ENVIRONMENTAL HEALTH AND SAFETY

Occupational Noise Exposure
29 CFR 1910.95

Is There a Problem?

- More than 30 million Americans are exposed to hazardous sound levels on a regular basis
- 10 million have suffered irreversible noise induced hearing loss
- Rate of hearing loss is increasing in the U.S.

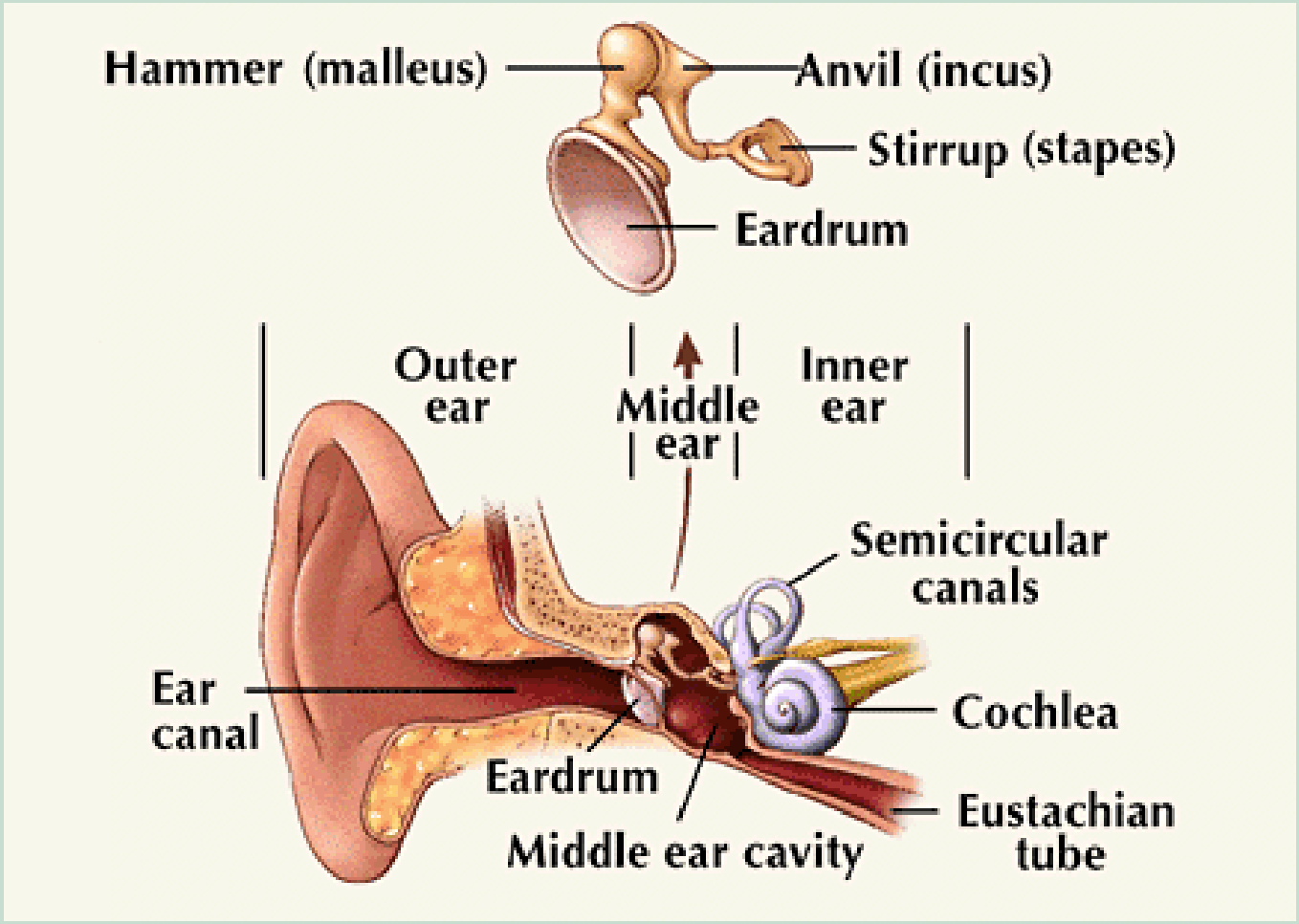
Good Hearing is Important

- Work sites can be dangerous
- What sound on a worksite alerts you to danger?
  - back up alarms
  - vehicle traffic
  - changes in equipment noise
  - verbal warnings from other workers

Group Exchange

- Think about what your favorite sound is?
  - Could you hear your favorite sound if you had a hearing loss?

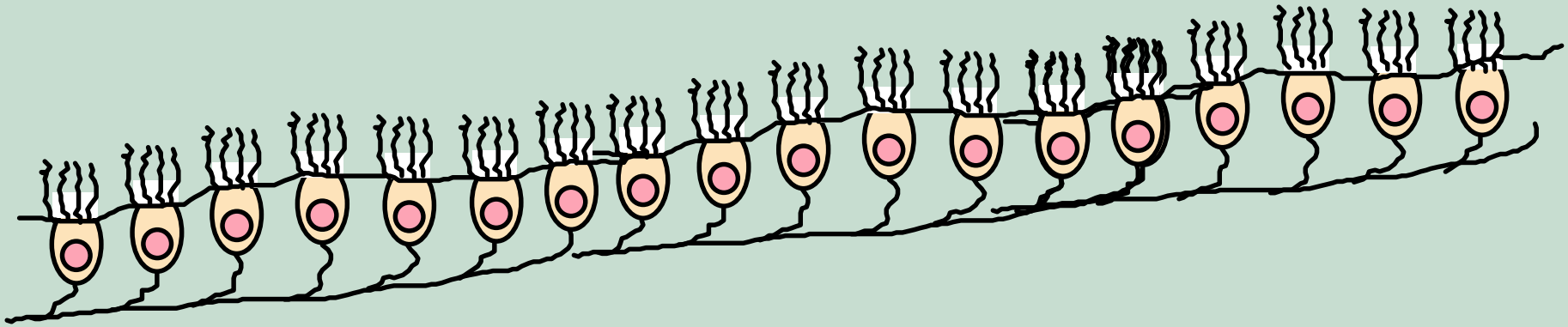
The Ear is a Delicate Tool



The Cochlea and the Inner Ear

☑ THE COCHLEA AND THE INNER EAR

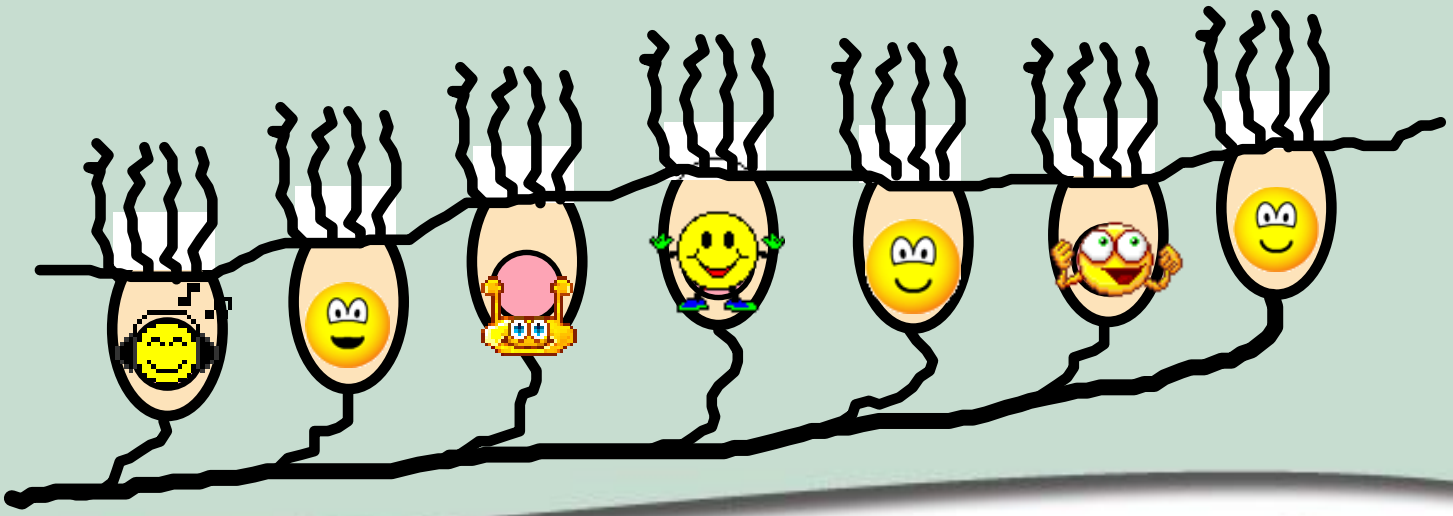
- ✓ A fluid filled sound reception chamber
- ✓ Contains thousands of tiny hair cells
- ✓ The cells respond to sound waves made in the fluid
- ✓ The cells pass the sensation on to the auditory nerve



The Cochlea and the Inner Ear

☑ SENSORI-NEURAL HEARING LOSS

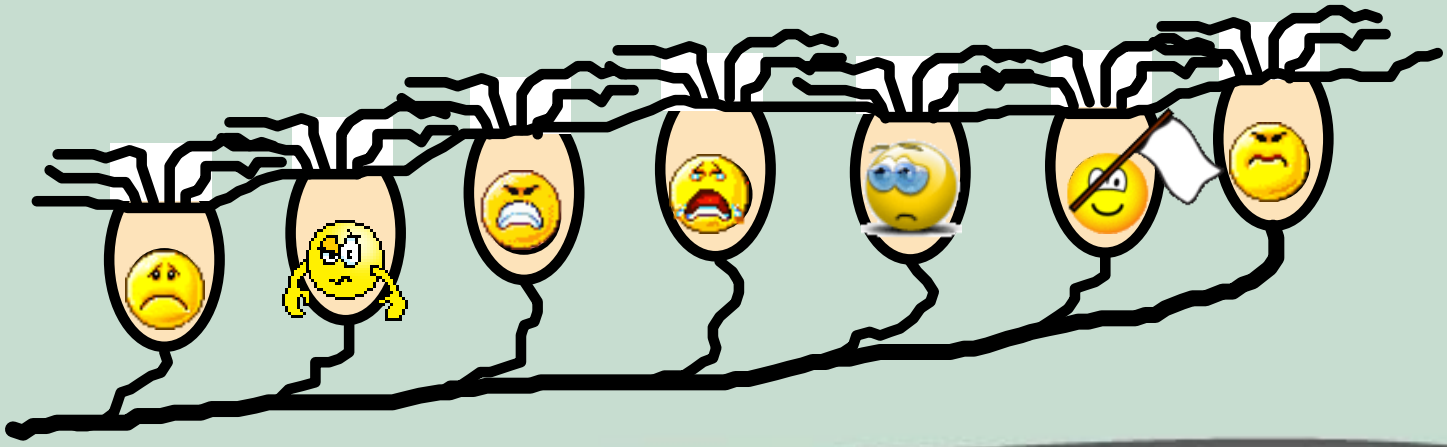
- ✓ Noise-induced hearing loss
- ✓ Damages the hair cells or auditory nerves
- ✓ If the noise is stopped hair cells can bounce back
- ✓ Damage can be temporary



The Cochlea and the Inner Ear

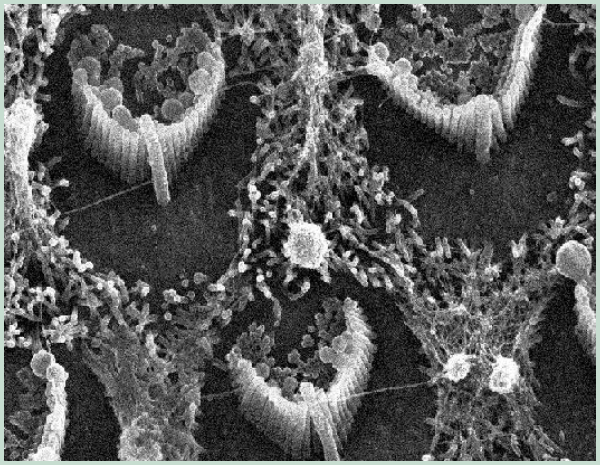
☑ SENSORI-NEURAL HEARING LOSS

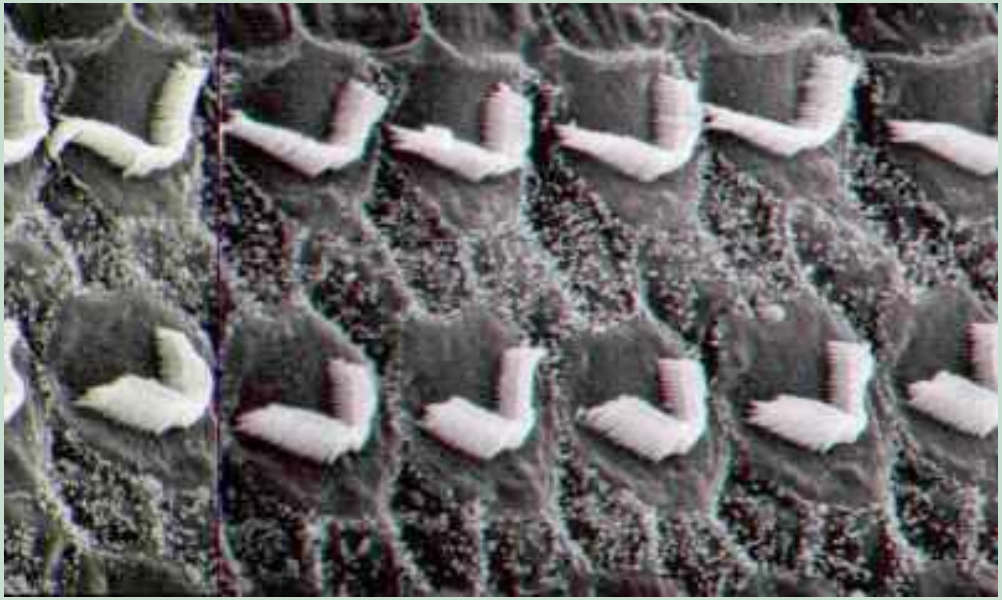
- ✓ If the noise continues hair cells can't bounce back
- ✓ Damage can be permanent!



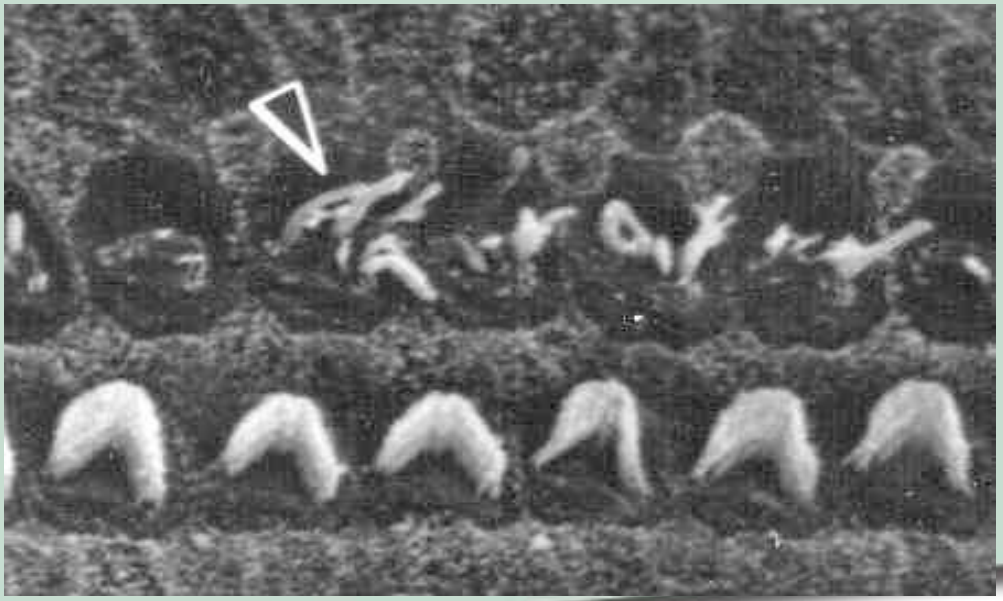
Inner Ear

- Cochlea
  - inside are nerve cells called hair cells
    - fragile
- Continuous noise
  - above 90 dBA
    - as bad for hair cells as continuous foot traffic is to grass





This is your ear.



This is your ear on noise.

Any Questions?

What is Noise?

- Noise is a physical energy that moves through the air like ripples in a pond
  - noise is directional
  - noise will bounce off walls and other objects

Two Components of Noise

- Frequency
  - perceived as “pitch”
  - measured in hertz (Hz)
  - human ear most sensitive in the 1,000 to 4,000 range
    - speech frequency ranges
- Intensity
  - perceived as “loudness”
  - measured in decibels (dB)
  - “A” scale mimics the human ear
    - used for noise surveys

How is Noise Measured?

- Sound level meter
  - instant noise readings
  - generally A scale used
    - mimics the human ear
- Noise dosimeter
  - measure a workers noise exposure over a shift
    - daily dose of noise
  - very accurate

Units of Measurement for Noise

- Decibel dB
  - *little increases on the decibel scale make a big difference*
    - a 6 decibel increase in noise is equal to doubling the intensity or loudness of the noise
- Ear protection needed
    - noise above 90 dBA
    - recommended at 85 dBA

Examples of Noise Levels

- Examples at Home
  - whispered voice - 20 dBA
  - refrigerator hum - 40 dBA
  - normal conversation - 60 dBA
  - average TV - 74 dBA
  - Blender - 80 dBA
  - lawn mower - 95 dBA
  - Leaf blower - 110 dBA
  - Chainsaw - 115 dBA

Noisy Hobbies

- Guns
  - large caliber short barrel = 130 dBA
  - shotguns & high powered rifles = 140 dBA
- Motorcycles
  - 90 dBA
- Snowmobiles
  - 120 dBA
- Woodworking
  - electric drill = 95 dBA
  - power saw = 110 dBA
  - air tools = 120 dBA
  - belt sander = 93 dBA
- Walkman headsets
  - 90 dBA
- Rock concerts
  - 140 dBA

Noise In The Workplace

- Examples at Work
  - lawn mower - 95 dBA
  - Leaf blower - 110 dBA
  - Chainsaw - 115 dBA
  - power actuated nail gun - 94 - 117 dBA
  - pneumatic hand held grinder - 101 dBA
  - air hammer - 105 - 130 dBA
  - snowplow 87 - 97 dBA
  - portable saw - 105 dBA
  - air wrench -107 dBA
  - arc welder - 116 dBA

Communication In Noisy Environments

- Hard to hear someone talking in noisy environments
  - the speaker needs to be louder than background noise
- Radios or cell phones will need to be turned up
  - if you have a hearing loss, it will be harder to distinguish speech in this environment

How Do You Know You Are Exposed to Damaging Noise

- Feel the need to shout in order to be heard 3 feet away
  - sound levels probably approaching 85 dBA
- If immediately after a period of high noise exposure
  - ringing, buzzing or whistling is noticed
- Equipment is tagged or marked as noise hazardous

How Much Noise Can You Be Exposed To?

- OSHA rules
  - 90 dBA averaged over an 8 hr shift
    - requires the use of PPE or other controls to reduce your exposure
    - earplugs must be used whenever noise is 90 dB +
  - 85 dBA averaged over an 8 hr shift
    - requires your employer to enroll you in a hearing conservation program
      - training
      - hearing tests & follow up

What is a TWA?

- This is a daily “dose” of noise not a single exposure to a noisy piece of equipment
- Your daily dose of noise (TWA) is a function of:
  - how loud the equipment is (intensity)
  - how close you are to the noise
  - how long you are exposed to the noise

Main Causes of Hearing Loss

- Heredity
- Infections
- Acustic trauma
- Prescription drugs
- Presbycusis

Types of Hearing Loss

- 2 Basic Types of Hearing Loss
  - Conductive
    - A hearing problem involving the outer ear or middle ear
  - Sensori-neural
    - A hearing problem involving the inner ear
- Mixed hearing loss
  - A problem involving the outer, middle and inner ear is a mixed hearing loss

Conductive Hearing Loss

Causes:

- middle ear infections,
- collection of fluid in the middle ear
- blockage of the outer ear (by wax),
- damage to the eardrum by infection or trauma,
- otosclerosis, a condition in which the ossicles of the middle ear become immobile because of growth of the surrounding bone,
- rarely, rheumatoid arthritis affects the joints between the ossicles.

Sensori-neural Hearing Loss

Sensori-neural hearing loss:

- age-related hearing loss,
- acoustic trauma (loud noise, etc.) to the hair cells,
- viral infections of the inner ear
- certain drugs, such as aspirin, quinine and some antibiotics, affect the hair cells,
- Meniere's disease
- acoustic neuroma (a benign – non-cancerous – tumor of the auditory nerve),
- meningitis (infection of the coverings of the brain),
- encephalitis (infection in the brain)

Tinnitus

- Hearing loss may not be silent ….
  - Persistent (often or all the time)
    - Ringing, roaring, clicking or hissing sound
  - 12 million Americans have Tinnitus
  - should be evaluated by a Dr.
  - smoking, alcohol & loud noise can make it worse
  - use earplugs whenever exposed to noise

In Addition to Hearing Loss….

- Exposure to noise can….
  - Cause increased fatigue
  - headaches
  - increase the heart rate and blood pressure
  - cause muscles to become tense
  - cause indigestion
  - can lead to impaired balance
  - make it more difficult to hear audible warning devices

Noise Induced Hearing Loss

- Entirely preventable
  - *"People would pay more attention to hearing loss if it caused a lot of physical pain"*

Audiometric (Hearing) Testing

- Required annually for those employees enrolled in a hearing conservation program
  - identifies anyone with a change in hearing
    - this is just a “screening test” and should not be used to diagnose the type or extent of hearing loss
  - testing helps determine the effectiveness of an employers hearing conservation program

Audiograms

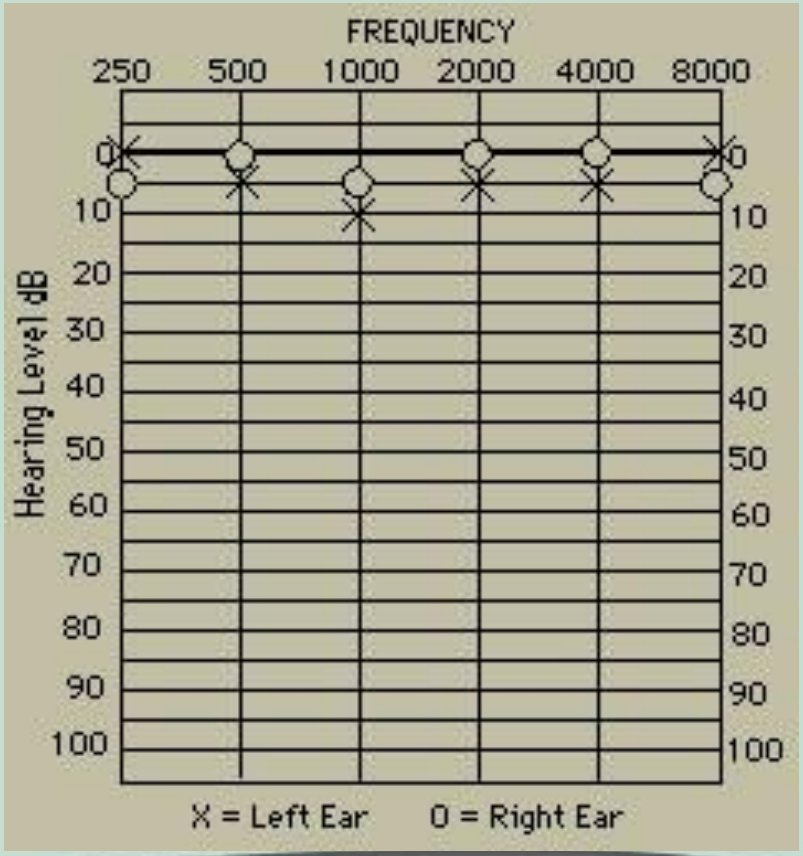
Computer generated “tape” showing normal hearing

NAME OF EMPLOYEE
TEST DATE
OTHER ID INFO

RIGHT EAR
500 HZ -> 5 dB
1000 HZ -> 10
2000 HZ -> 5
3000 HZ -> 15
4000 HZ -> 35
6000 HZ -> 25

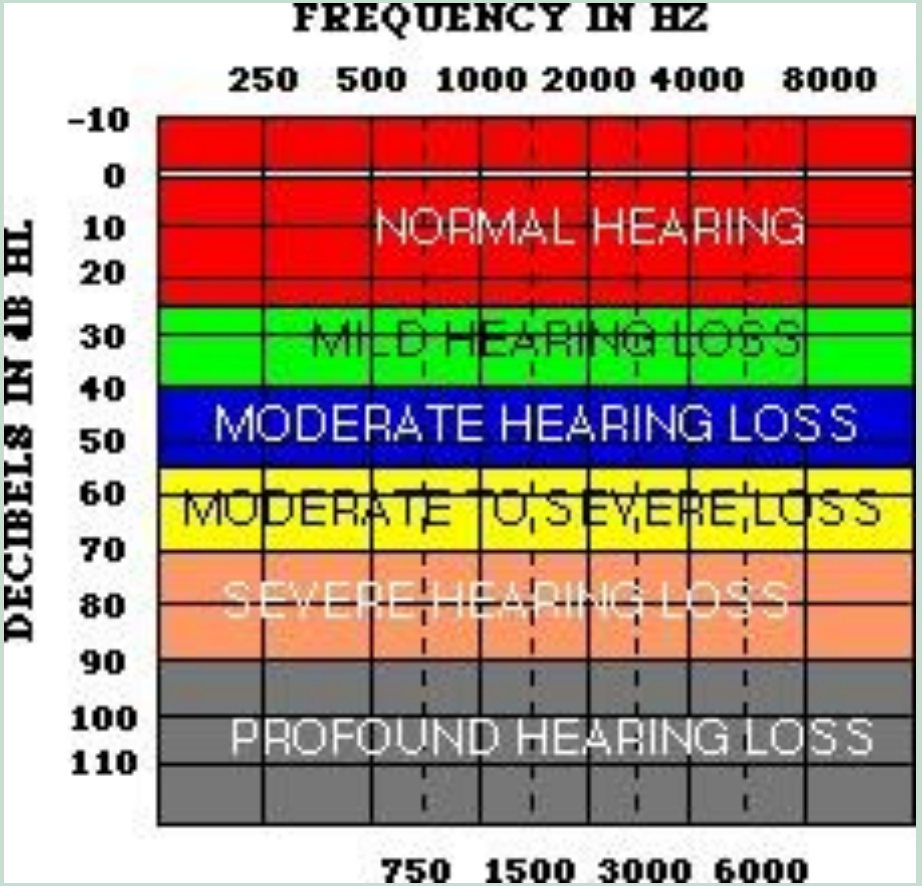
LEFT EAR
500 HZ -> 10 dB
1000 HZ -> 5
etc. etc. etc.

Computer generated graph of normal hearing

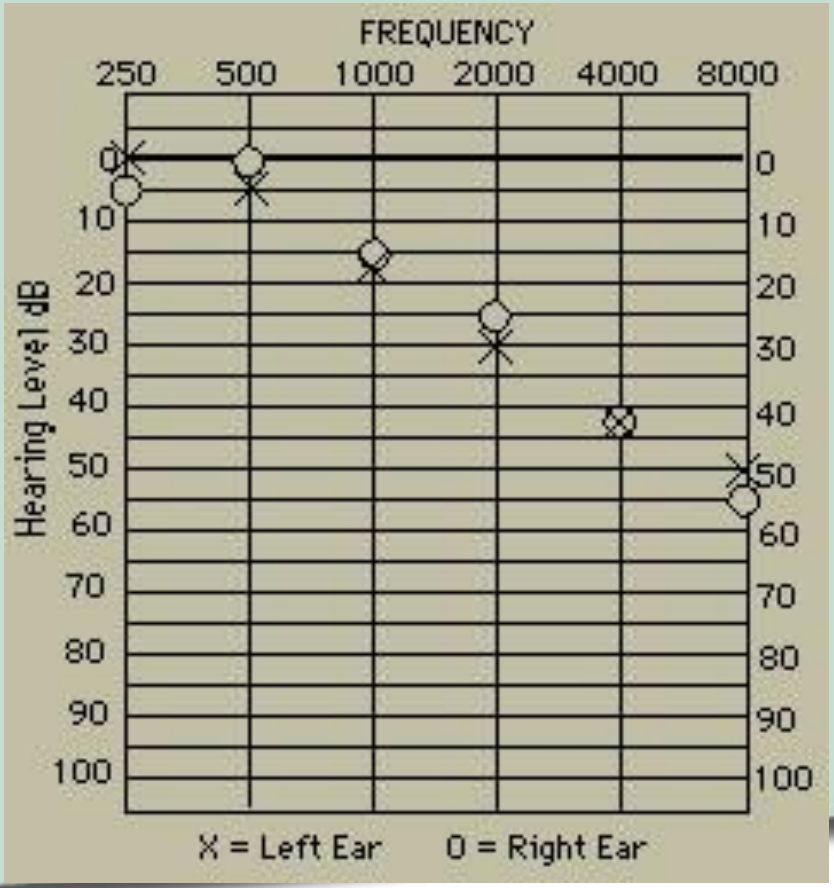


Degrees of Hearing Loss

- Normal 10 - 25 dB
- Mild 30 - 45 dB
- Moderate 50 - 65 dB
- Severe 70 - 85 dB
- Profound 90 dB



Example of hearing loss



- Have you had a STS?
  - an average shift of greater than or equal to 10 dB at 2000, 3000, 4000 Hz
  - calculated by
    - comparing your baseline test with your present hearing level

Poor Hearing Test Results?

The following can result in a bad test result:

- exposure to noise without hearing protection before the test
- failure to follow the technicians instructions
- fatigue
- substance abuse
- Tinnitus
- pseudohypacusis (faking it)

Prevention of Further Hearing Loss at Work

- *Identify noise hazardous equipment*
- Put distance between you and the noise source
- *Limit the amount of time you are exposed*
- Modify the noise source so it is quieter
- *Use hearing protection when around loud noise*

PREVENTION

Identify noise hazardous equipment:

- Measure noise sources at your job site to determine what poses a risk to hearing
  - include any equipment that produces 85 dB or greater in your inventory

PREVENTION

- Label or ID any equipment that exposes the operator to 90 dBA or more
- Always use hearing protection when working with labeled equipment

PREVENTION:

Limit the amount of time you are exposed:

- Schedule noise activities for fewest workers needed for the job
- Take breaks away from the noise hazardous area
- Limit the amount of time employees are exposed to noise

PREVENTION

Use hearing protection

- It is common for less than 50% of the employees who should be wearing hearing protection actually wear them in most industries
- If you have a hearing impairment it is critical you use them whenever you are exposed to noise
  - both on and off the job site!

HPD used - earplugs

- Earplugs
  - pre formed (latex)

  - hand formed (polyurethane or PVC)

HPD used - canal caps & ear muffs

- Canal Caps

- Ear Muffs

Noise Reduction Rating

- All hearing protection devices have a NRR assigned
- NRR's do not accurately reflect attenuation in the real world
- Field testing indicates……
  - NRR is approximately half of what is listed for earplugs
  - NRR is approximately 75% of what is listed for earmuffs

NRR's - Good Rule of Thumb

- Take the NRR on the package and divide the number by 2
- for example……
  - earplug with NRR of 30 dB most likely has a working attenuation of 15 dB
- Goal
  - select protection that will reduce your exposure below 85 dBA
- Backhoe = 93 dBA
  - earplug with a NRR of 20 so attenuation is about 10
    - 93 - 10 = 83 dBA

NRR the myth

Bigger is not necessary better

- Large NRR may not be appropriate if
  - noise levels are in the high 80 dB to low 90 dB range
    - what is needed is not an NRR of 30 dB but a well-fitted and comfortable device that can provide an actual delivered 10 or 15 dB of noise reduction
  - if the need to speak and be understood is needed in the noise environment
    - flat and moderate attenuation passive devices can be used

Flat Attenuating Devices

- Good for
  - noise exposures averaging 85 - 95 dBA as a TWA
  - environments were the spoken word needs to be heard
  - those employees with a hearing impairment

EAR UltraTech

Hearing Aids are not hearing protection

- Hearing aids do not block out enough sound for most occupational exposures to noise
- When hearing aid users are exposed to harmful levels of noise they should
  - remove their hearing aids and use hearing protection or
  - turn off their hearing aids and put ear muffs on over them

The bottom line……

- Your ears are a delicate tool - if your working with broken equipment you need to address your exposure by…
  - getting further evaluation from an audiologist; otogaryngologist; physician
  - choosing hearing protection that is right for you
  - asking for your employers help in evaluating your working environment and making changes to reduce your exposure