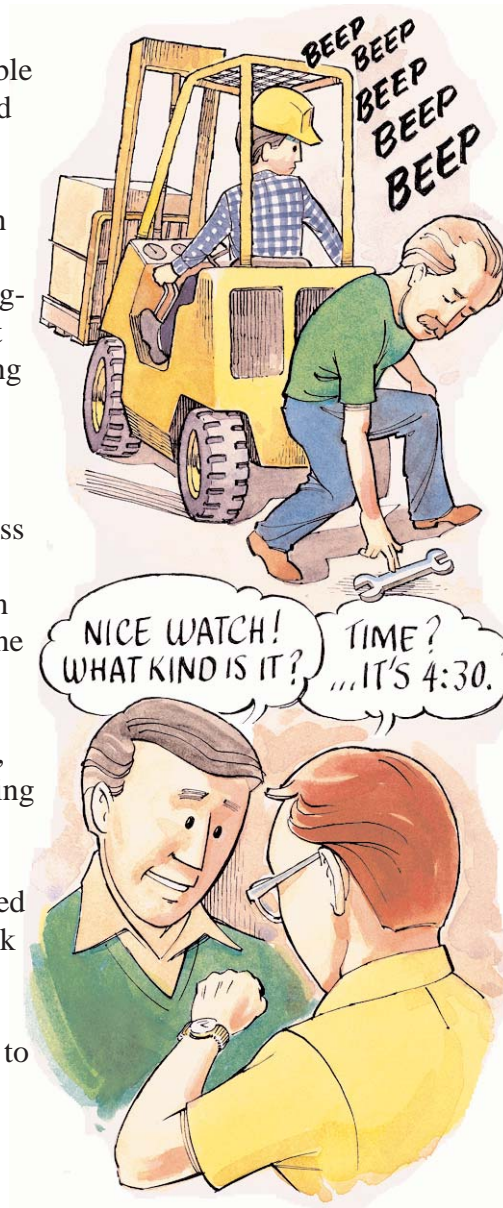
Sounds You Want to Hear

A hearing-impaired person may not be able to enjoy birds singing or cats purring, and distortion from damaged hair cells may make music seem like “just a racket.” It becomes difficult to detect problems with tools or car engines by listening for changes in the sounds they make. Hearing-impaired people worry about getting hurt by missing danger signals such as warning beepers.

Person-to-Person Communication

Most important, a person with hearing loss may not hear or understand family members and friends, particularly women and children with high-pitched voices. The individual will confuse similar-sounding words and mistake the message.

Embarrassed to ask the speaker to repeat, the listener may just “tune out.” Conversing in groups is most difficult, especially if there is background noise. People with hearing loss often become socially isolated as others find it too much trouble to speak to them. What’s more, hearing aids can’t completely correct the problem because louder sounds are not necessarily clearer to the damaged ear.



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Keep Track of Your Hearing

Check your current audiograms against past results. Pat yourself on the back if your thresholds are stable. If your thresholds are changing, a professional will review your audiograms along with information about your ear health and noise exposures to identify possible causes. If hearing changes appear to be noise-related, your employer may suggest different hearing protectors, retrain you in their use, or recommend you wear them during off-the-job exposures.

Remember: You Need Your Hearing!

These comments from people with noise-induced hearing loss show why it is worth the effort to properly wear hearing protectors: your quality of life depends on keeping your good hearing. Once hearing is lost it is gone forever.

Even if you already have some hearing loss, it is still essential to wear hearing protectors from now on to prevent the loss from worsening. It's never too late to start conserving your hearing!



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Noise Is All Around

Noise doesn't stop after leaving the workplace, and neither does the need for hearing protection. Be aware of noisy situations so you can protect yourself and enjoy a lifetime of good hearing.



Gunshots.

Protection is needed when shooting at both indoor and outdoor ranges.



Power Tools.

Semi-insert devices or earmuffs can be effective and convenient protection for these intermittent exposures.



Chain Saws.

Hearing protection is a must whenever operating a chain saw.



Aircraft.

When flying in small aircraft, foam earplugs or other hearing protectors are suggested.



Music.

If it's too loud, even music can be harmful to you hearing. Keep a safe distance from loudspeakers, and if necessary, wear hearing protection.



Radio Headphones.

Be smart — keep the music turned to safe levels. As a rule of thumb, while listening to headphones you should still be able to hear others speaking to you from a few feet away.



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Expandable foam plugs

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

Pre-molded, reusable plugs

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

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

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

Canal caps

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

The main advantage canal caps offer is convenience. When it's quiet, employees can leave the band hanging around their necks. They can quickly insert the plug tips when hazardous noise starts again. Some people find the pressure from the bands uncomfortable. Not all canal caps have tips that adequately block all types of noise. Generally, the canal caps tips that resemble stand-alone earplugs seem to block the most noise.

Earmuffs

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

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

Miscellaneous devices

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

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

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

Terms common to hearing loss prevention. The definitions below were written in as non-technical a fashion as possible.

ACOUSTIC TRAUMA

A single incident which produces an abrupt hearing loss. Welding sparks (to the eardrum), blows to the head, and blast noise are examples of events capable of producing acoustic trauma. (See also ototoxic and ototraumatic.)

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ACTION LEVEL

The sound level which when reached or exceeded necessitates implementation of activities to reduce the risk of noise-induced hearing loss. OSHA currently uses an 8-hour time weighted average of 85 dBA as the criterion for implementing an effective hearing conservation program.

ATTENUATION:

Real Ear Attenuation at Threshold (REAT)

A standardized procedure for conducting psychoacoustic tests on human subjects designed to measure sound protection features of hearing protective devices. Typically, these measures are obtained in a calibrated sound field, and represent the difference between subjects' hearing thresholds when wearing a hearing protector vs when not wearing the protector.

ATTENUATION:

Real-World

Estimated sound protection provided by hearing protective devices as worn in "real-world" environments.

BASELINE AUDIOGRAM

A valid audiogram against which subsequent audiograms are compared to determine if hearing thresholds have changed. The baseline audiogram is preceded by a quiet period so as to obtain the best estimate of the person's hearing at that time.

CONTINUOUS NOISE

Noise of a constant level as measured over at least one second using the "slow" setting on a sound level meter. Note, that a noise which is intermittent, e.g., on for over a second and then off for a period would be both variable *and* continuous

CONTROLS:

Administrative

Efforts, usually by management, to limit workers' noise exposure by modifying workers' schedule or location, or by modifying the operating schedule of noisy machinery.

CONTROLS:

Engineering

Any use of engineering methods to reduce or control the sound level of a noise source by modifying or replacing equipment, making any physical changes at the noise source or along the transmission path (with the exception of hearing protectors).

dB (DECIBEL)

The unit used to express the intensity of sound. The decibel was named after Alexander Graham Bell. The decibel scale is a logarithmic scale in which 0 dB approximates the threshold of hearing in the mid frequencies for young adults and in which the threshold of discomfort is between 85 and 95 dB SPL and the threshold for pain is between 120 and 140 dB SPL.

DOSIMETER

When applied to noise, refers to an instrument that measures sound levels over a specified interval, stores the measures, and calculates the sound as a function of sound level and sound duration and describes the results in terms of, dose, time-weighted average and (perhaps) other parameters such as peak level, equivalent sound level, sound exposure level, etc.

EQUAL-ENERGY RULE

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The relationship between sound level and sound duration based upon a 3 dB exchange rate, i.e., the sound energy resulting from doubling or halving a noise exposure's duration is equivalent to increasing or decreasing the sound level by 3 dB, respectively.

ERGONOMICS

The study or measurement of how work is done as it relates to worker fatigue, discomfort or injury.

EXCHANGE RATE

The relationship between intensity and dose. OSHA uses a 5-dB exchange rate. Thus, if the intensity of an exposure increases by 5 dB, the dose doubles. Sometimes, this is also referred to as the doubling rate. The U.S. Navy uses a 4-dB exchange rate; the U.S. Army and Air Force use a 3-dB exchange rate. NIOSH recommends a 3-dB exchange rate. Note that the equal-energy rule is based on a 3 dB exchange rate.

HAZARDOUS NOISE

Any sound for which any combination of frequency, intensity, or duration is capable of causing permanent hearing loss in a specified population.

HAZARDOUS TASK INVENTORY

A concept based on using work tasks as the central organizing principle for collecting descriptive information on a given work hazard. It consists of a list(s) of specific tasks linked to a database containing the prominent characteristics relevant to the hazard(s) of interest which are associated with each task.

HEARING DAMAGE RISK CRITERIA

A standard which defines the percentage of a given population expected to incur a specified hearing loss as a function of exposure to a given noise exposure.

HEARING HANDICAP

A specified amount of permanent hearing loss usually averaged across several frequencies which negatively impacts employment and/or social activities. Handicap is often related to an impaired ability to communicate. The degree of handicap will also be related to whether the hearing loss is in one or both ears, and whether the better ear has normal or impaired hearing.

HEARING LOSS

Hearing loss is often characterized by the area of the auditory system responsible for the loss. For example, when injury or a medical condition affects the outer ear or middle ear (i.e. from the pinna, ear canal, and ear drum to the cavity behind the ear drum - which includes the ossicles) the resulting hearing loss is referred to as a **conductive** loss. When an injury or medical condition affects the inner ear or the auditory nerve that connects the inner ear to the brain (i. e., the cochlea and the VIIIth cranial nerve) the resulting hearing loss is referred to as a **sensorineural** loss. Thus, a welder's spark which damaged the ear drum would cause a conductive hearing loss. Because noise can damage the tiny hair cells located in the cochlea, it causes a sensorineural hearing loss.

HEARING LOSS PREVENTION PROGRAM AUDIT

An assessment performed prior to putting a hearing loss prevention program into place or before changing an existing program. The audit should be a top-down analysis of the strengths and weaknesses of each aspect of the program.

HTL (HEARING THRESHOLD LEVEL)

The hearing level, above a reference value, at which a specified sound or tone is heard by an ear in a specified fraction of the trials. Hearing threshold levels have been established so that 0 dB HTL reflects the best hearing of a group of persons.

Hz (HERTZ)

The unit measurement for audio frequencies. The frequency range for human hearing lies between 20 Hz and approximately 20,000 Hz. The sensitivity of the human ear drops off sharply below about 500 Hz and above 4,000 Hz.

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IMPULSIVE NOISE

Used to generally characterize impact or impulse noise which is typified by a sound which rapidly rises to a sharp peak and then quickly fades. The sound may or may not have a "ringing" quality (such as a striking a hammer on a metal plate or a gunshot in a reverberant room). Impulsive noise be repetitive, or may be a single event (as with a sonic boom). Note: if impulses occur in very rapid succession (such as with some jack hammers), the noise would not be described as impulsive.

LOUDNESS

The subjective attribute of a sound by which it would be characterized along a continuum from 'soft' to 'loud'. Although this as a subjective attribute, it depends primarily upon sound pressure level, and to a lesser extent, the frequency characteristics and duration of the sound.

MATERIAL HEARING IMPAIRMENT

As defined by OSHA, a material hearing impairment is an average hearing threshold level of 25 dB HTL at the frequencies of 1000, 2000, and 3000 Hz.

NOISE

Any unwanted sound.

NOISE DOSE

The noise exposure expressed as a percentage of the allowable daily exposure. For OSHA, a 100% dose would equal an 8-hour exposure to a continuous 90 dBA noise; a 50% dose would equal an 8-hour exposure to an 85 dBA noise or a 4-hour exposure to a 90 dBA noise. If 85 dBA is the maximum permissible level, then an 8-hour exposure to a continuous 85 dBA noise would equal a 100% dose. If a 3 dB exchange rate is used in conjunction with an 85 dBA maximum permissible level, a 50% dose would equal a 2-hour exposure to 88 dBA or an 8-hour exposure to 82 dBA.

NOISE-INDUCED HEARING LOSS

A sensorineural hearing loss that is attributed to noise and for which no other etiology can be determined.

NRR (NOISE REDUCTION RATING)

The NRR is a single-number rating method which attempts to describe a hearing protector based on how much the overall noise level is reduced by the hearing protector. When estimating A-weighted noise exposures, it is important to remember to *first* subtract 7 dB from the NRR and then subtract the remainder from the A-weighted noise level. The NRR theoretically provides an estimate of the protection that should be met or exceeded by 98% of the wearers of a given device. In practice, this does not prove to be the case, so a variety of methods for "de-rating " the NRR have been discussed.

OTOTOXIC

A term typically associated with the sensorineural hearing loss resulting from therapeutic administration of certain prescription drugs.

OTOTRAUMATIC

A broader term than ototoxic. As used in hearing loss prevention, refers to any agent (e.g., noise, drugs, or industrial chemicals) which has the potential to cause permanent hearing loss subsequent to acute or prolonged exposure. (See also acoustic trauma.)

PERMISSIBLE EXPOSURE LIMIT

OSHA-permissible limits; presently 90 dBA. A time-weighted average exposure that must not be exceeded during any 8-hour work shift of a 40-hour work week

PRESBYCUSIS

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The gradual increase in hearing loss that is attributable to the effects of aging, and not related to medical causes or noise exposure.

SENSORI-NEURAL HEARING LOSS

A hearing loss resulting from damage to the inner ear (from any source).

SOCIACUSIS

A hearing loss related to non-occupational noise exposure.

SOUND LEVEL METER (SLM)

A device which measures sound and provides a readout of the resulting measurement. Some provide only A-weighted measurements, others provide A- and C-weighted measurements, and some can provide weighted, linear, and octave (or narrower) band measurements. Some SLMs are also capable of providing time-integrated measurements.

SPL (SOUND PRESSURE LEVEL)

A measure of the ratio of the pressure of a sound wave relative to a reference sound pressure. Sound pressure level in decibels is typically referenced to 20 mPa. When used alone, (e.g., 90 dB SPL) a given decibel level implies an unweighted sound pressure level.

STS

Standard Threshold Shift: OSHA uses the term to describe a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000 and 4000 Hz in either ear. Used by OSHA to trigger additional audiometric testing and related follow up.

OR

Significant Threshold Shift: NIOSH uses this term to describe a change of 15 dB or more at any frequency, 500 through 6000 Hz, from baseline levels that is present on an immediate retest in the same ear and at the same frequency. NIOSH recommends a confirmation audiogram within 30 days with the confirmation audiogram preceded by a quiet period of at least 14 hours.

TLV (THRESHOLD LIMIT VALUE)

A guideline provided by the American Conference of Governmental Industrial Hygienists to denote the exposure, which when reached or exceeded, may be hazardous. For noise the TLV is 85 dBA and the exchange rate is 3 dB.

TWA (TIME WEIGHTED AVERAGE)

A value, expressed in dBA, which is computed so that the resulting average would be equivalent to an exposure resulting from a constant noise level over an 8-hour period

THRESHOLD SHIFT

Audiometric monitoring programs will encounter two types of changes in hearing sensitivity, i.e. threshold shifts: permanent threshold shift (**PTS**) and temporary threshold shift (**TTS**). As the names imply, any change in hearing sensitivity which is persistent is considered a PTS. Persistence may be assumed if the change is observed on a 30-day follow-up exam. Exposure to loud noise may cause a temporary worsening in hearing sensitivity (i.e., a TTS) that may persist for 14 hours (or even longer in cases where the exposure duration exceeded 12 to 16 hours). Hearing health professionals need to recognize that not all threshold shifts represent decreased sensitivity, and not all temporary or permanent threshold shifts are due to noise exposure. When a permanent threshold shift can be attributable to noise exposure, it may be referred to as a noise-induced permanent threshold shift (**NIPTS**).

Tracer Protection Services

WEIGHTED MEASUREMENTS

Two weighting curves are commonly applied to measures of sound levels to account for the way the ear perceives the "loudness" of sounds.

A-weighting: A measurement scale that approximates the "loudness" of tones relative to a 40 dB SPL 1000 Hz reference tone. A-weighting has the added advantage of being correlated with annoyance measures and is most responsive to the mid frequencies, 500 to 4000 Hz..

C-weighting: A measurement scale that approximates the "loudness" of tones relative to a 90 dB SPL 1000 Hz reference tone. C-weighting has the added advantage of providing a relatively "flat" measurement scale which includes very low frequencies.