

RAY W.HERRICK LABORATORIES SCHOOL OF MECHANICAL ENGINEERING

PRESENTS

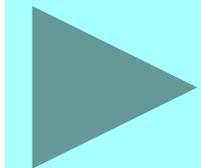


Student Individual Learning Package

Noise and Hearing Conservation

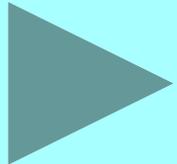
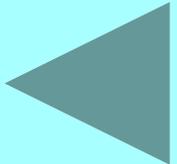
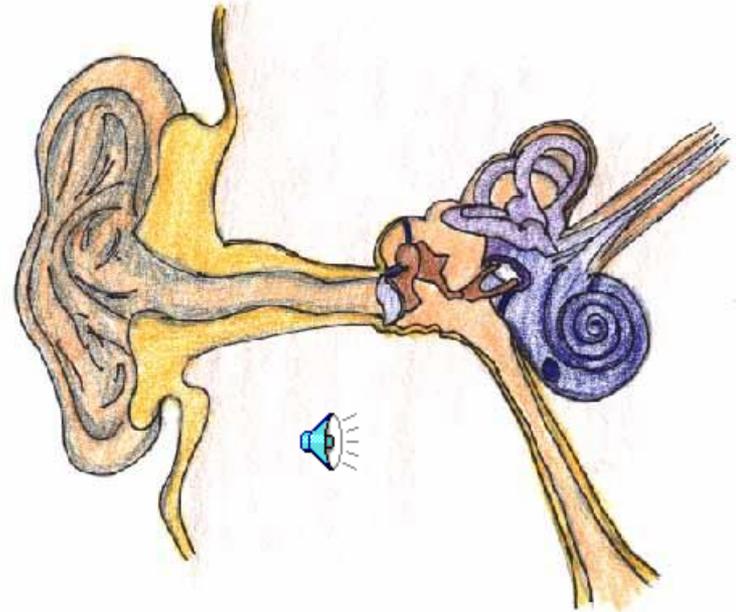
Noise and Hearing Conservation Online Training Instructions: View the following set of web pages and read each one carefully. You may navigate backward and forward through the series of pages by clicking on the previous and next buttons on the bottom of each page.

Post-Test: After you have viewed all the pages, you will be presented with a post-test. Complete the test online, then click on the "Send Quiz and Record" button at the bottom of the test page. The quiz will be automatically graded and recorded. Print the "certificate" complete the information and sign it. Send to Fritz Peacock as written documentation that you have received training, Remember, you cannot receive credit for having received this training without completion and submission of the post-test and completing and signing the training record in the shop.. This also assists the University in documenting your safety training. Now, to proceed to the module, click here the right forward button.



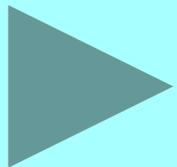
How Noise Can Affect Your Health

- Simply put, noise can damage your hearing! Exposure to excessive noise raises your hearing threshold -- the degree of loudness at which you first begin to hear. There are two types of hearing loss:
 - * A temporary hearing loss can be caused by exposure to loud noise for a few hours. Fortunately, hearing is usually restored after a period of time away from noise.
 - * A permanent hearing loss occurs after the ear has been continually exposed to excess noise. Hair cells in the inner ear gradually harden and die, making it increasingly difficult to recover from a temporary hearing loss.



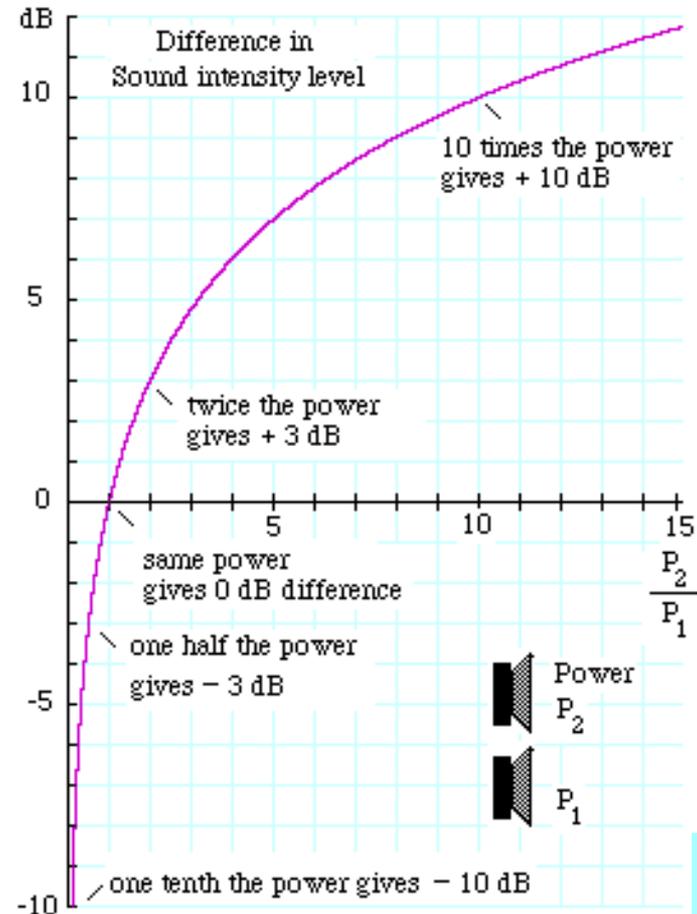
There are warning signs that may be indicative of permanent hearing loss, including:

- * inability to hear high-pitched or soft sounds
- * trouble understanding conversation, or speech heard over the telephone
- * ringing or roaring in the ears (**called tinnitus**)
- * There is **NO CURE** for hearing loss caused by noise. Hearing aids do not restore noise-damaged hearing, although they may help most people. In addition to hearing loss, excessive noise exposure may contribute to mental and physical stress, certain illnesses, and accidents.



Let's learn more about noise levels and their impact on our ability to hear.

- Sound is measured in decibels. The dB is a logarithmic unit used to describe a ratio. On the **decibel scale**, the smallest audible sound (near total silence) is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1,000 times more powerful than near total silence is 30 dB.



Here are some common sounds and their decibel ratings: A normal conversation takes place at about 60 decibels.

Prolonged exposure to noise above 85 decibels can cause hearing loss.

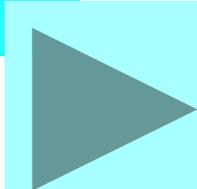
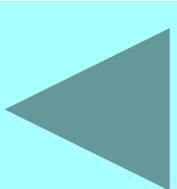
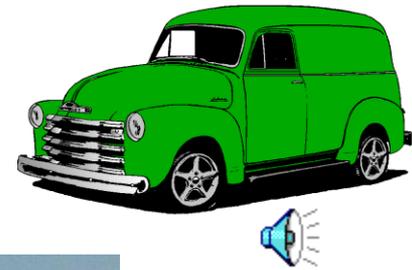
Click on speaker symbol

A lawnmower - 90 dB

A truck horn - 110 dB

A rock concert or a jet engine - 120 dB

A gunshot or firecracker - 140 dB



Not all sound pressures are equally loud.



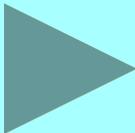
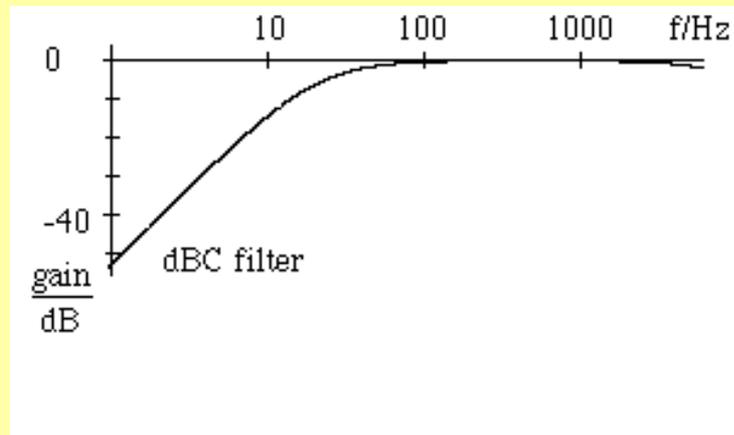
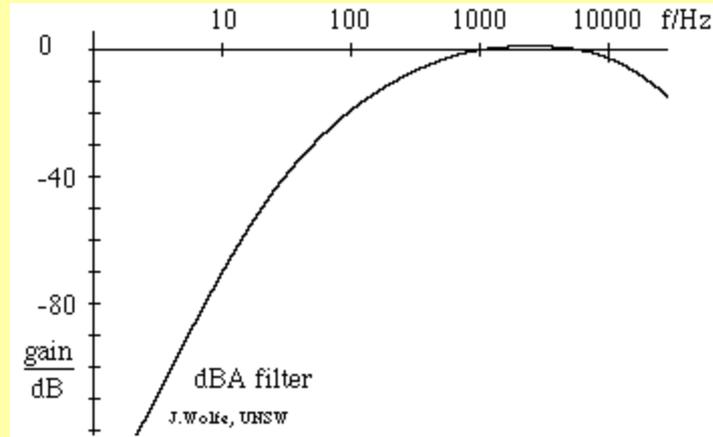
This is because the human ear does not respond equally to all frequencies: we are much more sensitive to sounds in the frequency range about 1 kHz to 4 kHz (1000 to 4000 vibrations per second) than to very low or high frequency sounds. For this reason, sound meters are usually fitted with a filter whose response to frequency is a bit like that of the human ear. If the "A weighting filter" is used, the sound pressure level is given in units of **dB(A)** or **dB(A)**. Sound pressure level on the dB(A) scale is easy to measure and is therefore widely used. It is still different from **loudness**. Because the filter does not respond in quite the same way as the ear.

Filters used for dBA and dBC

The most widely used sound level filter is the A scale, which roughly corresponds to the inverse of the 40 dB (at 1 kHz) equal-loudness curve. Using this filter, the sound level meter is less sensitive to very high and very low frequencies. Measurements made on this scale are expressed as dBA.

The C scale is practically linear over several octaves and is thus suitable for subjective measurements only for very high sound levels. Measurements made on this scale are expressed as dBC.

There is also a (rarely used) B weighting scale, intermediate between A and C. The figure below shows the response of the A filter (left) and C filter, with gains in dB given with respect to 1 kHz.



What type of hearing protector do I need for my work environment?

You have to consider the following factors, the noise level, the exposure time, and the comfort and ease of use of the protective device.

1. First, you have to select a hearing protector that has adequate attenuation for your work environment.
2. Second, you have to consider how you are going to use the protector. You may for instance choose a different protector if your use is intermittent, requiring you to take on and off the protector frequently, than if you are going to work a continuous eight hour shift in a noisy environment. An earmuff may be preferable in the intermittent environment, while an earplug may be the choice in a long-term exposure. An earmuff may be preferred in a cold environment, while an earplug may be the choice in a hot and humid environment.
3. There is no right or wrong choice, as long as you chose a hearing protector with adequate protection, and you use it correctly for the entire exposure time.



How does time affect my hearing protector requirements?

The hearing damage criteria established by the OSHA noise regulation takes into consideration the noise level and the exposure time. An exposure to 90 dB for eight hours is considered to be safe by OSHA, but it is recommended that you always use hearing protection when exposed to 100dB or more, even if the exposure is short. The exposure is doubled for every increase of 5 dB, as defined by OSHA. (Physically the sound pressure level doubles every 3 dB). The table below will explain the relationship between noise level and exposure time.

Noise level	Maximum exposure time	Comment
90 dB	8 hours	
95 dB	4 hours	
100 dB	2 hours	
105 dB	1 hour	Always use hearing protection, any exposure
110 dB	30 minutes	Always use hearing protection, any exposure
115 dB	15 minutes	Always use hearing protection, any exposure

How do I select a hearing protector with adequate attenuation for my noise situation?

You need to know the approximate noise level of the environment. The decibel (dB) level can be measured with a sound level meter. This works fine in the lab because we have the equipment, but at home you can use estimates and common sense. Most equipment and machinery used by homeowners, such as lawn mowers, chain saws, line trimmers and similar devices do not produce sounds in excess of 100dB. In addition the exposure time is usually limited to a couple of hours.

If you use a tool that produces 100 dB, and plan to use it for an hour or two, and you use an average hearing protector with a 25 dB Noise Reduction Rating, you will be more than adequately protected. Of course, if you also are exposed to noise at the lab, you must take this into consideration, since it is your total daily dose that matters.

To calculate your exposure the EPA noise regulation advises that you deduct the NRR from the noise level.

Example, the tool and hearing protector discussed above: $100 \text{ dB} - 25\text{dB} = 75 \text{ dB}$ at the ear.

For professional applications, when the noise level is known in dB(A), OSHA advises that the NRR be reduced by 7 dB:

Example: $100\text{dB(A)} - (25 - 7)\text{dB} = 82\text{dB}$ at the ear.

OSHA may also require a 50% reduction of the NRR after the above reduction:

Example: $100\text{dB} - (25 - 7) \times 0.5 = 91\text{dB}$ at the ear.

[Read more about conflicting information from EPA, OSHA and NIOSH on how to use the NRR](#)



I'm a big believer in wearing earplugs. I lost part of my hearing as a result of what could basically be called ignorance on my part. Plenty of rock concerts and gas turbine engines in the '60's and '70's, working in a really loud machine shop and riding motorcycles!

Foam ear plugs use a slow expansion Polyurethane foam, that makes it easier for inexperienced users to make a good insertion. A correctly inserted plug will allow the user to get the benefit of the excellent attenuation. It is known fact that laboratory attenuation data often cannot be achieved in the field, as a result of poor user insertion technique. With slow expansion foam, the user gets a better chance of achieving a good fit.



The previous page summary of OSHA's hearing conservation requirements is not intended to be complete.

J. Peacock

[The complete regulation \(29CFR-1910.95\) is available on the internet.](#)

Standard Devices

Ear plugs

- Inserted into the ear canal to provide an airtight seal between the ear canal and outside ear.
- Hearing speech: Ear plugs, if worn correctly, should enhance the ability to hear in noisy areas. Exception may be a worker diagnosed with high frequency hearing loss (HFHL)

FOAM EARPLUGS

FOR MAXIMUM EFFECTIVENESS AND COMFORT INSERT FOAM EARPLUGS (NSN 6515-00-187-6345) AS FOLLOWS: IMPORTANT - HANDS AND PLUGS SHOULD BE CLEAN PRIOR TO USE. DO NOT USE WHERE HAZARDOUS CHEMICALS OR MATERIALS COULD BE TRANSFERRED TO PLUG.

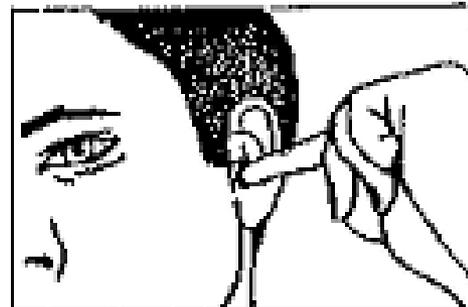
- 1** WITH BOTH HANDS GRASP THE ROUND SIDE OF THE PLUG. SLOWLY ROLL AND COMPRESS THE PLUG INTO A VERY THIN, GREASE-FREE CYLINDER.



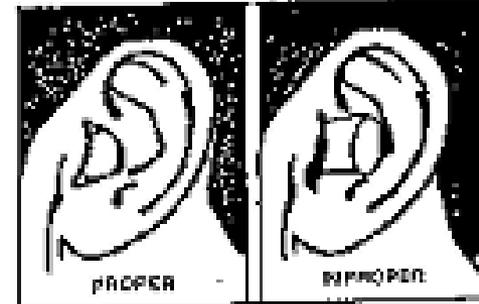
- 2** WHILE COMPRESSED, INSERT THE PLUG INTO THE EAR CANAL. FITTING THE PLUG IS EASIER IF THE OUTER EAR IS PULLED OUTWARD AND UPWARD DURING INSERTION.



- 3** WITH FINGER TIP, GENTLY HOLD THE PLUG IN PLACE UNTIL IT BEGINS TO EXPAND AND BLOCK THE NOSE. QUALITY OF FIT MAY BE ESTIMATED BY COUGHING.



- 4** CANNING FIT CAN BE TESTED IN THE PRESENCE OF NOISE BY ALTERNATELY COVERING AND UNCOVERING THE EAR WITH TIGHTLY FITTED GLOVES. WITH HIGHLY FITTED PLUGS THE NOISE LEVELS SHOULD BEGAIN NEARLY THE SAME WHETHER OR NOT THE EAR IS COVERED. KEEP PLUGS CLEAN BY WASHING IN WILD SOAP AND RINSING THOROUGHLY IN WATER. CHECK FOR DISCOLORATION OR DISFIGURATION OCCURS AFTER CLEANING.



Advantages Of Hand Formed Earplugs:

- **Universal fit**
- **Medical fitting not required**
- **Least expensive HPD's for infrequent or intermittent exposure**
- **Most comfortable**



Ear Muffs



Peacock

Standard Devices

- Communication type devices: Needing to communicate in very loud environment.
 - Headsets/Noise helmets
- Ear muffs:
 - Worn around the ear to decrease the noise reaching the ear.
 - Effectiveness depends on the seal between the foam cushion and the head.
 - Well fitted muffs usually offer same attenuation as a well-fitted ear plug.

Pre-Formed Earplugs

- Single Flange:
 - 5 color-coded sizes:
 - White (Extra Small)- 10% of the population
 - Green (Small)- 25%
 - Orange (Medium)-30%
 - Blue (Large)- 40%
 - Red (Extra Large)- 25%

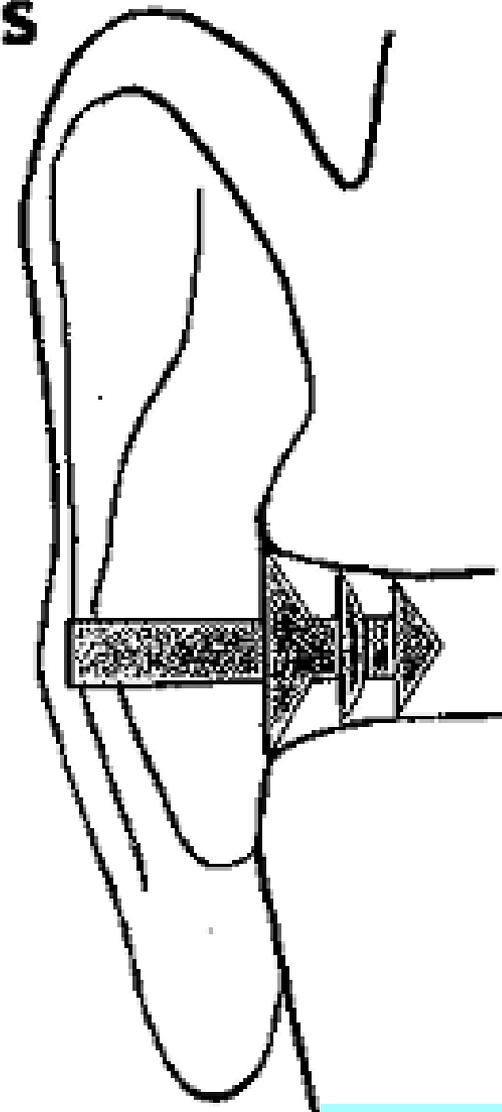


Procedures for fitting ear plugs

- Place the plug in the right hand between the thumb and forefinger preferably.
- Grasp the right ear auricle with left fingers and thumb and pull it outward and toward the back of the head.
- With the right hand, insert the ear plug into the canal with the tab pointed toward the bottom.

FOR MAXIMUM PROTECTION AND COMFORT INSERT TRIPLE FLANGE EARPLUGS AS FOLLOWS :

- 1. MAKE THE EAR CANAL ACCESSIBLE BY REACHING OVER HEAD WITH OPPOSITE HAND AND PULLING EAR OUTWARD.**
- 2. GRASP PLUG FIRMLY BEHIND LARGEST FLANGE.**
- 3. INSERT SMALLER FLANGE IN EAR CANAL. PUSH AND TWIST TOWARD REAR-CENTER OF HEAD.**
- 4. IF A GOOD SEAL IS NOT OBTAINED, USE SMALLER OR LARGER SIZE. TRIPLE FLANGE PLUGS ARE AVAILABLE IN THREE SIZES- LARGE, REGULAR, AND SMALL.**



Characteristics Of A Good Earplug Fitting:

- **Voices sound muffled**
- **“Vacuum” effect**
- **Comfortable**
- **Single flange tab facing toward back of head**
- **Largest flange of triple flange is flush against ear canal opening**
- **Fit each ear individually**

Purdue Resources

- Think you may have a hearing problem. Purdue's Speech and **Audiology Clinic: Services**
- **Contact Information**
- Telephone:
Carol Tebben — 765/494-4229
Audiology Clinic/Hearing Suites: Heavilon Hall (B33)
- http://www.cla.purdue.edu/slhs/pages/clinics/audiology_services.html

Other Resources

- For More information on Hearing
<http://www.cdc.gov/niosh/topics/noise/n>
- ME 413 <http://widget.ecn.purdue.edu/~me413/>
- Thanks to
http://wishatraining.lni.wa.gov/training/trainingkits/HearingProtection/Noise_Slides_handouts.pdf

