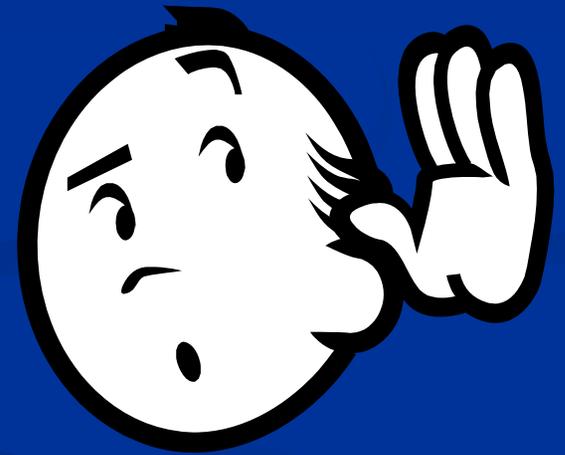


An Earful of Sound Advice

Protecting Your Hearing
at Work and Home



Noise Exposure at Home and Work

We will discuss:

- The effects of noise on hearing
- Recognizing excessive noise
- Noise sources at work and home
- Protecting yourself from damaging noise

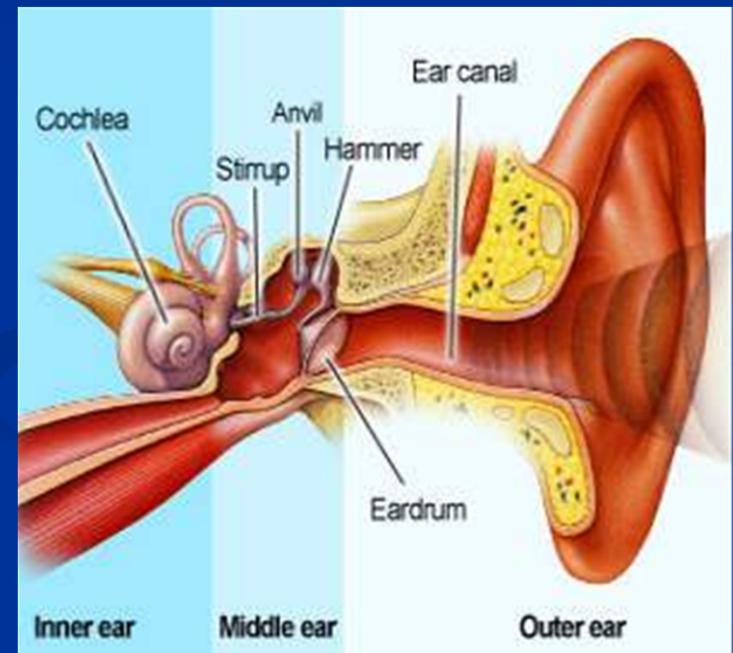


Long Term Exposure to Noise

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

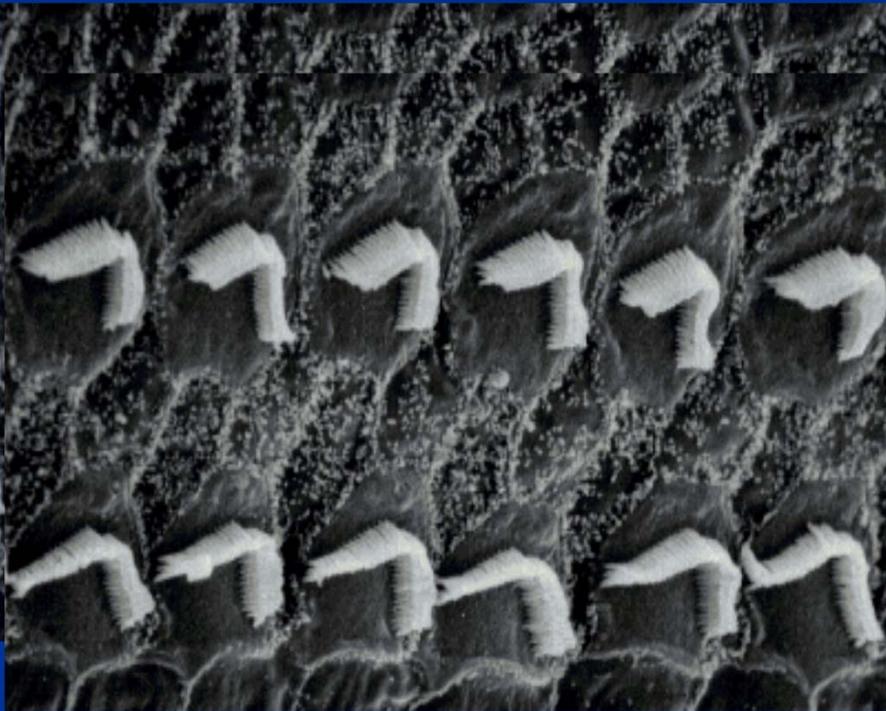
The longer and louder the noise, the greater chance permanent damage will occur.

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



Effects of noise to inner ear

Hair cells in inner ear transmit noise signals to the brain



Normal hair cells



Noise-damaged hair cells

Hearing Loss From Noise Exposure

The second most common cause of hearing loss (after aging).

Hearing loss from noise exposure is usually not noticed because it is so gradual.

It is irreversible and hearing aids offer at best partial compensation.

Effects ability to understand speech, enjoy music, recognize warning alarms and signals, etc.



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 may disrupt sleep, reduce concentration and cause irritability and depression.



When is Noise Too Loud?

Noise is measured in units called "decibels" or "dB"

If two people 3 feet apart must shout to be heard, the background noise is too loud (above 85 decibels).



Noise above 140 decibels causes pain and immediate hearing loss.



What is Too Much Noise Exposure?

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

Scientific studies have shown that hearing loss can 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 five minutes is very risky.

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



Daily Allowable Exposure Times to Noise

The table below shows noise levels and how long a person can be exposed without hearing protection before there is damage to the ear.

<u>Noise Level</u>	<u>Allowable Exposure Time</u>
85 decibels	8 hours
90 decibels	4 hours
100 decibels	1 hour
105 decibels	30 minutes
110 decibels	15 minutes
115 decibels	0 minutes

Examples of Noisy Equipment

Equipment

Back Hoe

Chain Saw

Front-end Loader

Gunshot

Jackhammer

Lawn Mower

Tractor

Circular Saw

Noise Level

85-95 decibels

110 decibels

90-95 decibels

140 decibels

112 decibels

90 decibels

95-105 decibels

90-100 decibels



Noise Sources at WFF

- Aircraft and turbine engines
- Rocket launches
- Machine shops
- Power tools
- Construction activity
- Cryogen venting
- Compressors
- Blowers and air handlers
- Grounds maintenance

Example – Antares Launch Noise

- Main Base – 80 dB
- Atlantic Fire Station – 92.3 dB
- V-30 Beachside – 104 dB
- U-30 SPANDAR Site – 104.5 dB
- Just west of X-079 – 110.1 dB
- Z-100 . . . blown over by launch and meter trashed!
- Because of short duration (less than 90 sec), launch noise reached hazardous levels only in exclusion area.



Meter at Z-100 after launch

Noise Sources at Home

- High-volume music and concerts
- Listening with headphones/earbuds
- Target shooting and hunting
- Lawn care equipment
- Home shops and power tools
- Chain saws
- Unmuffled I/C engines (go-carts, snowmobiles, racing vehicles)
- Motorcycling (even a bike with quiet pipes can expose you to excessive wind noise)

Protection From Noise

- Modify the source – quieter equipment (NASA's "Buy Quiet" Program)
- Separate people and source (distance, noise barriers)
- Minimize exposure times – shorten stays in noisy areas when possible
- Finally, use hearing protection when you MUST be around noises over 85 dB.

When to Use Hearing Protection

- At work, look for equipment labeling and area signs
- If in doubt, ask for noise survey
- At home, tools/equipment may have labels or warnings in manual
- Unmuffled I/C engines, impact hammers, and firearms are ALWAYS noise hazards
- Electronically amplified musical performances are usually noise hazards
- Remember "Speech at three feet" rule

Types of Hearing Protection

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

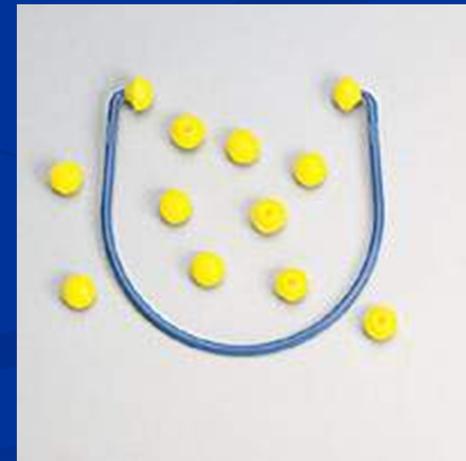
Ear muffs and earplugs provide about equal protection, ear caps somewhat less.



earmuffs



earplugs



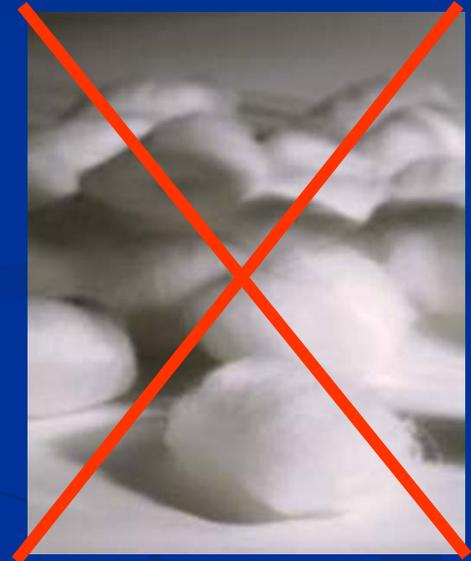
ear caps

Types of Hearing Protectors

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

They work much better than wads of cotton or bits of cloth stuffed in the ear.

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



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 - require little or 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

Inserting Foam Earplugs

Foam type earplugs are one-size-fits-all and must be inserted properly into the ear.

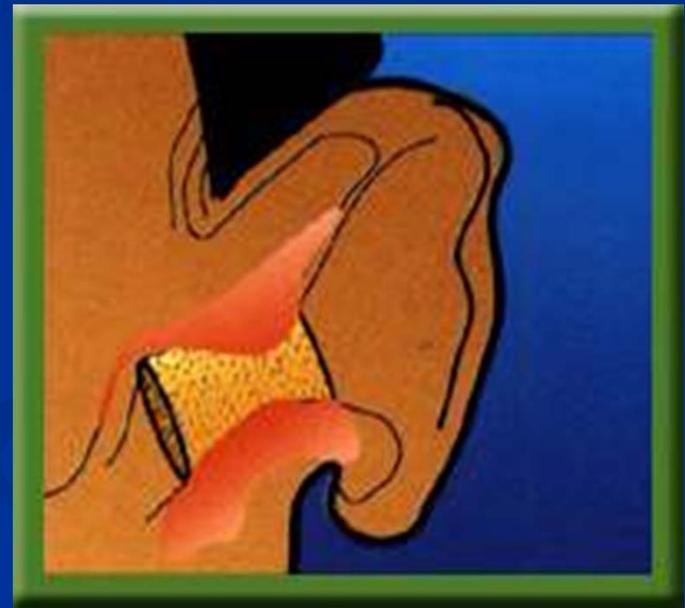


Roll earplug into small cylinder first, then insert in ear.

Inserting Foam Earplugs



Earplug incorrectly inserted



Earplug correctly inserted

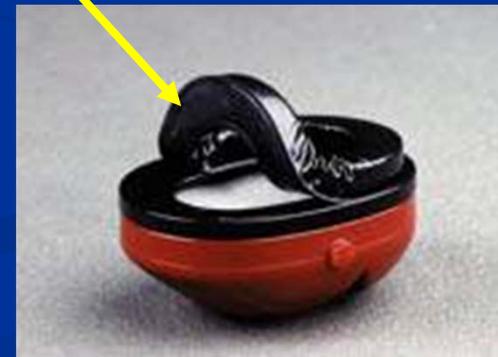
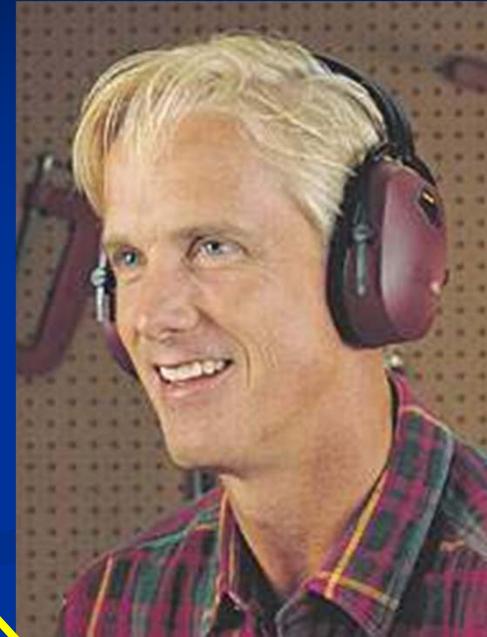
Ear Muffs

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.

Some pass or amplify low-level sounds while damping hazardous noise.

They last longer than most plugs.

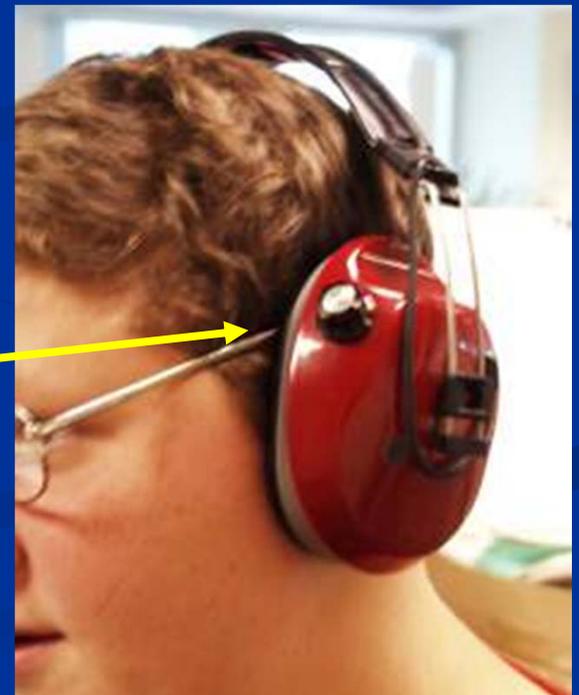


Ear Muff Comfort & Glasses



Muffs can be uncomfortable in hot weather.

Muffs may not seal well for someone with glasses or heavy sideburns.

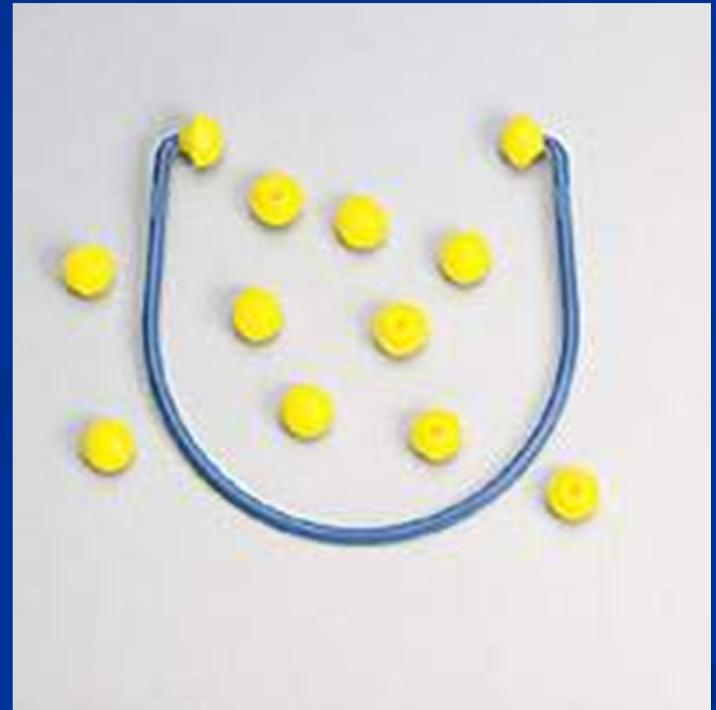


Ear Caps

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

They combine most of the disadvantages of muffs and plugs.

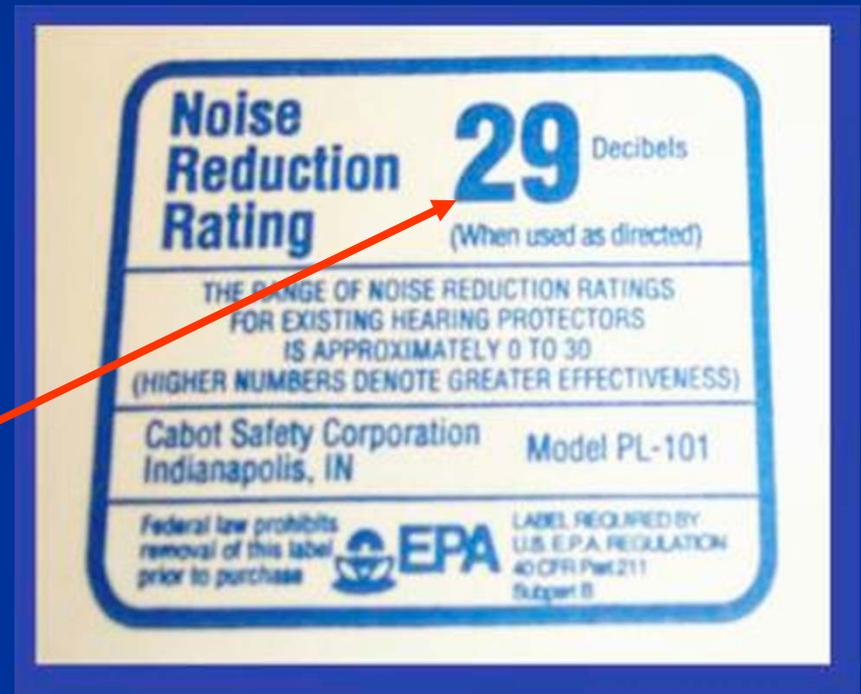
They are not as protective as earplugs or muffs.



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.



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 reduce overwhelming loud background noise.

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



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 could result in noise overexposure.



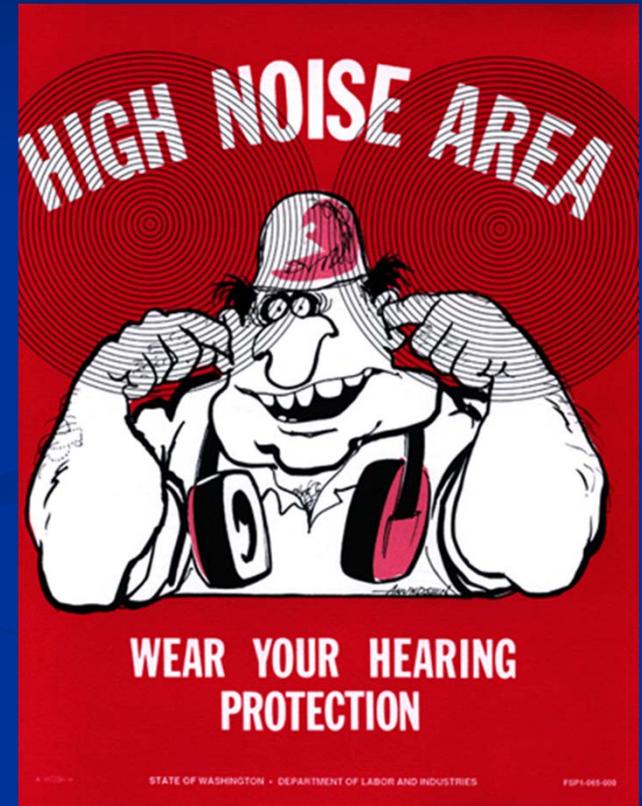
It won't protect your ears if it is around your neck!!!

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 against the head will "leak" noise into the ear.



Special Situations – Musical Events

Most pop, jazz, country, and rock concerts exceed safe sound levels.

Rock concerts average 100 dB and can reach 115 dB.

Classic orchestral music audience levels are generally safe, though orchestra musicians may be overexposed.



Musicians' Earplugs

Designed to reduce sound evenly, maintaining musical tone quality.

Available with several levels of moderate sound reduction.

Allow concertgoers to enjoy preferred music while reducing hearing damage.

May be useful for motorcyclists (can still hear horns, etc).

NOT suitable for industrial use.



Special Situation – Music Players

Headphones and earbuds don't seem as loud to users as speakers at the same level.

Hazardous levels easily achieved – an iPod with earbuds can reach 115 dB.

Typical listening habits lead to long exposure times.

These devices have been associated with hearing loss after a few years' use, even among teenagers and young adults.

Earbuds average 9 dB louder than earphones.



Avoiding Damage From Music Players

Use headphones, not earbuds.

Use sound-limiting software if player provides it.

Consider hardware limiters or “safety headphones” for kids.

Use “60-60” rule: don’t exceed 60% of maximum volume, and don’t listen for more than 60 minutes without a break.

If anyone but the user can hear the music, it’s too loud!



Special Situation - Shooting

Among all common sound sources, shooting produces the most extreme noise exposures.

With certain firearms, only a few shots, fired without protection, can cause permanent hearing damage.

Sound levels are proportional to powder capacity (larger cartridges are louder than smaller ones) and inversely proportional to barrel length (pistols are louder than rifles chambered for the same cartridge).

Shooting on indoor ranges greatly increases exposure.



Protecting Your Hearing While Shooting

Always, *always*, ***always*** wear hearing protection on the range!

Consider wearing double hearing protection (earmuffs over earplugs) when target shooting with anything louder than .22 LR.

Avoid indoor ranges if at all possible.

Remember that short barrels and muzzle brakes amplify noise.

Hunters may wish to consider using electronic hearing protection that passes quiet sounds while suppressing gunfire noise.



Workplace Noise Surveys

- Used to identify noise-hazardous areas, equipment, and jobs
- Conducted at WFF by Code 803
- If you feel noise in your work area has been overlooked, call me (Jeff Shelton) at 7569 or email carroll.j.shelton@nasa.gov