

Hearing Conservation



Class Objectives

What is sound?

How the ear works.

How is sound measured.

What does OSHA says about noise.

Audiograms - what it tells us.

How to prevent hearing loss.

Hearing Protection- Types & Proper Use.

Fact:

One in 10 Americans has a hearing loss that affects his/her ability to understand normal speech.

Excessive noise exposure IS the most common cause of hearing loss.

SOUND / NOISE

WHAT IS IT?

Vibrating Energy

or

Waves of Motion



Of which enters the ear canal –
humans have NO natural hearing defensive.

CATEGORIES OF SOUND/NOISE

Continuous - Steady, constant sound.

Impulse - Cyclic, interrupted sound.

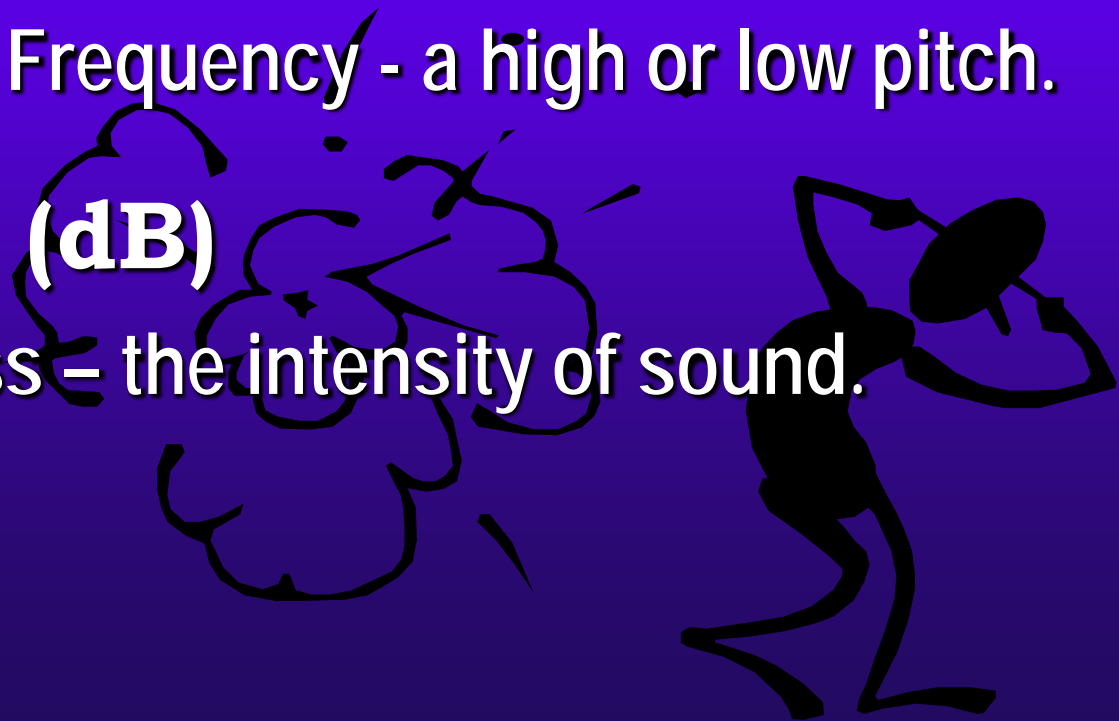
How is Sound Measured ?

Hertz (Hz)

- Sound's Frequency - a high or low pitch.

Decibels (dB)

- Loudness – the intensity of sound.



Frequency - A sounds pitch

Humans can typically hear between 20 - 20,000 Hz

20 Hz -being very low pitched.

20,000 Hz - is very shrill and high pitched.



Some can hear different frequencies better than others (even @ low decibels).

Decibels - A sounds loudness

Intensity of sound is measured in decibels (dB). The scale runs from the faintest sound the human ear can detect, which is labeled 0 dB, to over 180 dB, the noise at a rocket pad during launch.

The quietest sound some humans can detect is 0 dB.



DECIBEL READINGS

Normal Conversation 65db



Power Saw 110 db



Jet taking off within
100 feet = 145 db



EXAMPLES OF DB

0 - Faintest sound heard by human ear.

30 - Whisper, quiet library.

60 - Normal conversation, sewing machine, typewriter.

90 - Lawnmower, shop tools, truck traffic; 8 hours per day is the maximum exposure to protect 90% of people.

100 - Chainsaw, pneumatic drill, snowmobile; 2 hours per day is the maximum exposure without protection.

115 - Sandblasting, loud rock concert, auto horn; 15 min. per day is the maximum exposure without protection.

140 - Gun muzzle blast, jet engine; noise causes pain and even brief exposure injures unprotected ears.
Maximum allowed noise *with* hearing protectors.

How do we Hear?

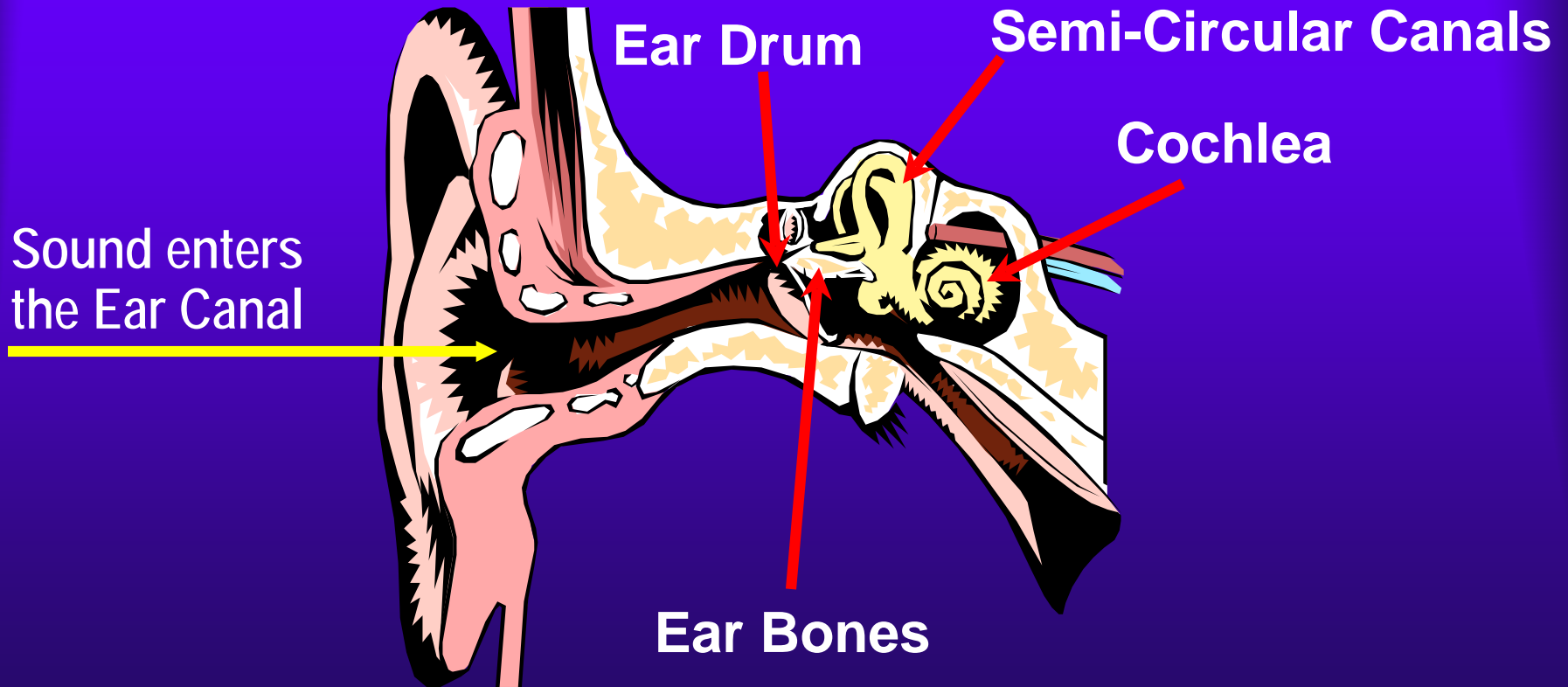
The outer ear collects the sound-waves sending them into the ear canal.

The waves hit the eardrum (vibrates) sending the vibration into the middle ear.

The vibrations travel through the bony parts (3) to the inner ear.

Vibrates through the semi-circular canal to the cochlea, where small hairs send electrical impulses to the audio nerve - to the brain.

Anatomy of the Ear

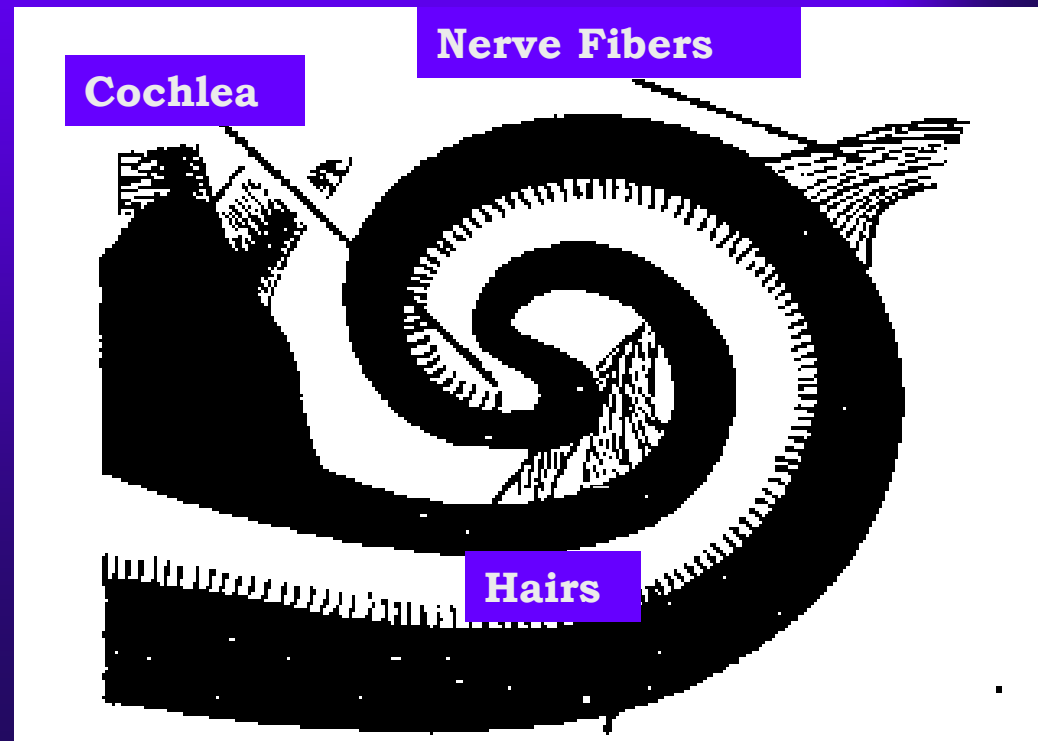


MIDDLE EAR

CLOSE UP VIEW OF INNER EAR



INNER EAR



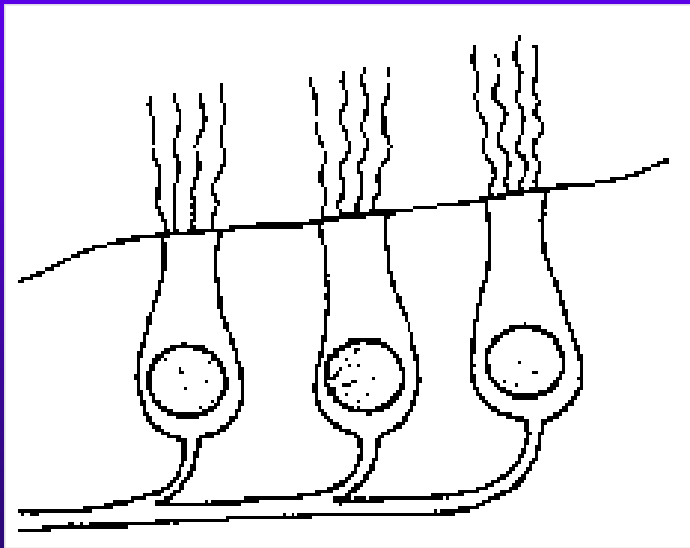
Inside the Cochlea (snail shell)

- ◆ Delicate hair cells vibrate to different frequencies and loudness.
- ◆ Hair cells detect this vibration sending electronic signals to the brain to register as sound.
- ◆ Loud sounds destroy the hair cells, and they stop functioning. – FOREVER !

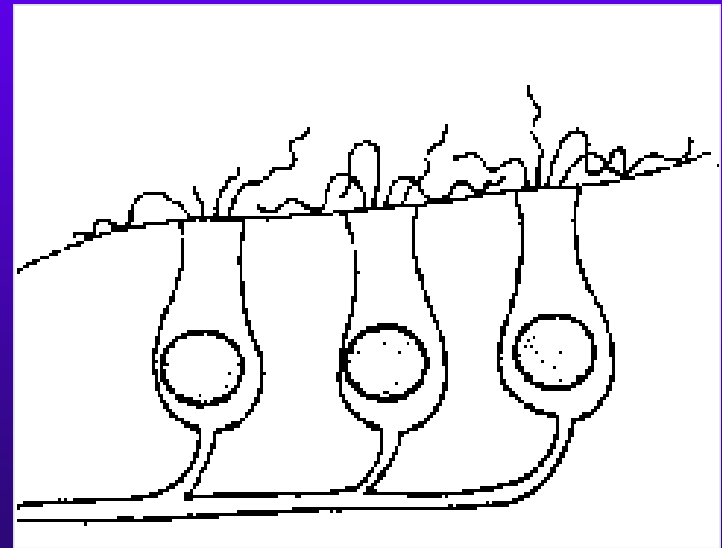
HEARING LOSS

Hairs inside Cochlea

Healthy Hair Cells



Damaged Hair Cells



The Ear does something else too!

The Semi-circular canals

- Three tubes laying perpendicular to one another.
- Filled with fluid and tiny hair cells.
- Depending on which way your head is tilted, the fluid moves the hair cells, an they send a signal to your brain.

Responsible for balance

DECIBEL READINGS

For unprotected ears, the allowed exposure time decreases by one-half for each 5 dB increase in the average noise level.

For instance, exposure is limited to:

- ◆ *8 hours at 90 db*
- ◆ *4 hours at 95 db*
- ◆ *2 hours at 100 db*

LIMITATIONS

Critical Range is 85 - 125 dB
(This range causes most damage)

The highest permissible noise exposure for the unprotected ear is *115 dB for 15 minutes/day*.

Any noise above *140 dB* should not be subjected to the unprotected ears.

DECIBEL MEASUREMENTS

Decibels are measured logarithmically.

This means that as decibel intensity increases by units of 10, each increase is 10 times the lower figure.

Thus, 20 decibels is 10 times the intensity of 10 decibels, and 30 decibels is 100 times as intense as 10 decibels.

Example

In the field, we determined the loudness of two compressors right next to each other.

Comp. #1	Comp. #2
89 dB	87 dB

How loud is noise in this area?

- Do we add to get a total?
- Do we add and take the average?

Neither- because it is a log scale
Use the following factor chart

Difference in db values	Add to higher value
0 or 1 db	3 db
2 or 3 db	2 db
4 or 10 db	1 db
10 or more	0 db

$$82 \text{ dB} + 83 \text{ dB} = 86 \text{ dB}$$

$$87 \text{ dB} + 89 \text{ dB} = 91 \text{ dB}$$

How does the Safety Person determine noise levels

Sound level meter

(Dosimeter)

- Determine the loudness (dB) of noise at any given moment.

Personal Dosimeters

- Worn by employees
- Measures the avg. loudness in an 8 hour work shift "8hr. TWA"
(Time Weighted Average)
- Can also measure noise dose

What does OSHA say?

At 85 dB (8hr. TWA)

Train employees

- Make hearing protection available**
- Sample for noise levels**
- Do hearing tests**
- Notify employees of results**

What does OSHA say?

At 90 dB or more

(100% Dose)

- We must keep levels at or below 90 dB**
- Or require hearing protection that will lower noise levels to to 90 dB**

Hearing Tests

We must determine a baseline audiogram

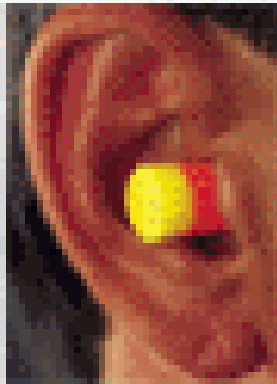
We test your hearing every year to determine if you have experienced a hearing loss (Standard Threshold Shift)

Standard Threshold Shift - A loss of 10 dB or more at 2000, 3000, or 4000 Hz.

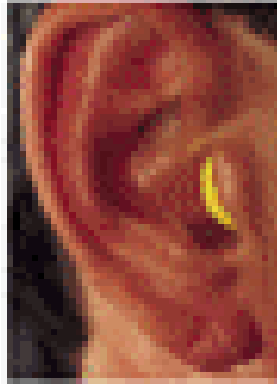
Audiogram

	200 Hz	1000 Hz	2000 Hz	3000 Hz	4000 Hz	6000 Hz
Baseline	5 dB	5 dB	0 dB	5 dB	10 dB	10 dB
Annual	5 dB	5 dB	10 dB	20 dB	35 dB	15 dB
Difference	0	0	10	15	25	5

HEARING PROTECTION

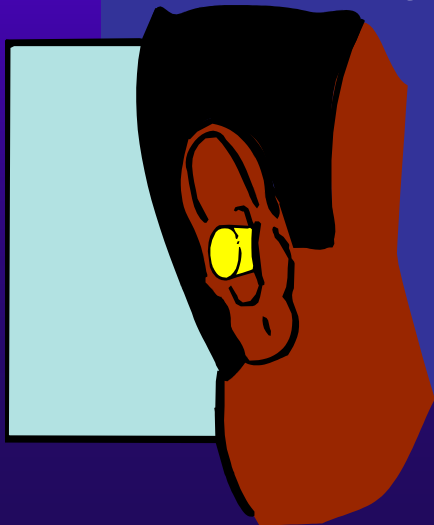


Incorrect



Correct

Ear Plugs



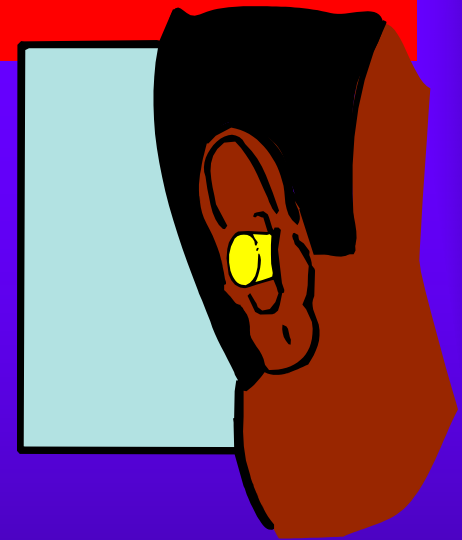
Ear Muffs



Hearing Protection

NRR - Noise reduction rating

- Express - 25 NRR
- Classic - 29 NRR
- Max Lite - 30 NRR



DO NOT Subtract the NRR from the noise level

- WRONG (109 dB - 25 NRR = 84 dB)

You must use the “Safety Factor”

Safety Factor

OSHA says the hearing protection is designed to reduce the noise by the NRR, but that is unlikely to happen due to :

- Leaks in the seal
- Vibration
- Improper insertion / fit

(NRR - 7) Safety Factor

AN Example of NRR Protection

The noise at a large compressor is 109 dB.

You are wearing the Express plugs with an NRR of 25.

Do you have enough protection to place you below 90 dB level?

NO

$$\text{NRR } 25 - 7 = 18$$

$$109 - 18 = 91$$

RULE OF THUMB

If you have to raise your voice to be heard by someone less than two (2) feet away –

YOU NEED HEARING PROTECTION

A Final Note

Hearing is important

In time, noise levels at 85 dB can permanently damage your hearing

Wear your hearing protection both at work and at home

Choose hearing protection with a high NRR, and wear it properly

It's a marvelous system – protect what you've got!

