

3M Hearing Conservation

Leading the advancement of hearing conservation



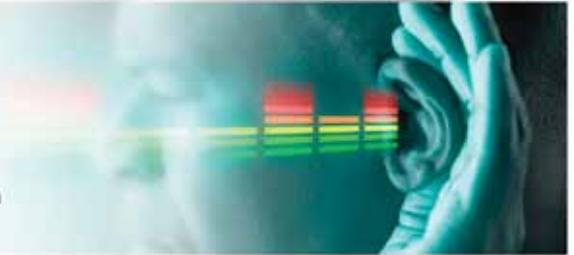
Life Can
Be Loud

Know your hearing protection

Noise is everywhere. It is the most pervasive environmental pollutant on the planet. Virtually everything we do makes noise, and the more we do it, the faster we do it, and the more of us there are - the more noise is made. In fact, silence, by which we mean complete absolute quiet, is so rare that few of us have had the joy, or perhaps even the possibility to experience it. If we have, it is so unusual that we can likely cite the time and place of its last occurrence. The opportunities to savor such tranquility are rapidly vanishing.



life can be
LOUD
know your hearing protection



The Sound Around Us

Not only is noise present in our daily routines and recreational activities, but upwards of 5 million Americans, possibly as many as 30 million, work in hazardous noise on a daily basis. Estimates from the National Institutes of Health suggest that **hearing loss afflicts 28 million Americans**. About 1/3 of those cases are at least partially attributable to noise. Later in this booklet we'll tell you how the ear works and how noise can affect it, so you will understand why you should protect your ears from too much sound today in order for your hearing to serve you tomorrow.

In a world as noisy as ours we frequently tune out. Moreover, our culture is so visually dominant that often sight overwhelms the other senses such as audition (the hearing of sounds), which is habitually relegated to second-class status. The purpose of this pamphlet is to address these issues – to increase your appreciation and awareness of the sounds around you and to provide some tools to help you protect yourselves from loud, annoying and/or hazardous sound.

Measuring Noise

Noise hazard depends on the **level** (sometimes called intensity) of the noise, its **duration**, and **how often** the exposure occurs. The point above which regular exposure to sounds becomes hazardous is a level of about 85 decibels (abbreviated dB, or sometimes dBA which is the value that more closely corresponds to human hearing). Noise is measured using a sound level meter.

You Don't Get "Used to Noise"

Noise does not have to be uncomfortably loud, or even painful, to be damaging. You may think your ears are "used to the noise," but what has probably happened is that your hearing has been temporarily dulled or that hearing loss has already begun.

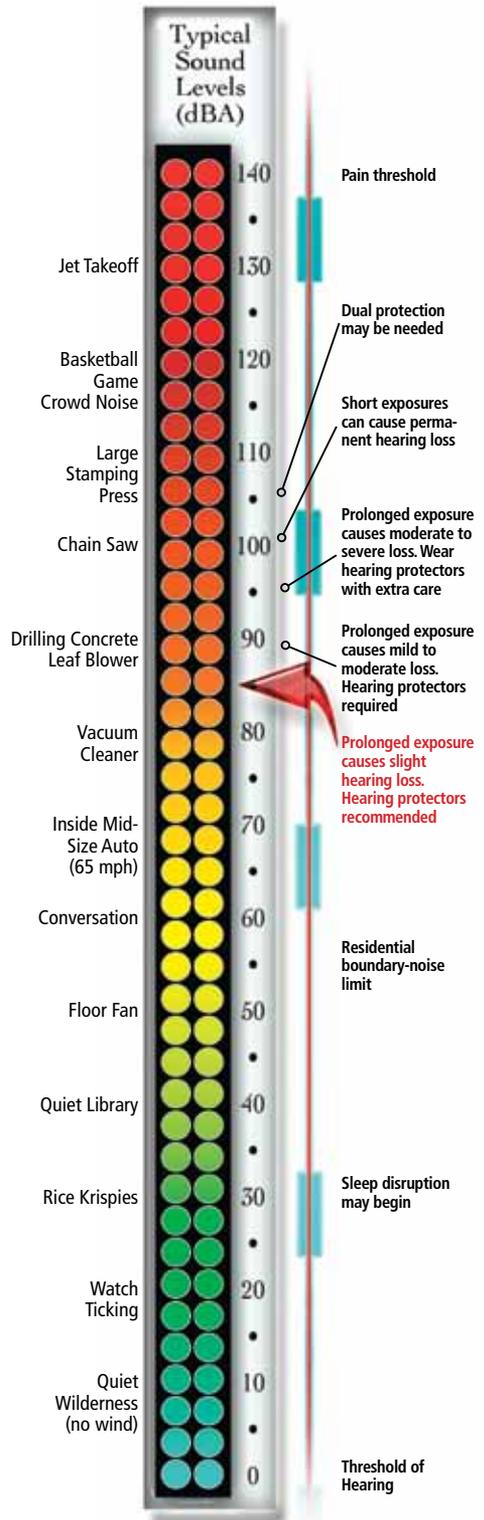
A Rule of Thumb

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.

Using Your Ears to Assess Noise Risk

If, after the noise stops, you notice a ringing, buzzing, or whistling in your ears that wasn't there before, this is a warning indicator. Called **tinnitus**, this is like a "sunburn" of the nerve cells of your inner ear, indicating that they have been irritated and overworked. Tinnitus is especially noticeable in a quiet place, such as when you are 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.

Apparent muffling or softening of sounds after noise exposure is a warning sign that your hearing is affected by a **temporary threshold shift**. Repeatedly exposing your ears without protection can cause the shift to worsen and become permanent, resulting in untreatable damage to your hearing ability.



Hearing Protection

Hearing loss due to noise is almost entirely preventable by judicious use of hearing protection. To find what is best for you, try different devices from the wide variety available today. Be sure to carefully read the instructions because hearing protectors must **fit properly and be worn correctly** to do the job. Hearing protector effectiveness is specified by a Noise Reduction Rating (NRR), typically ranging from 15-35 decibels. In practice the protection that normally can be achieved is about 10-20 decibels. The more carefully you fit 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

Foam Plugs



Foam plugs, made from expandable slow-recovery foam, **provide the best combination of comfort and protection** for most users. They must be properly prepared for insertion. One size fits most. Once in the ear, foam plugs expand to provide a snug and secure custom fit. The two most common complaints about foam plugs (“not enough protection,” and “they don’t stay in”) are almost always solved by greater practice and care in insertion.

Premolded Plugs



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 period of regular wear you’ve been unable to get used to your earplugs, try another size, type, or brand of hearing protector.

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 Much Protection

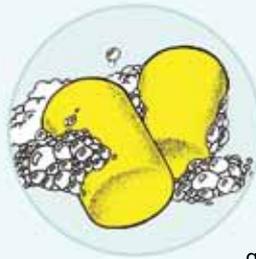
Don't get hung up on the NRR, the government-mandated noise protection factor that appears on all hearing protector packaging. The numbers are based on optimized laboratory tests that, in practice, represent what only a few of the most-motivated best-trained users can achieve. Your best bet is to use the NRR only as an indicator that a product was designed and tested for noise reduction. Except for very loud noises such as gunfire where selection is more critical, most hearing protectors provide sufficient protection when worn properly and consistently. Foam plugs or earmuffs, or a combination of the two generally provide the highest levels of protection.

HOW TO USE



Slowly roll and compress foam plugs into a very thin crease-free 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 allow to fully 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. Carefully twist the plug to break the seal for a slow, safe removal.



Premolded plugs will normally last several months or more depending upon the type, and environmental factors. They should be replaced if they shrink or swell, harden or soften, 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 while wearing protection.

However, unless you already have a significant hearing loss you'll be surprised how well you can hear speech and many other sounds while protected in the noise.

When you properly wear hearing protectors you'll be protected from temporary hearing shifts so that you are able to hear as well after a noise exposure as when it started. 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

Semi-Insert Device

Canal Caps

Banded Hearing Protectors



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**. Those that just cap the canal entrance give rise to a larger occlusion effect (see above) which can be annoying to some wearers.

Earmuffs



Earmuffs have rigid cups with soft plastic cushions that seal around the ears to block noise. Muffs come in one-position or multi-position bands, and are also sold in styles for attachment to hard hats. Cushions may be filled with foam, liquid, or a combination; let personal preference be your guide. For sustained exposures to very loud noises, or if you feel the need for more protection, wear muffs and plugs together (**dual protection**) for an additional 5-10 dB of noise reduction.

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 due to what is called the **occlusion effect**. If you don't hear the change, or if it isn't the same in both ears, you have not 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. Many manufacturers sell replacement tips.

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 cushions. Thick or poorly fitting eyeglass temples may also cause some loss in noise reduction.



Cushions can be cleaned with warm soapy water and rinsed thoroughly. Do not use alcohol or solvents. Cushions normally need replacing at least yearly, or whenever they become stiff, cracked, or no longer seal. Don't modify earmuffs in any way, and especially do not stretch or abuse the headbands as this will reduce your protection.

Specialized Hearing Protectors

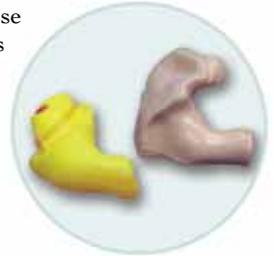
Musician's Earplugs

Certain earplugs are designed for moderate noise reduction and better sound quality (more uniform attenuation across the range of frequencies). For many sound exposures such as live music, public events, and transportation, these devices provide the needed protection, while making listening easier and more enjoyable. The effect with these earplugs can be compared to wearing medium neutral-gray sunglasses instead of very dark color-tinted lenses that dramatically change one's perception. The Professional Musician 3M™ E-A-R™ Plug is one such product. Special types of custom earmolds also provide this feature.



Custom Molded Earplugs

Custom earmolds can be very comfortable. They are suitable for use as hearing aids and as earplugs for hearing protection. As earplugs they can be made from a custom impression of the ear canal using material with the consistency of thick honey (usually sent to a lab for final fabrication), or in the case of a unique product called the 3M™ CustomE-A-R™, by injecting silicone into a specially designed (yellow) bladder. The bladder design is safer to make, ready to wear, and can be immediately acoustically verified for fit. Such fit verification is important since the acoustic seal of an earmold can be compromised if the impression is not precise for an exact fit.



Electronic Earmuffs

Some earmuffs use a microphone embedded in the earcup to pickup sounds and transmit them through the earmuff to an earphone inside. This allows better hearing at low sound levels without the need to remove the device, while still providing sufficient protection at higher sound levels. Typically the electronics in the muff limit the amplified sound to a predetermined safe value such as less than 85 dBA. These muffs can be excellent for use while hunting or on the firing line, and for those with a mild hearing loss they can actually amplify sounds, thus making it easier to hear.



Active Noise Reduction (ANR)

Today it is possible to use sound to cancel sound. A microphone within the earmuff detects the sound passing through the cup walls and sends that signal through circuitry to generate an anti-phase version that is rebroadcast through a speaker in the cup. The result is sound cancellation, but due to physical limitations this process only works well in the lower frequencies, middle C and lower. This is effective in certain military situations, and in general aviation, especially when the devices also include communications. The principal consumer application is reduction of nuisance noise such as experienced while traveling. An ANR earmuff, which also plugs into an earphone jack on entertainment devices, can provide balanced noise reduction while simultaneously permitting listening to music or movies.



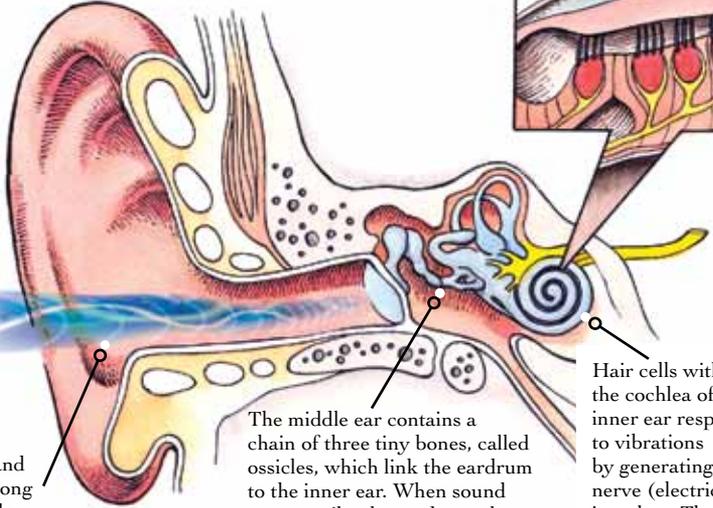
Your Hearing *How it works and how we measure it*

How We Hear

Healthy inner-ear nerves (**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.

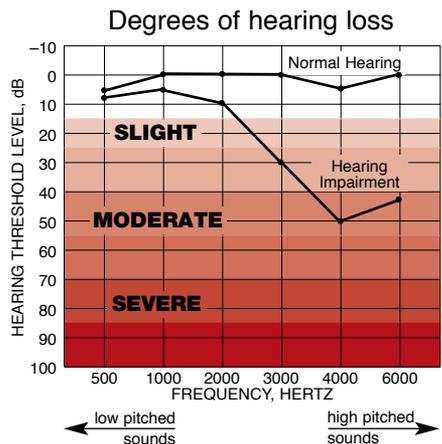
Hair cells within the cochlea of the inner ear respond to vibrations by generating nerve (electrical) impulses. The brain interprets these as sound.

Measuring Hearing

Hearing is measured by a professional with an **audiometer** that sends tones to each ear through earphones. 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**.

Your thresholds (measured in decibels) are recorded on a chart called an **audiogram**, for tones at different pitches or frequencies (measured in "Hertz," which is a special term for cycles/second). 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.

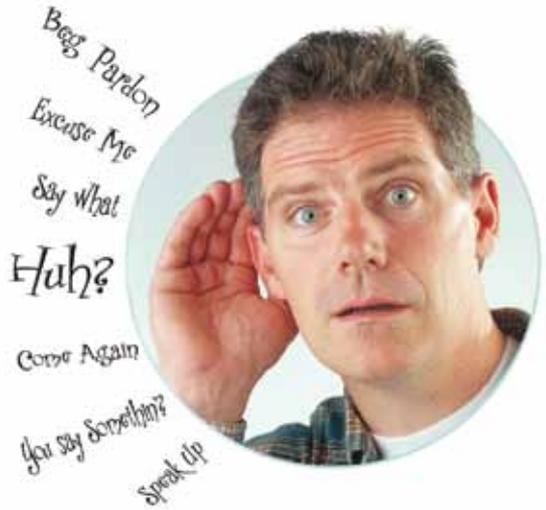
It is a good idea to have a complete hearing evaluation even if you don't suspect a hearing problem. This gives you a baseline against which to compare future audiograms if problems occur. Professionals suggest evaluations every 10 years; more often for those over 50. If you anticipate regular exposure to high-level noise, for example if you are an avid recreational shooter, you may wish to obtain more frequent tests until you can assure that your hearing is stable. Unusual changes would alert you and your hearing specialist (audiologist or otolaryngologist) to look for noise-related (inadequate or improperly fitted protection) or medical causes before it's too late.



Do Yourself a Favor - Save Your Hearing!

Person-to-Person Communication

Inarguably, the most important function of our hearing is communication. A person with hearing loss may not hear or understand family members and friends, particularly women and children with high-pitched voices. Communication over the telephone for business or pleasure becomes more difficult. 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.

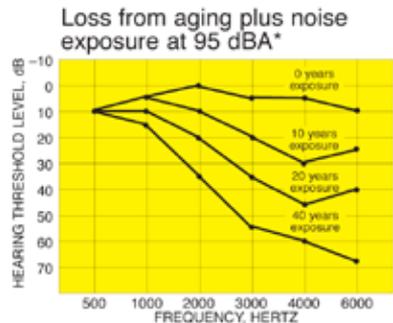
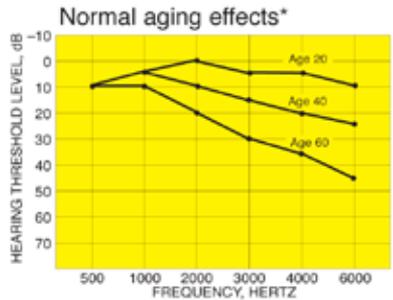


Often the message is as much in the sound of the voice as in the content of the speech. Poet Maya Angelou has observed, “Words mean more than what is set down on paper. It takes the human voice to infuse them with shades of deeper meaning.”

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. The noise-induced component can come from occupational exposures as well as the many loud recreational sounds we willingly expose our ears to on a daily basis. 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.



*The trends are less severe for females.

Sounds You Want to Hear

A hearing-impaired person may not be able to enjoy ordinary sounds of nature or even the sounds of pets, 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. It can be inconvenient to miss the sound of the alarm on your wristwatch or the phone ringing in the next room. Hearing-impaired people worry about getting hurt by missing danger signals such as warning beepers or smoke detectors.

Remember: You Need Your Hearing!

These comments from people with noise-induced hearing loss show why it is worth the effort to wear hearing protectors properly: your quality of life depends on keeping your good hearing. Once hearing is lost it is gone forever. And if you aren't willing to wear an earplug for hearing protection today, how would you tolerate wearing a hearing aid that fits to the ear with an earplug-like tip, every day and every waking hour for the rest of your life.

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. Carry them with you like a pair of sunglasses so that whenever annoying or potentially damaging sounds assault your ears, you have the protection you need. It's never too late to start conserving your hearing!



...Always this ringing in my ears.

My daughter no longer seems to speak clearly.

I miss the birds, the wind in the trees, the whispers.

I miss all the good sounds...



Noise Is All Around

Be aware of noisy situations such as the ones illustrated to the right, so you can protect yourself and enjoy a lifetime of good hearing.

Music

If it's too loud, even music can be harmful to your hearing. Keep a safe distance from loudspeakers and if necessary, such as at concerts, 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.



Nuisance Noise

For these noises simply pick that plug or muff that is comfortable for you. For snoring the plug of choice will almost always be a foam plug for its combination of great noise reduction and nightlong comfort.



Gunshots

Protection is needed when shooting at both indoor and outdoor ranges. For some people, exposure to one unprotected shot can spell permanent hearing loss.



Power Tools

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



Chain Saws & Leaf Blowers

Hearing protection is a must whenever operating these very loud tools. Not only will you protect your hearing, but you will feel more relaxed too.



Aircraft

When flying in small aircraft, foam earplugs or other hearing protectors are suggested. Pilots need protection too.



Written by:

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WARNING!

These hearing protectors help reduce exposure to hazardous noise and other loud sounds. Misuse or failure to wear hearing protectors at all times that you are exposed to noise may result in hearing loss or injury. For proper use, see supervisor, User Instructions, or call 3M in U.S.A. at 1-800-243-4630. In Canada, call Technical Service at 1-800-267-4414. If there is any drainage from your ear or you have an ear infection, consult with your physician before wearing ear plugs. Failure to do so may result in hearing loss or injury.

3M

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