

HEARING LOSS PREVENTION: USING PRECAUTIONS AND PROTECTION




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WHAT IS NOISE?

- Noise is any unwanted sound
- A disturbance, especially a random and persistent disturbance, that obscures or reduces the clarity of a signal
- Ways to describe noise
 - Intensity, Frequency, Nature, Duration





- A better measurement of noise is a sound level meter or dosimeter
- This will measure the noise in your environment
- Once you know the sound level, you can take steps to protect your hearing



FREQUENCY

- At any volume high frequency sounds are more damaging than sounds containing low frequencies
- Most hearing protectors reduce sounds in the high frequencies more aggressively than the lows

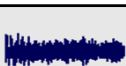


DURATION

- This ties into the intensity of a sound
- These duration times are based on daily exposure levels, so they are cumulative for a 24 hour period



NATURE



- Both of these sound types can cause damage
- If the steady state noise is loud enough and you are in the environment long enough it can cause just as much damage as an impulse sound



THE FOUR P_s OF NIHL

- It develops **P**ainlessly
- It **P**rogressives over time
- It's **P**ermanent
- And it's 100% **P**reventable



HOW DOES A NIHL HAPPEN?

- Acoustic trauma such as an explosion, or a one time exposure to an extremely loud sound (fireworks, gun, bombs)



HOW DOES A NIHL HAPPEN?

- Daily exposure to moderately loud sounds that add up to damage over time (factory work, farming equipment, working a music concert)



TEMPORARY THRESHOLD SHIFT (TTS)

- After an exposure to high noise levels the outer hair cells experience a temporary threshold shift
- During this time a person may experience
 - Reduced hearing ability (hearing loss)
 - Aural fullness (stuffed feeling in their ears)
 - Tinnitus



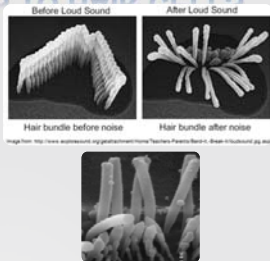
TTS RECOVERY

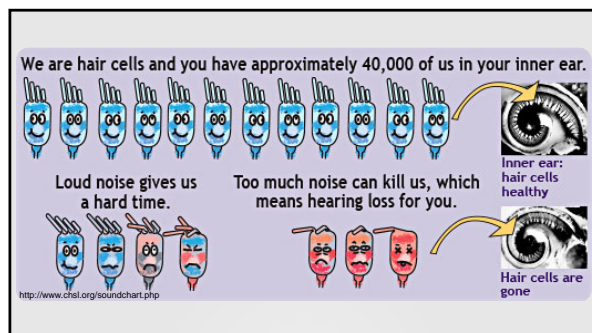
- As the name states this type of threshold shift is temporary
- After several hours or even days in a more quiet environment the person's hearing thresholds should return to normal and the tinnitus should dissipate
- The greater the threshold shift the longer it will take to recover



WHAT HAPPENS TO HAIR CELLS

- May only involve the stereocilia and can somewhat be repaired
- Involve the entire hair, which undergoes apoptosis and dies





WHEN SOMETHING IS TOO LOUD?

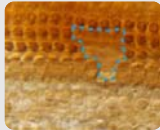
- A good rule of thumb is the 3 foot rule:
 - If you have to raise your voice to be heard by someone standing 3 feet away from you, then the noise level is most likely too loud

PERMANENT THRESHOLD SHIFT (PTS)

- Repeat exposure to loud noise can lead to permanent hearing loss
- When the hearing loss is caused from noise exposure we label that loss a Noise Induced Hearing Loss (NIHL)
- With the permanent hearing loss comes other issues such as
 - Stress, reduced productivity, concentration and communication difficulties
- This can contribute to workplace accidents making it difficult to hear warning signals and understand speech

WHAT HAPPENS TO HAIR CELLS

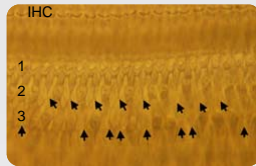
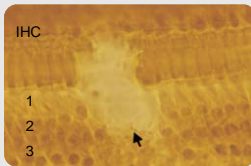
- After repeat exposure more severe damage is seen in the stereocilia of the outer hair cells
- More definitive damage can occur when the hair cell itself disappears
 - Supporting cells can also be damaged or disappear as well



Images from: <http://www.neuronella.com/brain/brain/brain/trauma.htm>

FREQUENCY MATTERS

4000 Hz Octave Band Noise 500 Hz Octave Band Noise



Images from: <http://otol2.wustl.edu/bears/noise.htm>

PHYSIOLOGIC CHANGES IN THE ORGAN OF CORTI

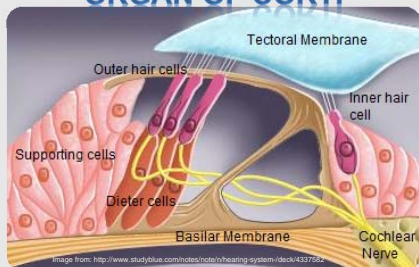
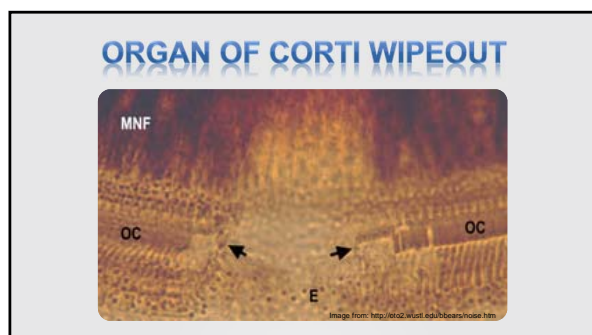
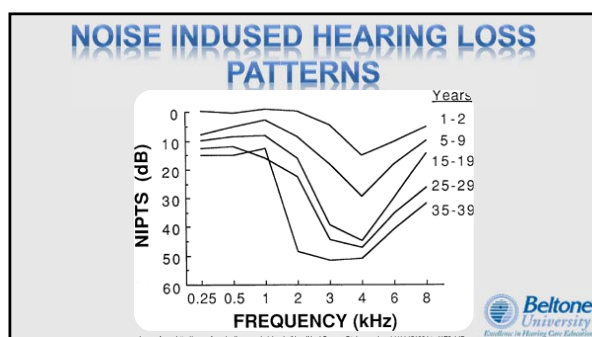
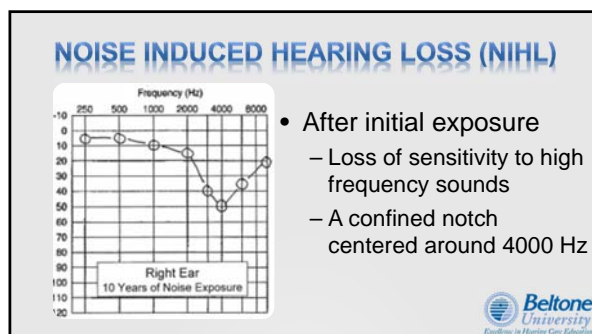


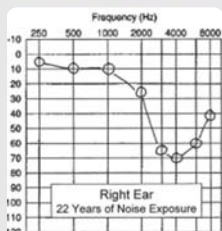
Image from: <http://www.studydrive.com/notes/notes/hearing-system-deck/433702>







NOISE INDUCED HEARING LOSS (NIHL)



- After continued exposure
 - The notch at 4000 Hz deepens and widens involving more frequencies
- Remember progressive high frequency hearing losses can go undetected by patient's for years as there is no loss of loudness

NOISE INDUCED HEARING LOSS

- What can cause a noise induced hearing loss?



WORK ENVIRONMENTS: MUSIC

- Most workers at live music venues are exposed to more noise than noise standards allow
- New term "music induced hearing loss"
- It's not noise it's music
 - Musicians don't want to wear hearing protection
 - A concert isn't the same with the volume turned down

WORK ENVIRONMENTS: NASCAR

- "Noise is part of NASCAR"
- Noise measures taken
 - In the pit during a race at 130 dBA
 - In the stands during a race at 96 dBA
 - 114dBA in the race car during practice
 - During the race 140 dB
- Most racing associations do not require drivers and crew members to wear hearing protection



THE STANDARDS

OSHA and NIOSH



DEVELOPMENT OF OSHA STANDARD

- Part of the US Department of Labor
- OSHA was created by the Occupational Safety and Health Act of 1970
- The specific standard for occupational noise exposure is OSHA standard 29 CFR 1910.95



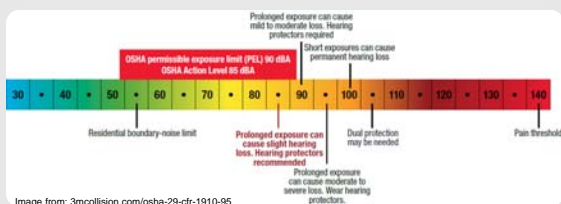
OSHA STANDARDS FOR NOISE

Noise Level	Exposure Limit
90 dBA	8.0 hours
92 dBA	6.0 hours
95 dBA	4.0 hours
97 dBA	3.0 hours
100 dBA	2.0 hours
102 dBA	1.5 hours
105 dBA	1.0 hours
110 dBA	30 minutes
115 dBA	15 minutes

Image from: www.ohsonline.com



HEARING PROTECTION REQUIREMENTS

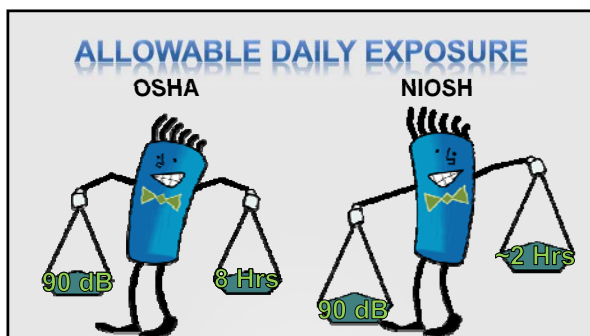


DEVELOPMENT OF NIOSH STANDARD

- Part of the CDC (Centers for Disease Control and Prevention)
- Conducts research and provides information, education, training, and recommendations regarding occupational safety and health
- Recommended Exposure Limits (REL) are based on scientific data











NOISE DOSIMETRY

- Measures sound levels continuously over time and converts that into a noise dose
- Provides a more accurate estimate of risk
- Alert users in real time of the need to use hearing protection

HEARING PROTECTION SELECTION

Which One is Right for Me?

EARMUFFS

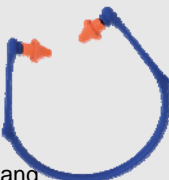
- Pros
 - Easy to fit/wear
 - Good for short use
 - Options for radio and electronics



- Cons
 - Can become hot/heavy with extended wear

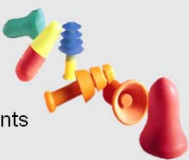
BANDS

- Pros
 - Convenient for intermittent noise
- Cons
 - Lower attenuation than earplugs
 - Noise can transmit through the band



EARPLUGS

- Pros
 - Comfortable for extended use
 - Can be custom made
 - Disposable or reusable
 - Cooler in hot/humid environments
 - High levels of attenuation
- Cons
 - Needs a good fit to attain rated attenuation



CUSTOM EAR PLUGS

- Generally are easier to place and can provide similar amount of reduction as muffs
- There are several different variety of custom ear plugs



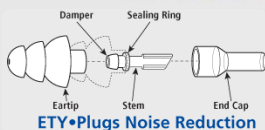
EAR PLUGS WITH FILTERS

- Some ear plugs have filters added into the housing offering
 - A more flat level of noise reduction
 - Different levels of attenuation

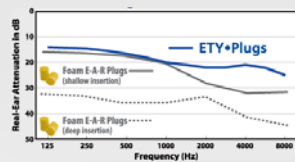


Images from: Etymotic.com

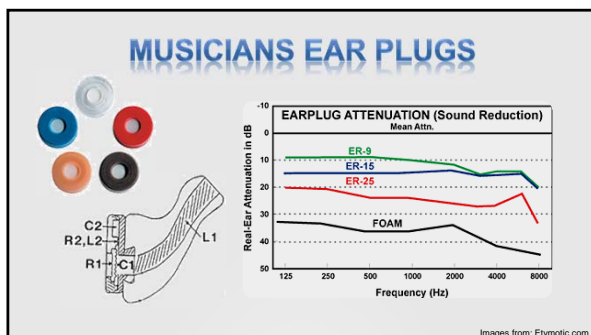
FILTERED EAR PLUGS



ETY•Plugs Noise Reduction



Images from: Etymotic.com



SO WHAT DO I DO WITH THIS INFORMATION

How do I protect myself?

Beltone University
Excellence in Hearing Care Education

NOISE REDUCTION RATING

- Labels regulated by ANSI standard S3.19-1974 and EPA regulation 40 CFR 211 subpart B
- NRR are not measured with the dBA weighted sound

Noise Reduction Rating 33 DECIBELS
(WHEN USED AS DIRECTED)

THE RANGE OF NOISE REDUCTION RATINGS FOR EXISTING HEARING PROTECTORS IS APPROXIMATELY 0 TO 30 (HIGHER NUMBERS DENOTE GREATER EFFECTIVENESS)

DAI WORLD, INC.
Aliso Viejo, CA 92656 #2427

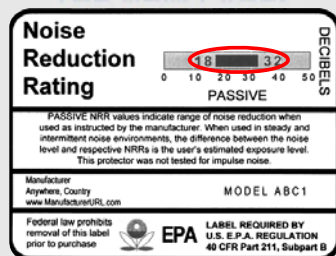
Federal law prohibits removal of this label prior to purchase. EPA LABEL REQUIRED BY U.S. E.P.A. REGULATION 40 CFR Part 211, Subpart B

REVISIONS TO NRR RATING

- The EPA and ANSI believe the current standard may not reflect real-life working conditions well enough
- Proposing a new rule to test both active and passive hearing protection devices
- Will also retest devices every 5 years since material and designs can change over the years



THE NEW LABEL



OUR ROLE IN THIS

- Education
 - To help modify behaviors
 - To teach about the auditory system
 - Different types of hearing protection
 - OSHA standards
- Impressions for custom ear plugs
- Hearing tests and hearing aid fittings
- Tinnitus counseling and treatment



SUMMARY

- Noise is any unwanted sound or disturbance that reduces signal clarity
- A NIHL can occur from a one time acoustic trauma or from prolonged daily exposure
- OSHA and NIOSH have standards for allowable noise limits
- There are many different types of hearing protection out there, none better than the other unless your patient won't wear it



QUESTIONS