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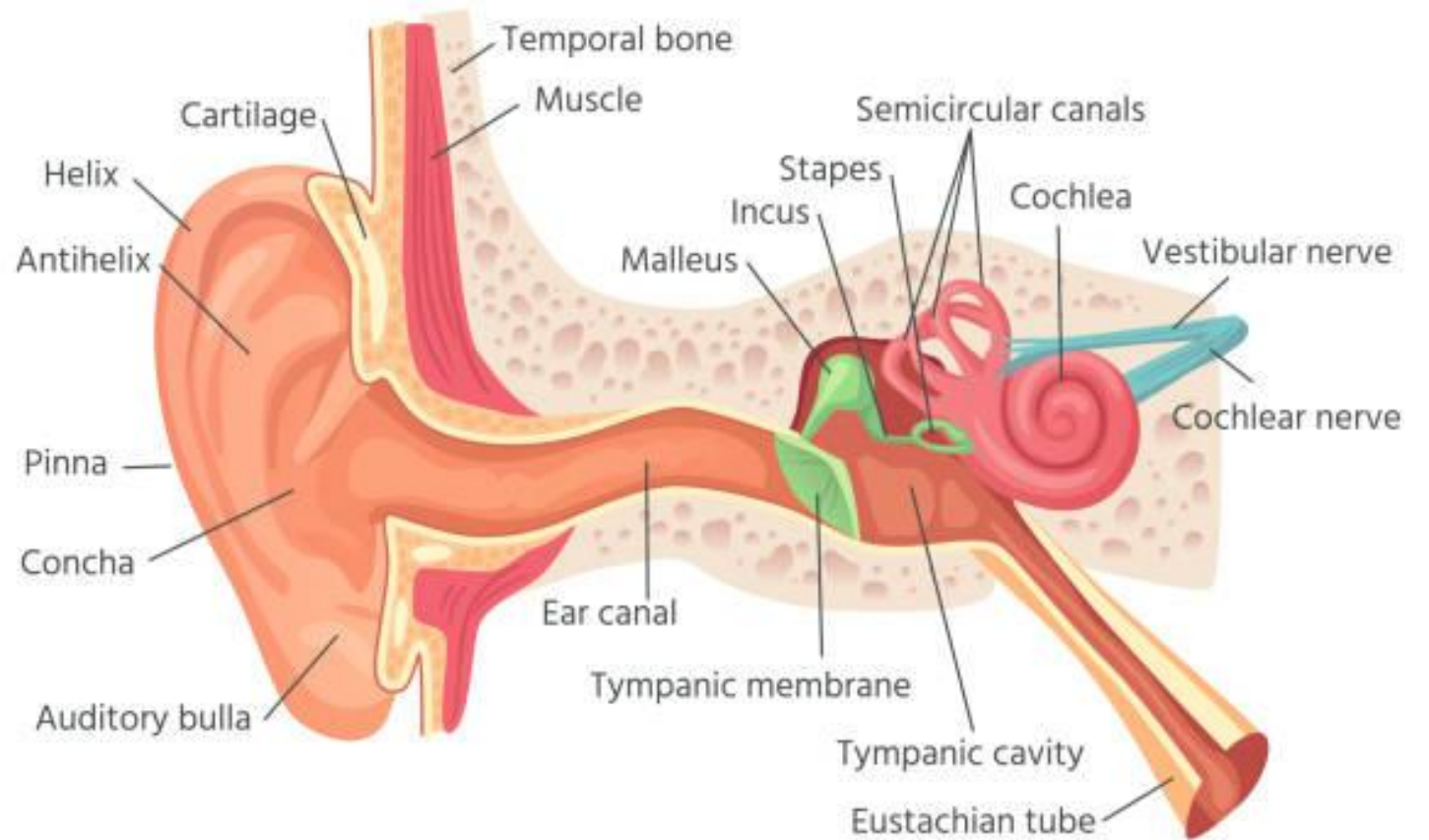
Noise
Happens—
Hearing loss
doesn't have
to



HEARING CONSERVATION IS A SOUND INVESTMENT

Larry D. Giovinazzo, Au.D.

The ear and how it works



Why Small dB Changes Matter

The decibel scale is logarithmic, not linear.
The logarithmic way to express

Sound Energy

- +3 dB = double the sound energy
- +10 dB $\approx$ sounds twice as loud
- Example:
 - 85 dB $\rightarrow$ baseline
 - 88 dB $\rightarrow$ twice the energy
 - 91 dB $\rightarrow$ four times the energy
 - 94 dB $\rightarrow$ eight times the energy
 - 97 dB $\rightarrow$ sixteen times the sound energy
- Small increases in dB can greatly increase hearing risk
- Your Ears measure energy---Your Brain measures Loudness.



“Think of decibels like money in a bank account. +3 dB is like doubling your money—big deal, right? But your ears don’t feel it that way. To your brain, it takes +10 dB before it sounds twice as loud. By the time something ‘sounds twice as loud,’ your ears are actually taking in 10 times more energy!”

Instruments Used to Measure Noise

Three Ways We Measure Noise

Sound Level Meter
Spot Measurements



What's Loud

Noise Dosimeter
Full-Shift Exposure



Total Exposure(Daily Budget)

Smartphone Apps
Quick Screening Only
(Not a Substitute for Calibrated Instruments)



Quick Check Only(Awareness)

- **Smartphones Can Estimate Noise Levels
(Smart Watches)**

- Both Apple and Android phones support sound level meter apps that measure decibels. In fact, on the Apple iPhone and Apple Watch, the [embedded Health app](#) measures decibels and can send alerts when it is too loud. Here are other sound level meter apps:

- [NIOSH Sound Level Meter App](#) (iOS)
- [NoiSee](#) (iOS)
- [SLPnFFT Noise Meter](#) (iOS)
- [Sound Meter X](#) (iOS)
- [Sound Meter](#) (Android)
- [SoundPrint](#) (iOS and Android)



OSHA vs the World: Noise Exposure Standards

OSHA

Legal Standard

- Action Level: **85 dBA**
- PEL: **90 dBA**
(Protection Required)
- Exchange Rate: **5 dB**

Bottom Line:
Allows more
noise exposure

NIOSH / ACGIH

Best Practice

- Limit: **85 dBA**(Protection)
- Exchange Rate: **3 dB**
- Based on **equal energy principle**

Bottom Line:
More protective

EU Standards

- Action Levels: **80 / 85 dBA**
- Upper Action Level: **85 dBA**
(Protection Required)
- Exposure Limit: **87 dBA (with PPE max to the ear)**
- Exchange Rate: **3 dB**

Bottom Line:
Most common worldwide

85 dBA + 3 dB exchange rate = Widely used Best Practice(NIOSH, ACGIH & EU)

OSHA **5 dB** rule allows significantly more exposure

Hearing protection devices



Earplugs

- Foam
- Pre-molded
- Custom

Most Common



Earmuffs

Easy to Use



Electronic / Level-dependent
Communication headsets

Best for Communication

Noise Reduction Rating (NRR)



Purpose: Developed by the EPA for consumer use and guidance



Achieve appropriate—not maximum—attenuation

More is NOT always better

OSHA Adjustment VS NIOSH Derating

Method/Protector Type		NIOSH Derating
OSHA Method (All Protectors)		Earmuffs- 75% of labeled NRR
$(NRR - 7) \div 2$ (OSHA estimate)		Formable- 50% of labeled NRR
		Non-Formable- 70% of labeled NRR

OSHA = Simpler estimate

NIOSH = More realistic (and more conservative)

Why Most Hearing Protection Fails in the Real World

Poor Fit



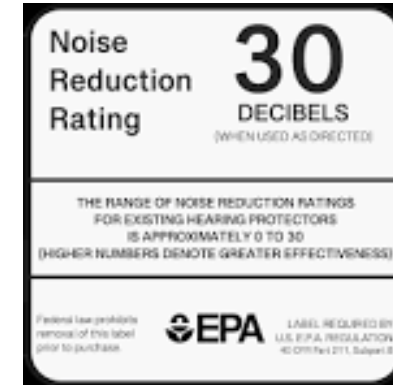
Not Inserted Deep Enough
Wrong Size/Type
Breaks Seal

Inconsistent Use



One Ear Exposed
Intermittent Protection
Seconds Off = Minutes of Exposure

Overreliance on NRR



NRR = Lab Rating → NOT real-world Protection
False Sense of Security
No Fit Verification

Tips for choosing the right hearing protection

Match Protection to Noise Level

Many industrial environments range from 85-95dBA

Goal: reduce exposure to 75-85 dBA

Measure with SLM or Dosimetry

100dBA + need double protection

Consider the Work Environment

Other PPE: hard hats, safety glasses confined space...

Communication needs

Comfort during full shift

Interference with job tasks

The BEST Protection= Work Consistently

Comfortable= worn correctly

Simple= used more often

Worn Correctly and Consistently matters more than NRR

The best hearing protection is
the one worker's wear

Referred By _____ Problem _____

Test Location _____ Audiometer _____ Case No. _____

Test Reliability _____ Examiner _____ Date _____

SYMBOLS:

Air Conduction:

- X (Blue) left ear thresholds
- O (Red) right ear thresholds

XQ No response to maximum output of the audiometer

- (Blue) left ear masked thresholds
- △ (Red) right ear masked thresholds

Bone Conduction:

- > (Blue) left ear thresholds
- < (Red) right ear thresholds

↔ No response to maximum output of the audiometer

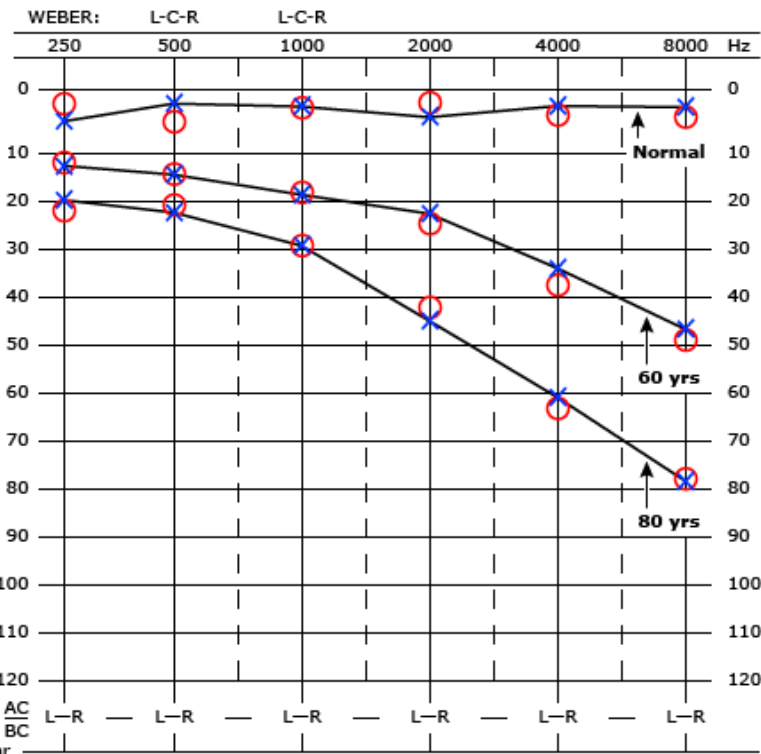
-] (Blue) left ear masked thresholds
- [(Red) right ear masked thresholds

S Sound field

Hearing-threshold level in decibels (ANSI, 1969)

Effective Masking AC BC Non-Test Ear

PURE-TONE AUDIOMETRY



PURE TONE AVERAGES			
EAR	.5-1	.5.1.2	
LEFT			
RIGHT			

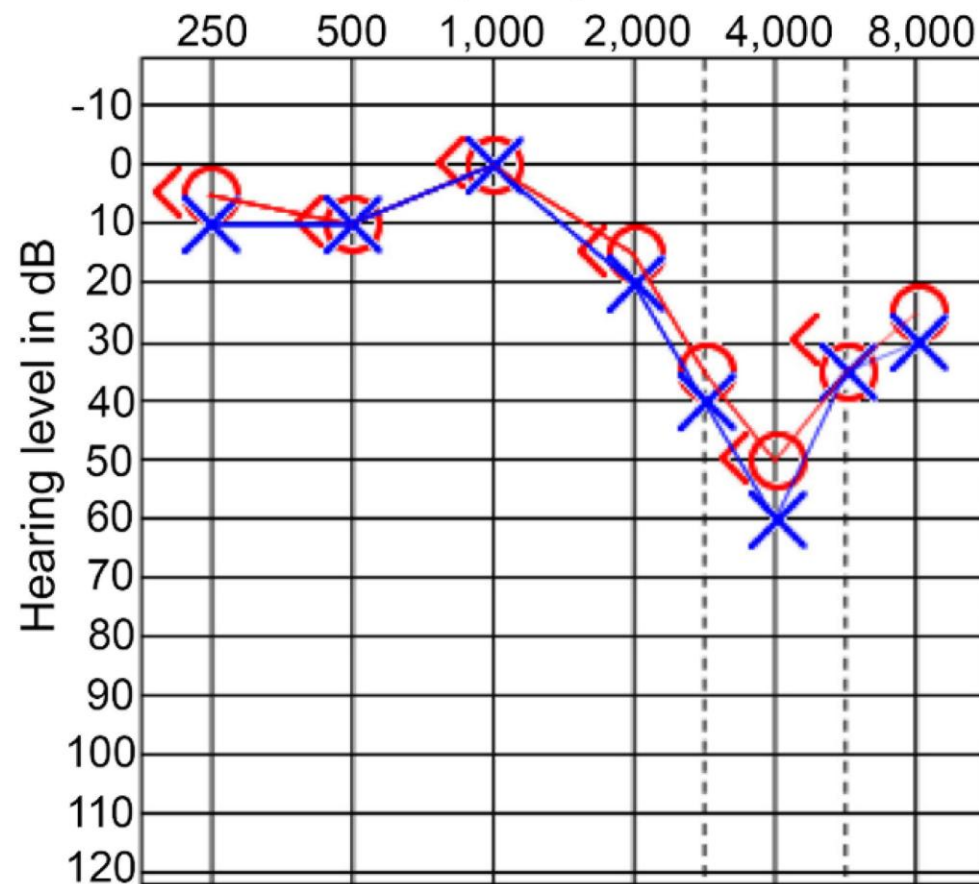
TONE DECAY FREQUENCY			
EAR			MASK
Left			

Tympanogram			
	R	L	
NML		.5K	
FLAT		1K	
NEG		2K	

SPEECH AUDIOMETRY

Right Intensity Left Intensity Masking							
SRT	dB	dB	dB	dB	L	R	
DISCM	%	dB	%	dB	L	R	
	%	dB	%	dB	L	R	
	%	dB	%	dB	L	R	
MCL	dB	MCL	dB				
	dB		dB				

Frequency in Hz



Air conduction threshold (unmasked)

Right ear Left ear

Bone conduction threshold (unmasked)

Right ear Left ear

With consonants removed (much harder to understand):

ea e i ou a e a e o o e e a.

With vowels removed (simulating mild hearing loss):

Pls brng yr sfty glsss t wrk vry dy.

Normal sentence:

Please bring your safety glasses to work every day.

Effects of Noise Exposure on Your Life

◆ Auditory Effects (Hearing-Related)

- Temporary hearing loss (**TTS**) after loud noise
- Permanent hearing loss (**PTS**) over time
- Ringing in the ears (**tinnitus**)
- Difficulty hearing high-pitched sounds
- Trouble understanding speech—especially in noise

◆ Non-Auditory Effects (Beyond Hearing)

- Increased stress anxiety and mental fatigue
- Reduced concentration and productivity
- Communication breakdowns
- Safety risks (missed alarms, warnings, signals)
- Sleep disruption

▲ Long-Term Health & Life Impacts

- Increased risk of **high blood pressure & cardiovascular disease**
- Higher risk of **cognitive decline and dementia**
- Greater risk of **workplace accidents and injuries**
- Income loss** from reduced job performance and employability

Noise doesn't just affect your hearing—it affects your safety, performance, and quality of life.

Summary

◆ What We Covered

- How noise **damages hearing**
- Understanding **decibels and exposure**
- Measuring workplace noise (**SLM & dosimetry**)
- Choosing the **right hearing protection**

▼ Key Takeaways

- Noise exposure affects **hearing, health, and safety**
- **Fit and consistency** matter more than NRR
- The right protection = **matched to the hazard**
- The best protection is the one **worn correctly—every time**