

# Hearing Conservation and Noise Control



# Objectives

- What is sound?
- How the ear works
- How to measure noise
- What the Regulations say about noise
- Reading hearing tests
- Hearing Protection



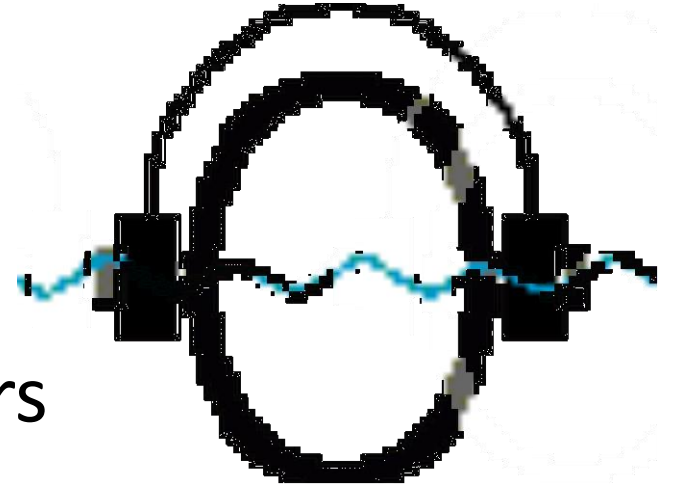
# What is Sound?

- Hertz (Hz)
  - Frequency a high or low pitch
- Decibels (dB)
  - The loudness of the sound



# Frequency

- Humans can typically hear between 20 - 20,000 Hz
- You can hear different frequencies better than others



# Decibels

- The quietest sound most humans can detect is 0 dB
- Some humans can even hear sounds as quiet as -5 dB

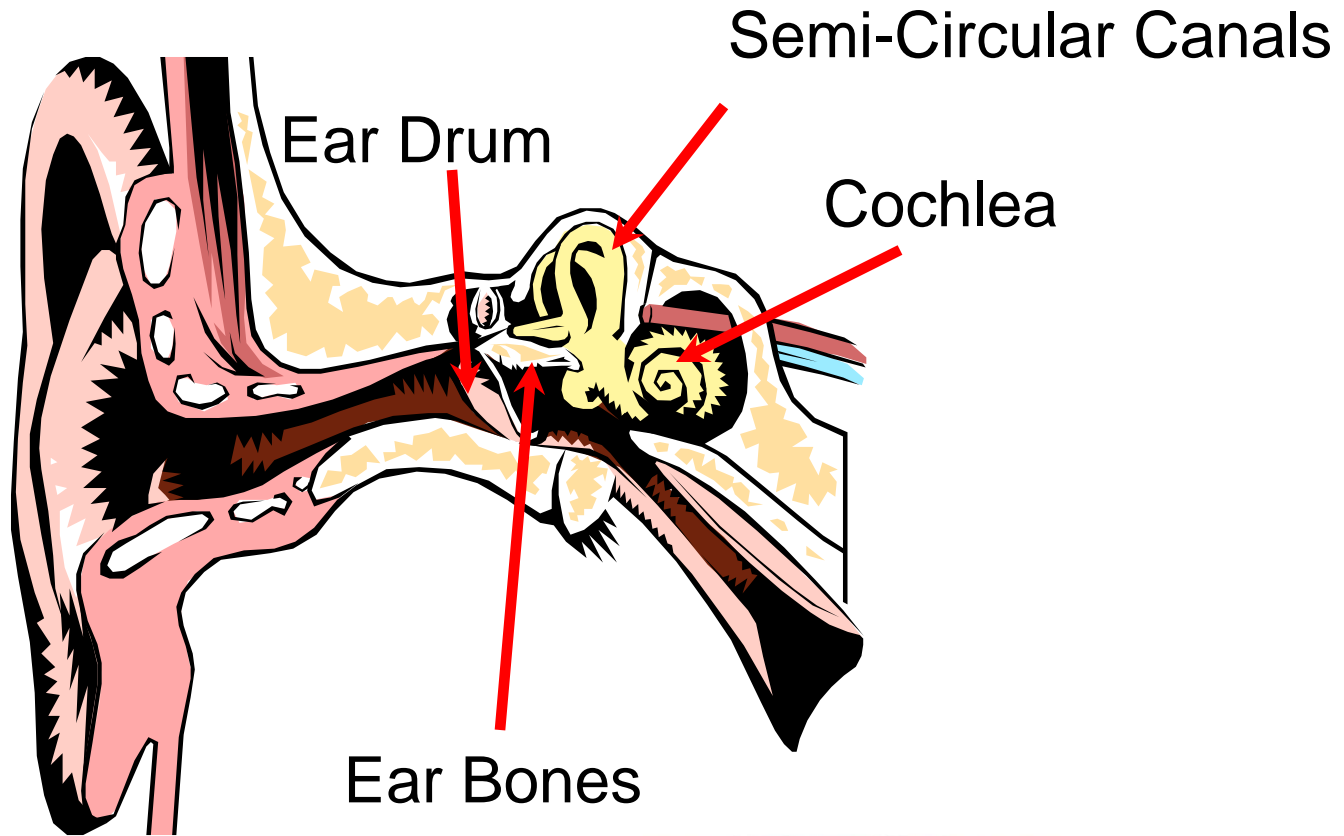


# Common Sounds

- 30 dBA Library/Soft Whisper
- 50 dBA Light auto traffic (100 ft)
- 60 dBA Conversational Speech
- 70 dBA Noisy Restaurant
- 80 dBA Alarm Clock (2 ft)
- 100 dBA Firecrackers
- 110 dBA Pile Driver or Rock Concert
- 120 dBA Jet Takeoff or Auto Horn (3 ft)
- 140 dBA Threshold of Pain or Air Raid Siren
- 180 dBA Rocket Launching Pad



# Anatomy of the Ear



# How do we Hear?

- The outer ear collects the soundwaves
- The waves hit the eardrum, and cause it to vibrate
- The vibrations are sent through the ear bones to the cochlea





# Inside the Cochlea (snail shell)

- Delicate hair cells vibrate to different frequencies
- Hair cells detect the vibration, and send a signal to the brain
- Loud sounds destroy the hair cells, and they stop functioning **FOREVER!**



# 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



# How to measure noise

- Decibels are measured on a **logarithmic** scale
- Every time you add **6 dB**, you **double** the sound pressure of the noise



# Example

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

89 dB

87 dB

- How loud is this area?
  - Do we add?
  - Do we add and take the average?



Difference in dBA 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 dB	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**
  - Determine the loudness (dB) of noise at any given moment
- **Personal Dosimeters**
  - Worn by employees
  - Measures the average loudness in an 8 hour work shift
    - “**8hr. TWA**” (Time Weighted Average)
  - Can also measure **noise dose**



# What do the Regulations Say?

- Between 80 dBA and 85 dBA
  - Inform workers of the hazards of the level of noise
  - On the request of the worker, provide hearing protection



# What do the Regulations Say

- Over 85 dBA
  - Implement sound control measures that reduce the noise to which the worker is exposed to 85 dBA or less or
    - Inform workers of the hazards of the level of noise
    - Provide hearing protection that reduces the exposure to below 85 dBA
    - Provide the worker with annual audiometric tests which begin with a baseline within 70 days of exposure





# What are Our Noise Levels?



# Hearing Tests

- We test your hearing every year to **determine if you have experienced a hearing loss (Standard Threshold Shift)**
- Standard Threshold Shift is a **change in hearing threshold relative to the baseline audiogram of an average of 10 db or more at 2000, 3000, and 4000 Hz in either ear.**



# 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



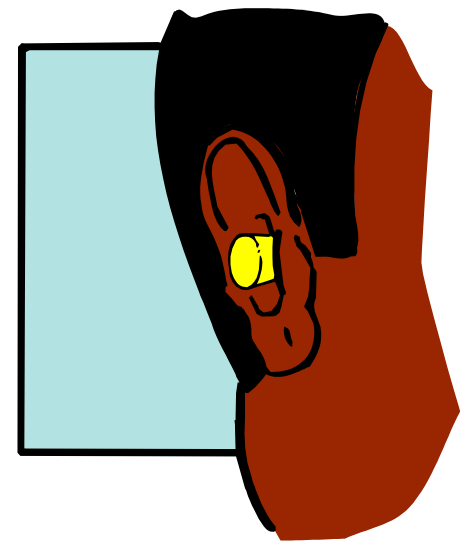
# Hearing Loss



- Impact - One loud bang
- Cumulative - Years of a noisy environment
- Tinnitus - Ringing in the ears
- Presbycusis - Hearing loss due to aging



# 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** ( $109 \text{ dB} - 25 \text{ NRR} = 84 \text{ dB}$ )
- You must use the “**Safety Factor**”



# Safety Factor

- 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

• **(NRR - 7) / 2**



# 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?



# Hearing Protection at our Facility/Site/Program

- Type
- Limitations
- Cleaning
- Where, when, why and how they should be used
- When do I need new equipment
- Where do I get equipment
- What do I do if I have problems with the equipment, I.e. fit, allergy, etc.





# 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

