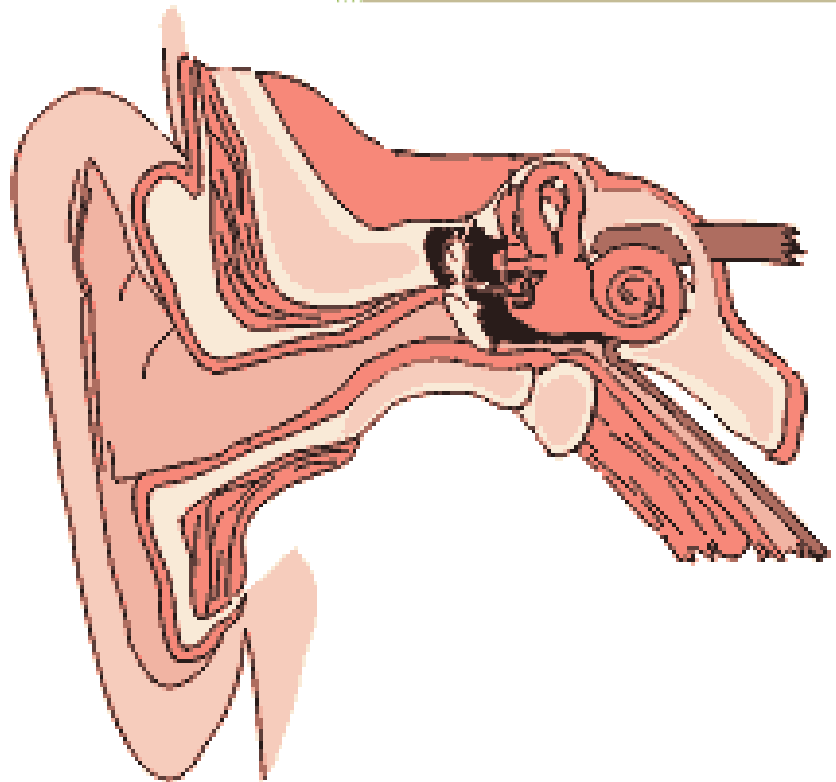


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The Basics of Hearing Protection



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Rob Vajko

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The Basics of Hearing Protection

Unlike many of the safety issues we might be dealing with on a daily basis, hearing protection issues do not usually affect us immediately. Noise induced hearing loss does not cause immediate pain and is usually not noticeable in the early stages. Damages to hearing may take several years to show up because they are cumulative. Because the hearing loss is gradual and slow it may take even longer before the true nature of the damages are known.

Because this is the case, hearing protection, more than any other safety related issue is one that tends to be ignored by workers. This is why a clear understanding of the long range effects of hearing damage is so important.

The Nature of the Problem

To understand how we can lose our hearing through damage to the ear canal because of repeated exposure to loud noise we need to understand how it is that we actually hear and how the ear canal works.

We hear because of the thousands of tiny hairs in the cochlea. When sound waves enter the ear canal they cause these hairs to vibrate. Our brain then “interprets” the various frequency that result from all these vibrations. The low frequencies originate from the first part of the cochlea (these are the first hairs that the sound waves hit) and the highest frequencies originate from deepest within the cochlea. The cochlea is essentially a spiral (visualize it as one of the party favors that unfurl when you blow in them) lined on the inside with thousands of tiny little hairs.

The problem is that loud noises act like a strong wind and literally blow the hairs down. Healthy hairs bounce back with no problem but as we get older and as we are exposed to more and more loud or continuous noises, the hairs have a harder time bouncing back. These damaged hairs (visualize a wheat field that has been trampled down flat) can no longer vibrate as they are meant to do, hence the damaged hearing. Hearing aids do not “fix” the problem they simply magnify the sound. The quality of the sound remains far from normal.

In a hearing seminar that I attended a few years back, the speaker played a tape pronouncing a list of words but with the high frequency removed, as would be the case with hearing damage due to loud noise over time. We were asked to write down the words that we heard. The speaker then read the list back, this time with the low frequencies put back in. Most of us could not believe how few of the words we had actually heard correctly. Imagine listening to someone underwater and you will have a better understanding of what we are talking about. Sounds of speech like “th”, “sh”, “f”, “t” and “p” become difficult to hear so that words like “Short” may sound like “ort”, words like “people” sound like “eo” and so on.

Decibel Levels and Noise Hazards

OSHA has determined that exposure to noise levels above a Time Weighted Average of 85 dBA are unacceptable. Accordingly, levels must be reduced to fall below the 85 dBA or, if that is not possible, then workers must be given hearing protection that will limit their exposure to these harmful decibel levels.

Measuring Noise – There are three different elements that need to be considered in order to ascertain the hazard of noise, the decibel level (sometimes referred to as the intensity), the length of time that the noise is present (duration) and how often the noise occurs.

[Sound Level Meters](#) (a single point measurement) or [Noise Dosimeters](#) (records sound level over a set amount of time) are used to measure the decibel levels.

The general rule is that if you have to yell to be heard from three feet away than hearing protection should be worn because the decibel level is probably over 85 dBA.

Understanding Noise Levels	
Decibel Level (dB)	Type of noise
140	Gun firing (Anything higher than this will usually be painful)
135	Jet taking off
120	Chain saw
100	Power Tools (even short exposures can result in permanent hearing loss)
90	OSHA limit (damage should be expected above this level)
75	Average vacuum cleaner
60	Normal Conversation
45	Normal outdoor noises (rustling leaves, light breeze, etc...)
30	Normal whisper
0	Threshold of hearing

For a more complete “Noise Thermometer” provided by Howard Leight go to https://eporia6.eporia.com/Resources/Company_79/HP202_Noise_Thermometer.pdf

OSHA Standard	
Length of time you can be safely exposed (In Cumulative Hours Per Day)	Sound level (dBA)
8	90 or less
4	95
2	100
1	105
1/2	110
1/4 or less	115
Never	more than 115

Tinnitus – Tinnitus is a ringing or buzzing noise in your ears when there should be no noise present. This is an indication that the hairs in the inner ear have been irritated and temporarily damaged. If noise protection isn't used tinnitus can become permanent resulted in constant ringing or buzzing in the ears.

The Noise Reduction Rating and the Problem with it

For the past years, the Noise Reduction Ratings (NRR) has been a single number that has been based on ideal laboratory situations that haven't really matched the real workaday world. In other words the rating was set based on a perfect fit in a perfect environment. Unfortunately that just isn't reality. Improper fits are common. Workers aren't as well trained as they should be; other factors come into play. The truth is that most workers aren't getting the protection that is listed on the earplug.

This has led to a system of "de-rating" designed to give a more accurate rating but which has, in truth, led more to confusion that left users unsure of the level of protection they were actually getting.

In an effort to remedy this, the United States Environmental Protection Agency (EPA) is set to announce a new rating system that provides workers with a NRR range rather than a single number. The higher number would reflect the level of protection that a highly motivated and competently trained employee could expect to achieve while the low number would reflect the level of protection that could be expected from an employee that has received minimal training.

The difference between the old and the new rating system is best visualized through this chart provided [Howard Leight](#) by Sperian

Comparison

	Old NRR	Proposed New NRR
Rating	A single-number estimate of protection	A high/low range of estimated protection
Description	Estimates the 98th percentile of protection obtained by users when properly fitted	Estimates the 80th and 20th percentile of protection obtained by users
Test Protocol	ANSI S.3.19-1974 (Experimenter Fit) 10 subjects for earplugs and earmuffs, HPDs fit by experimenter	ANSI S12.6-2008 Method A (Supervised Subject Fit) 20 subjects (for earplugs) or 10 subjects (for earmuffs), HPDs fit by subject after brief training
Application	Intended for use with dBC noise measurements. Requires a 7 dB correction for use with dBA noise measurements.	Can be applied directly to dBA noise measurements
De-Rating	Various de-rating schemes promulgated by various organizations (including OSHA)	Designed to be used with no required de-rating
Retesting	Currently, no retesting of HPDs	required Periodic retesting of HPDs required

Solutions

First and foremost and whenever possible, we need to try to reduce the level or remove the source of the noise. Modifications or isolation can help reduce noise levels on existing machinery. Placing sound limiting barriers around noisy machinery can help as well as, whenever possible, moving machinery outside or placing it in another room.

Because it isn't always possible to engineer the noise out of the workplace, however, there are several different types of hearing protection that is available to protect workers.

Types of Hearing Protection Available

Foam Earplugs – This is the most common and inexpensive form of hearing protection. These plugs are made of expandable slow recovery foam. They are generally rolled in order to compress them and then inserted in the ear canal. It is easier to get the rolled earplug into the ear canal by reaching around the back of your head with your hand and grabbing the top of the ear and pulling it back and up. This will straighten the ear canal and allow easier insertion of the earplug. While foam earplugs are generally considered disposable, they can be washed in mild detergent, air dried and reused if desired. Earplugs that change their firmness and/or lose their ability to re-expand properly should be discarded.



Pre-molded Earplugs – These are made from flexible polymers that are preshaped to fit the ear canal. These are reusable earplugs and should be inserted in the same way as a foam earplug. They should be cleaned with a mild detergent to keep them clean and keep them from transmitting dirt and germs to the ear canal. They should be stored in a clean carrying case when not in use.



Push-In Earplugs – These earplugs contain a foam pod or cone on the end of a hard stem. The stem helps push the earplug into the ear.



Hearing Bands – These are soft pods attached to a lightweight headband. They can be taken off and put back on easily. When not in use, the band can hang around the neck. This makes headbands the ideal choice for workers who are going in and out between areas where hearing protection is needed and areas where it is not. To insert, simply hold the end of the pod and wiggle it into the ear canal. As with the foam earplugs it might help to reach around and pull the ear up and out to straighten the ear canal. The pods are replaceable.

Hearing bands can be used over and over. Clean the pods with soap and water. Do not bend the rigid band as it is pre-molded to provide tension to keep the pods in place.



Earmuffs – This is a “cup” that fits over the whole ear that is attached to a band. The cup seals over the ear to muffle the sound. Bands are often adjustable to fit different size heads. In order to be effective, there must be nothing interfering with the seal. Make sure that the pad is directly against the skin all the way around each ear and that there is no hair interfering with the seal.

Clean with soap and water. Many earmuffs are available in a standard version, a behind-the-head version or a cap-mounted version that clips into the slots in the hard hat.



Metal Detectable Earplugs – These can be foam or pre-molded earplugs used primarily in the food industry in order to make sure that lost earplugs don't contaminate the product. It usually consists of a small metal BB that is inserted in the earplug when it is being made.



Custom Molded Earplugs – This option involves making a mold of the individual ear and then making a custom earplug specifically designed for the user. They are extremely comfortable as they fit perfectly.

Electronic Earmuffs – There are many different types of electronic earmuffs.

- **"Tunes" Earmuffs** – This is an earmuff with a built-in radio. Similar earmuffs are available with plug-ins for MP3 players, CD players, etc...
- **Tactical Earmuffs** – This earmuff amplifies the warning signals and speech while "shutting off" all noises over 82 dBA.
- **Push-to-listen** – These are regular earmuffs with a push button that cancels out the effect of the earmuff temporarily allowing you to hear co-workers, directions or anything else you might need to hear, without removing the earmuffs.
- **Communication Headsets** – These headsets are designed to be used with radios and other communication systems either in a wired version or in a wireless style.

Hearing Loss due to exposure to noise is preventable. If not prevented, it is permanent. Do allow the sounds of life to be stolen from you. Protect yourself!