

Hearing Conservation Training



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Training

- Ensure that affected employees do not suffer health effects from exposure to excessive noise or chemicals at work
- Know the effects of noise on hearing
- Understand purpose, advantages, and limitations of hearing protection devices
- Be familiar with the selection, fit, use and care of protectors
- Know the purpose and procedures of audiometric testing

Statistics and Facts

- About *22 million* workers are exposed to hazardous noise and 10 million to solvents that can cause hearing loss
- Hearing loss is the 3rd most common chronic physical condition among adults in the U.S.
- Noise-induced hearing loss is the most common occupational hazard in the U.S.
- Hearing loss from noise is slow and painless; you can have a disability before you notice it
- It is **100%** preventable

[Noise and Hearing Loss Prevention | NIOSH | CDC](#)



Causes of Occupational Hearing Loss (OHL)

- **Noise** is considered loud (hazardous) when it reaches 85 decibels or higher or if a person has to raise their voice to speak with someone 3 feet away (arm's length)
- **Ototoxic chemicals** can cause OHL, make the ear more susceptible to the damaging effects of hazardous noise



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Noise

- Any unwanted sound
- By-product of many processes - operating machinery
- Exposure to high levels of noise may lead to hearing loss and other harmful health effects



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OSHA Noise Exposure Levels

- The OSHA permissible exposure limit for noise is 90 dBA as an 8 hour TWA
- OSHA requires a hearing conservation program when noise exposure is at or above 85 decibels averaged over 8 working hours, or an 8-hour time-weighted average (TWA)

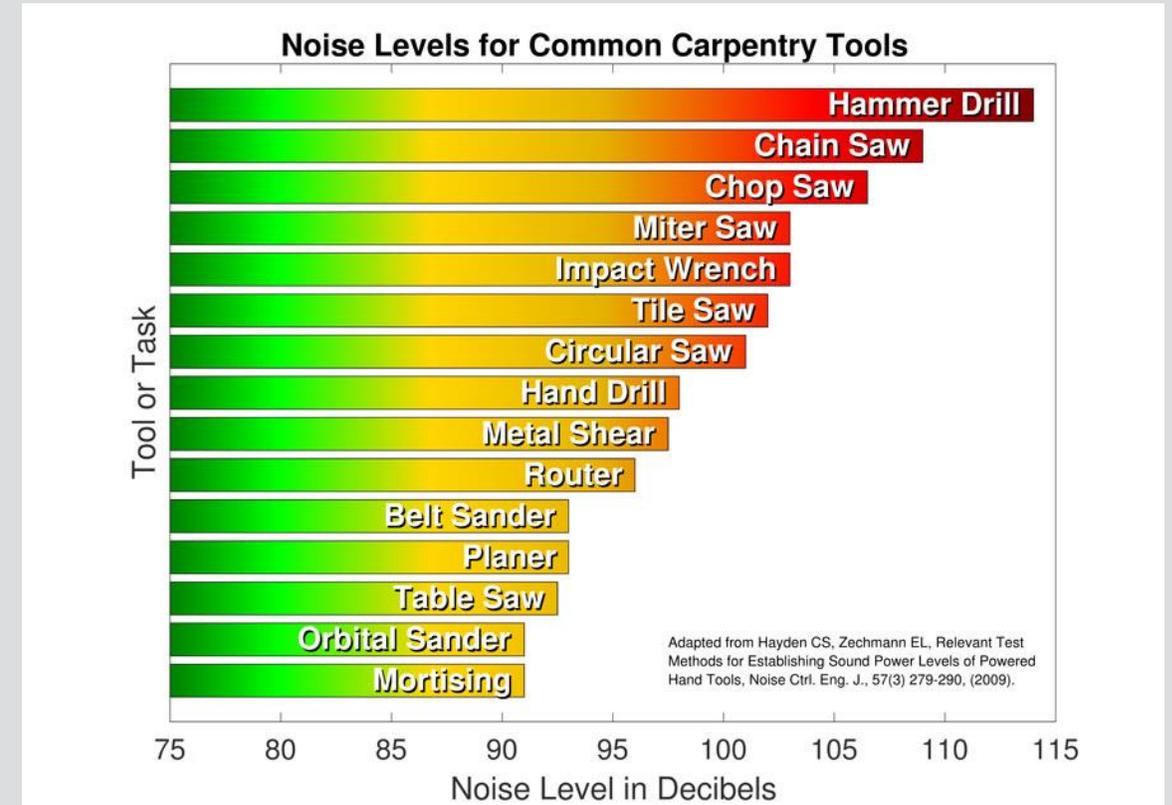


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How Loud is Loud?

| Sound levels of common noises | |
|-------------------------------|---|
| Decibels | Noise source |
| Safe range | |
| 30 | Whisper |
| 40 | Refrigerator |
| 60 | Normal conversation |
| 75 | Dishwasher |
| Risk range | |
| 85 | Heavy city traffic, school cafeteria |
| 95 | Motorcycle |
| 100 | Snowmobile |
| 110 | Chain saw, jackhammer, rock concert, symphony |
| 115 | Sandblasting |
| 120 | Ambulance siren, thunder |
| 140-165 | Firecracker, firearms |

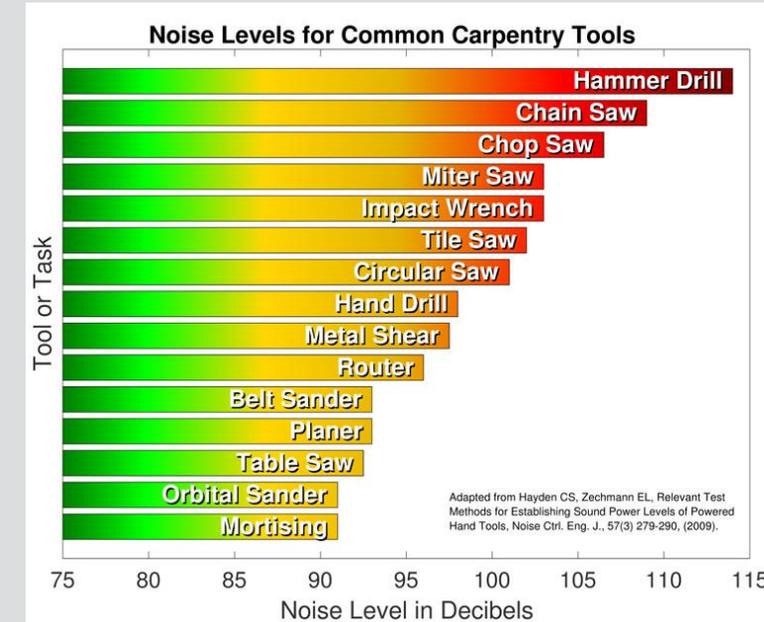


If you must raise your voice to speak with someone only 3 feet away, you are in high (hazardous) noise.

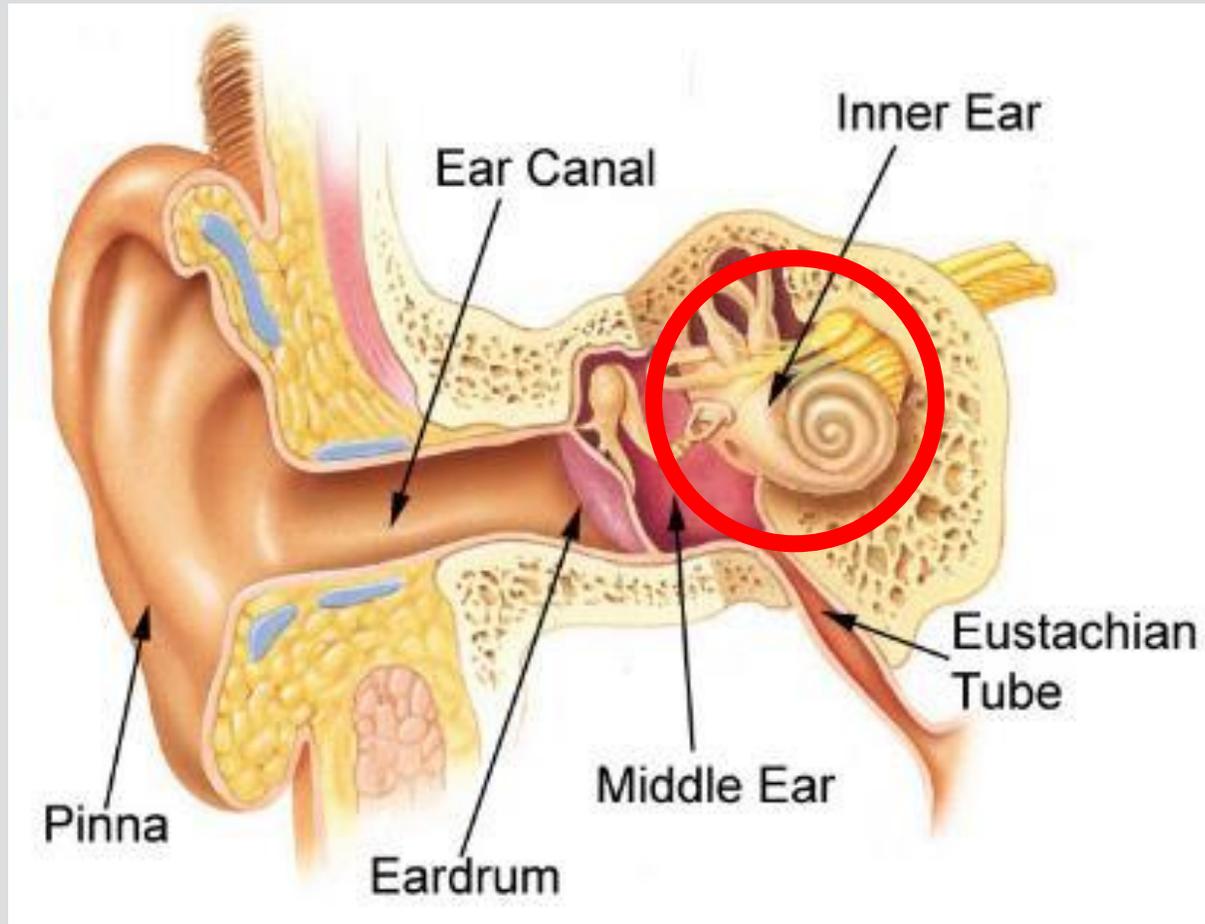
OSHA Table One

| 8- HOUR A-WEIGHTED* SOUND LEVELS & ALLOWABLE EXPOSURE TIMES | | |
|---|-------------------------------------|---|
| A-Weighted Sound Level (dBA) | Allowable Exposure Duration (Hours) | When the sound level is constant over the entire work shift, noise dose or percent noise exposure (D) is calculated as $D=100 C/T$ C = length of work day in hours T = reference duration corresponding to the measured sound level $T = 8/2^{(L-90)/5}$ L = A-Weighted Sound Level |
| 80 | 32 | |
| 85 | 16 | |
| 90 | 8 | When the sound level is not constant over the work shift but is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by where C_n indicates total time of exposure at specific noise level and T_n indicates reference duration for that level. $D = 100(C_1 / T_1 + C_2 / T_2 + C_n / T_n),$ |
| 95 | 4 | |
| 100 | 2 | |
| 105 | 1 | |
| 110 | 0.5 | |
| 115 | 0.25 | |
| 120 | 0.125 | |
| 125 | 0.063 | |
| 130 | 0.031 | |

[Full table for all dBA values available in 1910.95 Appendix A Table G-16A](#)



Ear Anatomy



- Noise causes wear & tear of hairs or nerve cells in the cochlea that send sound signals to the brain
- Loud blasts of noise can result in rupture of the eardrum



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Ototoxic Chemicals



- Chemicals which may cause hearing loss or balance problems
 - Can occur through inhalation, ingestion, or skin absorption
- Affects how the ear functions, causes hearing loss, and/or affects balance
- Certain pesticides, solvents, and pharmaceuticals
 - <https://www.osha.gov/publications/shib030818>
- Risk of hearing loss is increased when workers are exposed to these chemicals AND elevated noise levels

Ototoxins

| Substance Class | Chemicals |
|--|--|
| Pharmaceuticals <i>*Ototoxicity at therapeutic doses is limited</i> | Aminoglycosidic antibiotics (e.g. streptomycin, gentamycin) and some other antibiotics (e.g. tetracyclines), Loop diuretics* (e.g. furosemide, ethacrynic acid) Certain analgesics* and antipyretics* (salicylates, quinine, chloroquine) Certain antineoplastic agents (e.g. cisplatin, carboplatin, bleomycin). |
| Solvents | Carbon disulfide, n-hexane, toluene, p-xylene, ethylbenzene, n-propylbenzene, styrene and methylstyrene, trichloroethylene. |
| Asphyxiants | Carbon monoxide, hydrogen cyanide and its salts, tobacco smoke |
| Nitriles | 3-Butenenitrile, cis-2-pentenenitrile, acrylonitrile, cis-crotonitrile, 3,3'-iminodipropionitrile. |
| Metals and Compounds | Mercury compounds, germanium dioxide, organic tin compounds, lead. |

Occupational activities that often have high noise exposure and could add synergistic effects when combined with ototoxicant exposure (i.e., occurring in the above industries) may include:

- Printing
- Painting
- Construction
- Manufacturing
- Fueling vehicles and aircrafts
- Firefighting
- Weapons firing
- Pesticide spraying



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Hearing Loss

- **Temporary** – results from short term exposure; hearing returns when away from the noise
- **Permanent** – results from exposure to moderate to high level of noise over a long period of time

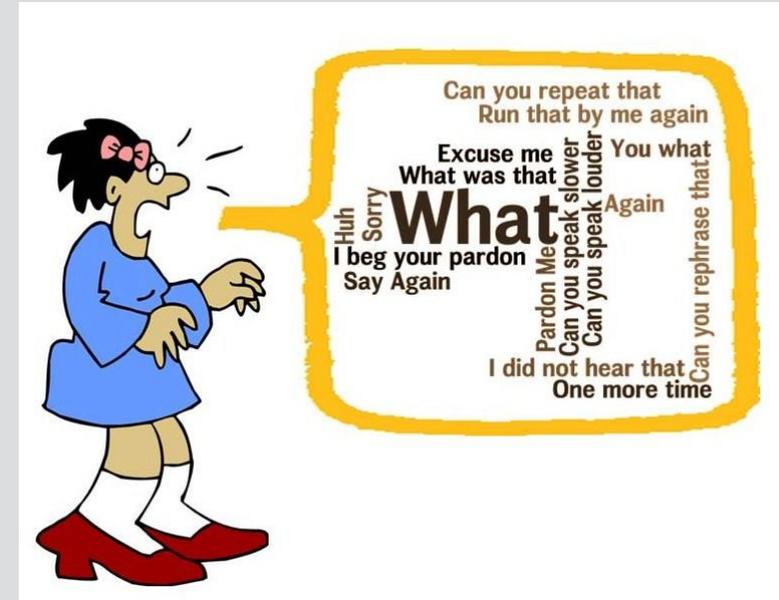


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Signs of Hearing Loss

- Muffling of speech and other sounds
- Difficulty understanding words, especially against background noise or in a crowd
- Trouble hearing consonants
- Frequently asking others to speak more slowly, clearly and loudly
- Needing to turn up the volume of the television or radio



Noise Monitoring

- Requires the monitoring of noise exposure levels to identify employees exposed to noise at or above 85 decibels (dB) averaged over 8 working hours, or an 8-hour time-weighted average (TWA)
- Must repeat monitoring whenever changes in production, process, or controls increase noise exposure
- Employees are entitled to observe monitoring procedures and must receive notification of the results of exposure monitoring

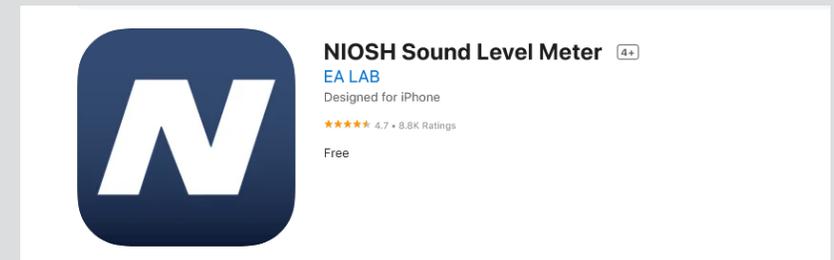


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NIOSH Sound Level Meter App

- Combines features of sound level meter and noise dosimeters into a one app
- Helps workers make informed decisions about their noise environment
- Up-to-date information on what noises are considered hazardous, how to conduct a noise measurement, how to properly select a hearing protector, and guidelines for preventing hearing loss



<https://itunes.apple.com/us/app/niosh-slm/id1096545820?mt=8>

Hearing Protection Devices



- Employees must wear hearing protection
 - If they are exposed to noise over the permissible exposure limit of 90 dB over an 8-hour TWA
 - If they have incurred standard threshold shifts that demonstrate they are susceptible to noise

Types of Hearing Protective Devices

- Ear muffs
- Foam insert earplugs
- Semi-aural ear caps/bands



Semi-aural ear caps or bands



Earplugs



Earmuffs



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Noise Reduction Rating (NRR)

- Indicates the level of sound that is blocked when used alone without simultaneous noise-blocking objects
- Reported in dB
- Higher values indicate higher levels of noise reduction
- Highest NRR rating for earplugs is 33
- Highest NRR rating for earmuffs is 31

Ear Muffs

Advantages

- Best protection at higher frequencies
- Various NRRs available
- Durable, long lasting
- Can be fitted on hard hat
- Reusable

Disadvantages

- Higher cost
- Eye glasses can interfere with ear muff seal
- May be uncomfortable in hot environments
- Must be cleaned before use by another worker



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Foam Insert Earplugs



Advantages

- More protection at lower frequencies than muffs
- Various NRRs available
- Inexpensive; disposable
- Can be custom molded for individual worker
- Reusable plugs are available

Disadvantages

- Hands must be cleaned before inserting earplugs
- Improper insertion reduces NRR value



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Semi-aural Caps/Bands

Advantages

- Various NRRs available
- Easy to use
- May be re-used
- Best for areas with intermittent noise



Disadvantages

- Improper insertion reduces effectiveness
- More expensive than ear plugs
- Typically have lower NRRs than plugs or muffs



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Selection of Hearing Protection Devices

- Employee may select hearing protection from a variety of suitable hearing protectors provided employer
- Select hearing protection based on
 - Employee comfort
 - Level of noise exposure
 - NRR of device
 - Type of work being performed
 - Environmental conditions

Fit, Use and Care of Hearing Protection Devices

- Ensure proper initial fitting
 - Contact EHS with questions
- Supervisors oversee the correct use of hearing protectors
- Hearing protectors are replaced as necessary at no cost to employee
- Hearing protection devices must be cleaned and stored according to manufacturer's instructions

Audiometric Testing

- Required for employees exposed to 8 hour TWA \geq 85 dBA to monitor employee's hearing over time
 - Baseline test to be completed within 6 months of first exposure above the action level
 - Must have at least 14 hours without exposure to noise at or above 85 dBA
 - Annual testing thereafter
- Audiometric testing performed and reviewed by medical professionals

Standard Threshold Shift (STS)

- A change in employee's hearing threshold relative to their baseline audiogram of 10 dB or more at 2000, 3000, and 4000 hertz in one or both ears
- Re-test within 30 days to confirm



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Access to Information

- [OSHA 29 CFR 1910.95](#) online and available in the workplace
- EHS maintains records of noise monitoring and exposure evaluations for 2 years
- Audiometric test records are kept for the duration of employment



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Thank you!

Please remember that this training is required annually as long as you continue to have noise exposure about the 85 dBA



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