

# RSI Day 2006

## Noise:

### Its Effects and Methods to Reduce Exposure

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**Occupational Health Co-ordinator**



# The “Unfair” Hearing Test

- Listen to the following 10 words and write down what you hear.

The Rehabilitation Centre (2006)



# The “Unfair” Hearing Test - Answers

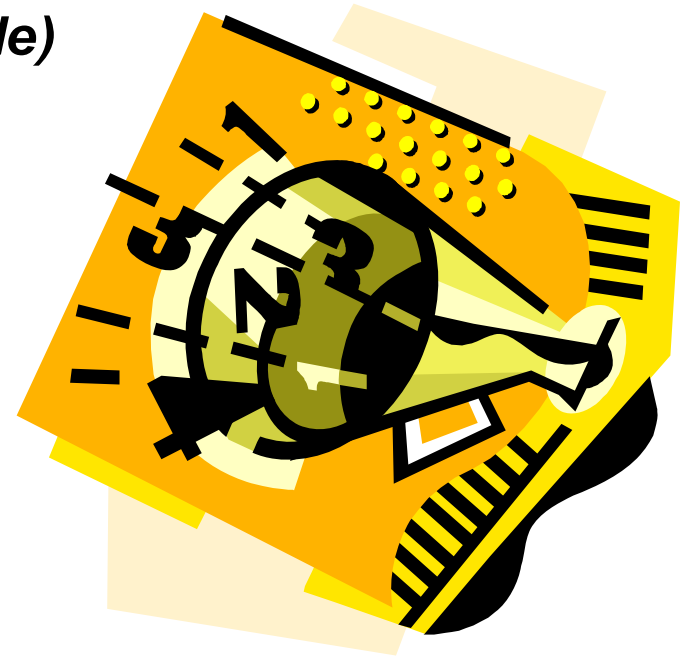
## How did you do?

1. Fill
2. Catch
3. Thumb
4. Heap
5. Wise
6. Wedge
7. Fish
8. Shows
9. Bed
10. Juice

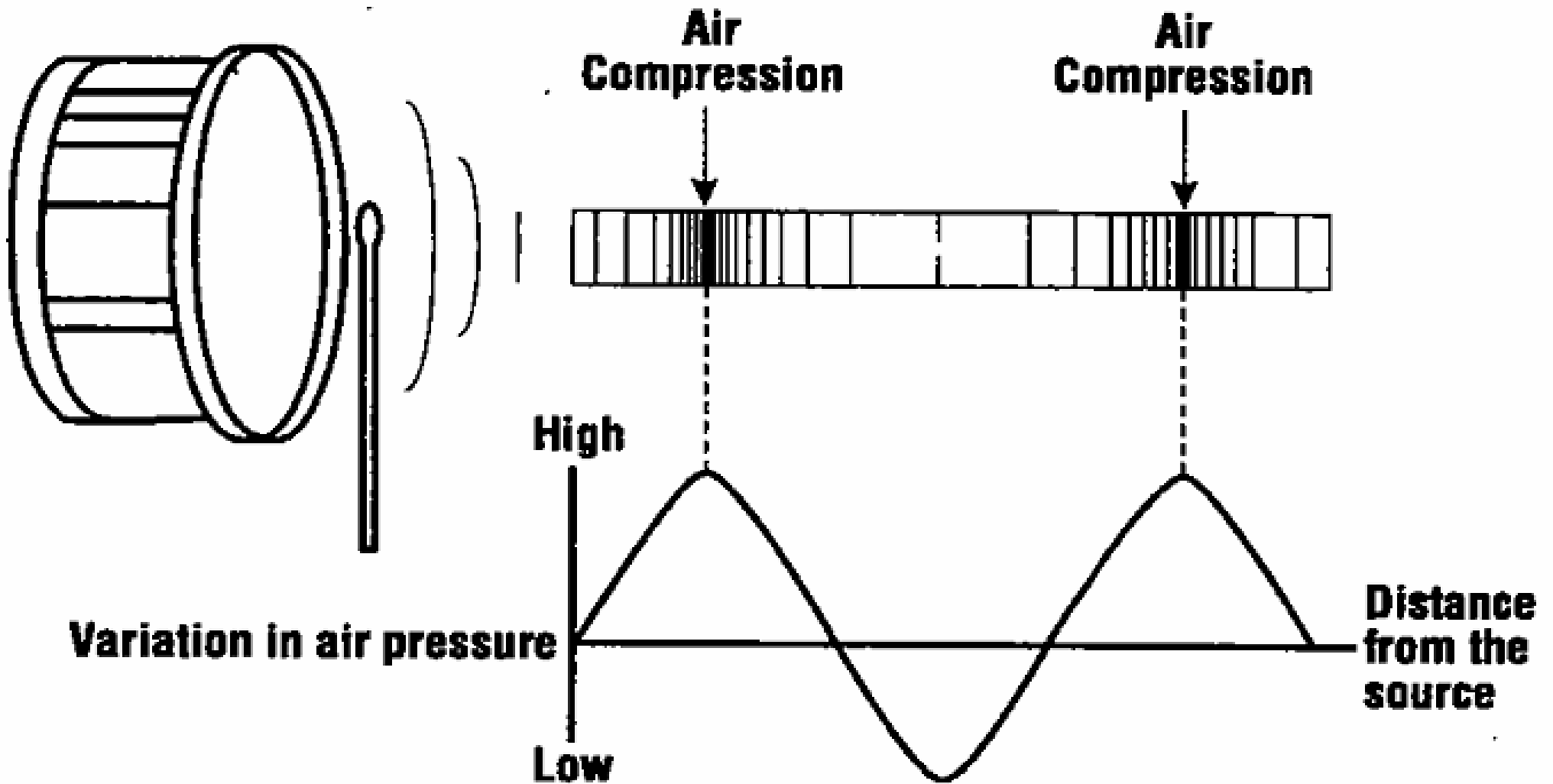


# What is Noise?

- **Unwanted sound** (*loud, disagreeable*)
  - **Created by vibration**
    - **Sources**
      - Environmental
      - “Leisure”
      - Occupational
- **Spreads through air and other materials**



# PRODUCTION OF SOUND WAVES



(CCOHS, 2005)

Occupational Health  
Clinics for Ontario  
Workers Inc



Centres de santé  
des travailleurs (ses)  
de l'Ontario Inc.

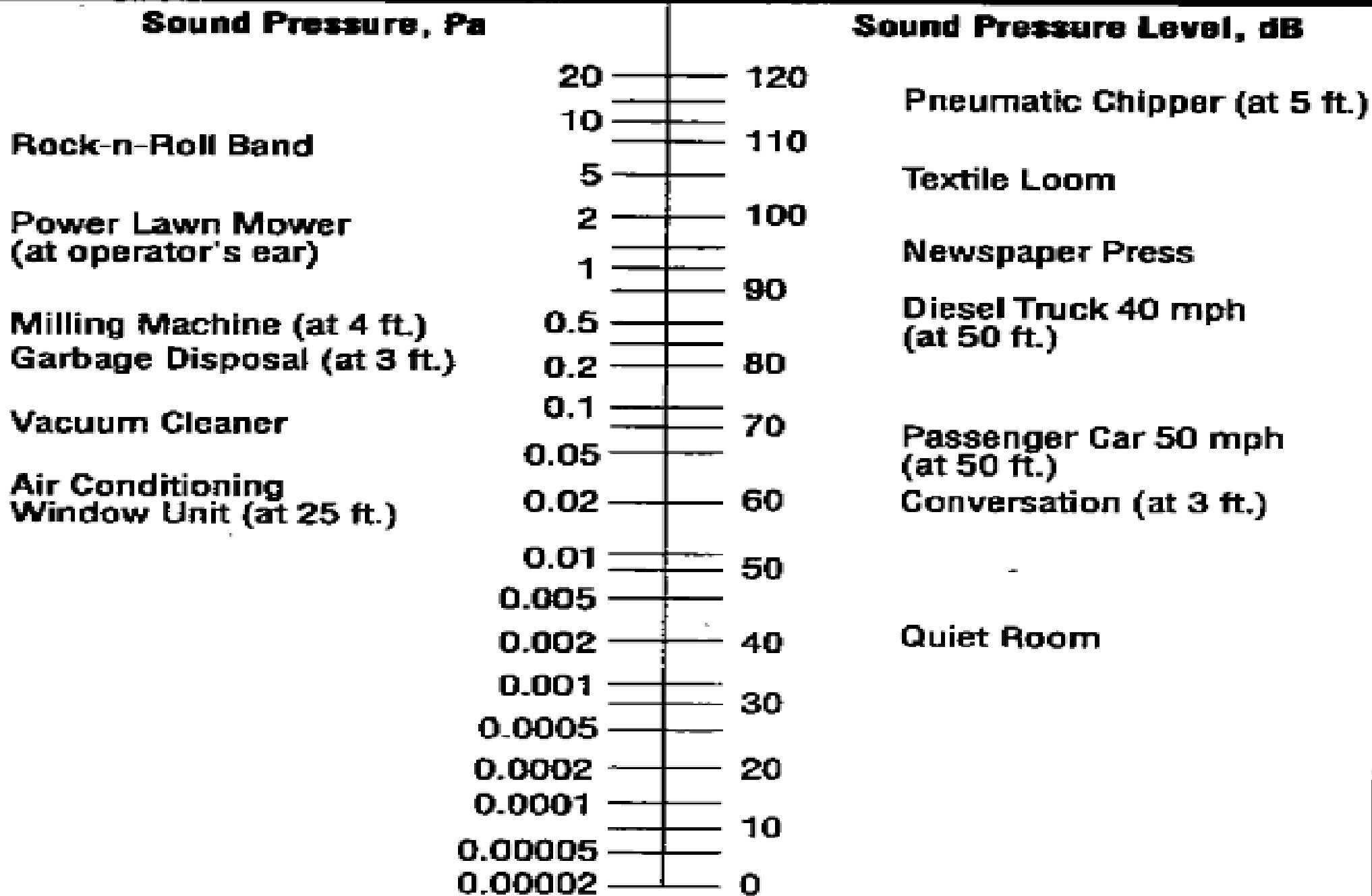
# How is it measured?



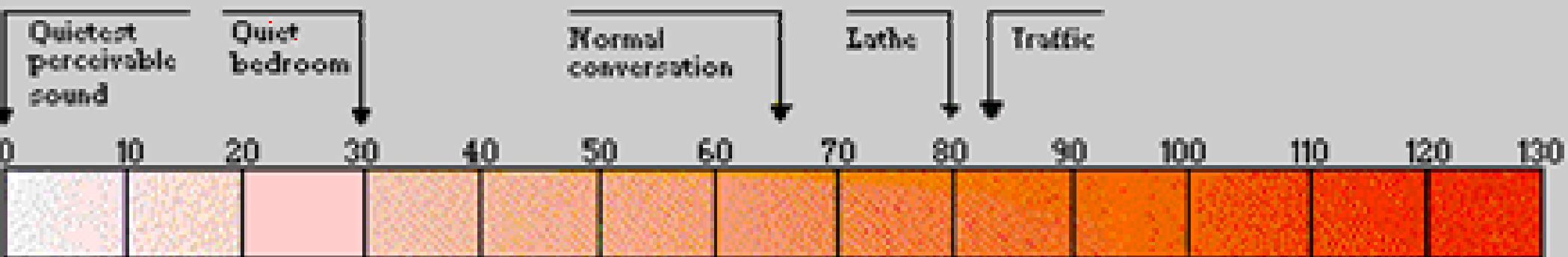
- **Frequency (Pitch) –**  
Sound waves per second  
- Hertz (Hz)
- **Amplitude (Loudness) –**  
Loudness of sound depends on Sound Pressure  
– Decibel (dB)



# A COMPARISON OF SOUND PRESSURE AND SOUND PRESSURE LEVEL



# The Decibel Scale *Some typical sound levels*



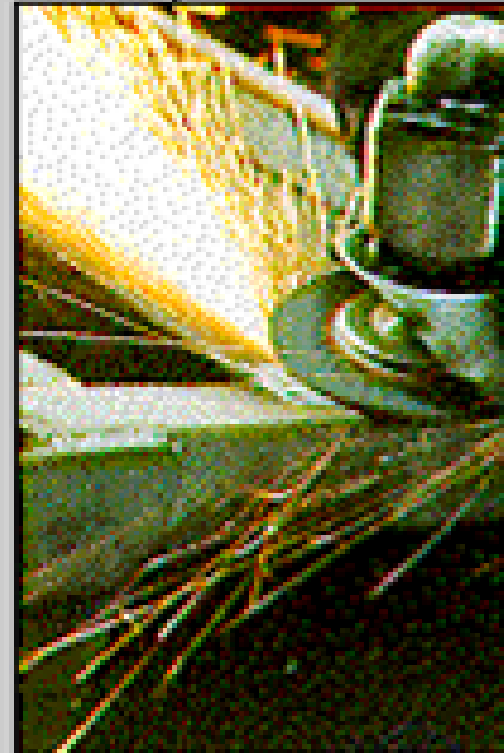
Front end loader



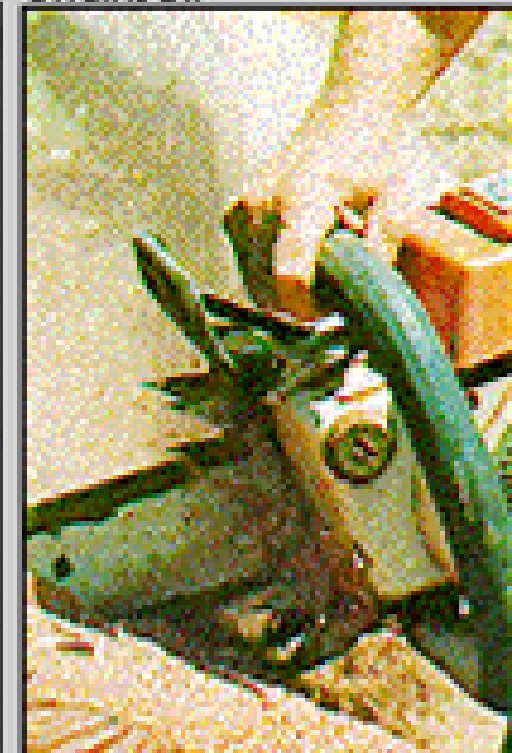
Lawn mowing



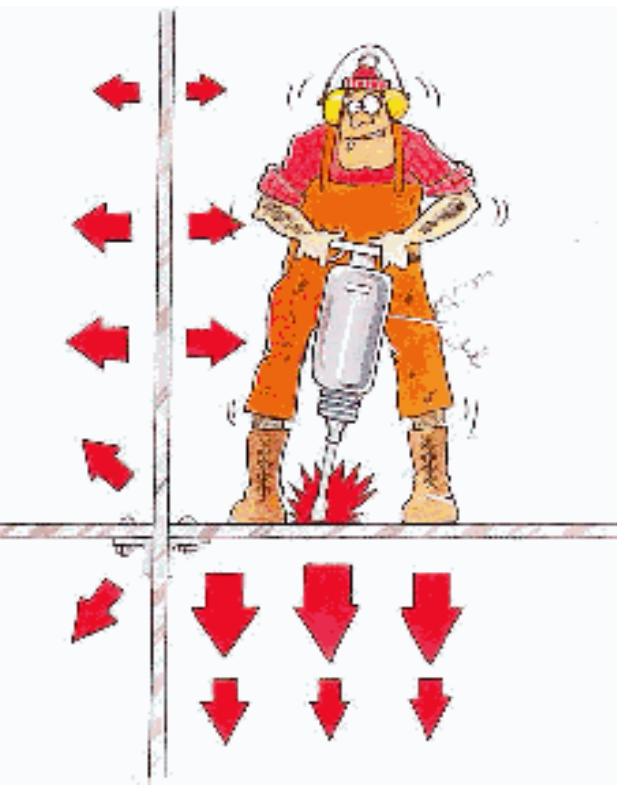
Grinding



Chainsaw



# Types of Noise (Time Distribution)



- **Continuous**
- **Intermittent**
- **Impulse/Impact**
- **Fluctuating**



# A-weighting Decibels

- **As perceived by human ear**
- **Referred to as dB(A)**
  - **Legislation gives exposure limits in dB(A)**



# General Rules

**SPL is related to the sound energy entering the ears of the exposed person.**

- **3 dB increase - sound energy doubles**
- **3 dB decrease - sound energy halved**
  
- **10 dB ↑ - sound energy increased by factor of 10**
- **20 dB ↑ - sound energy increased by factor of 100**

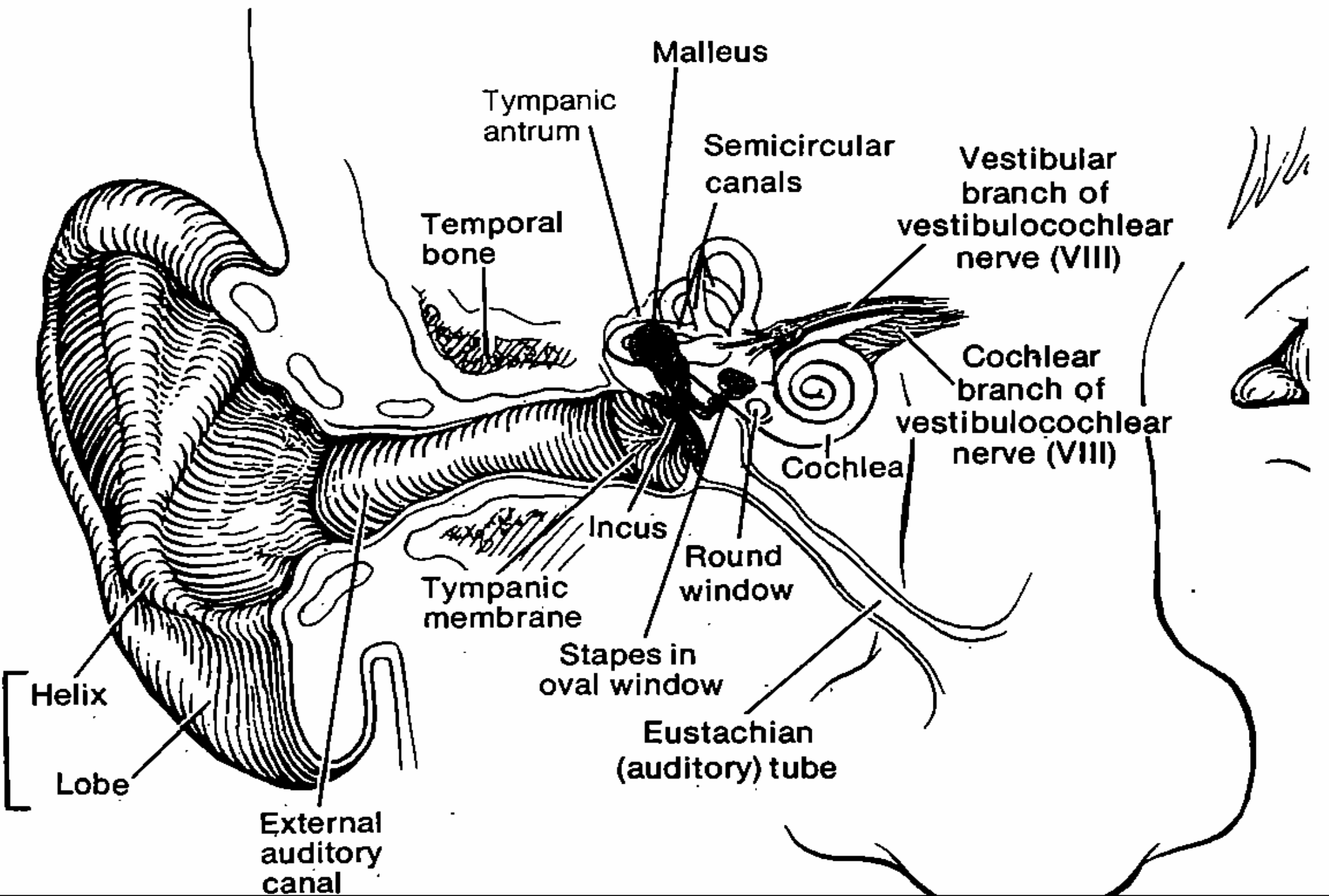


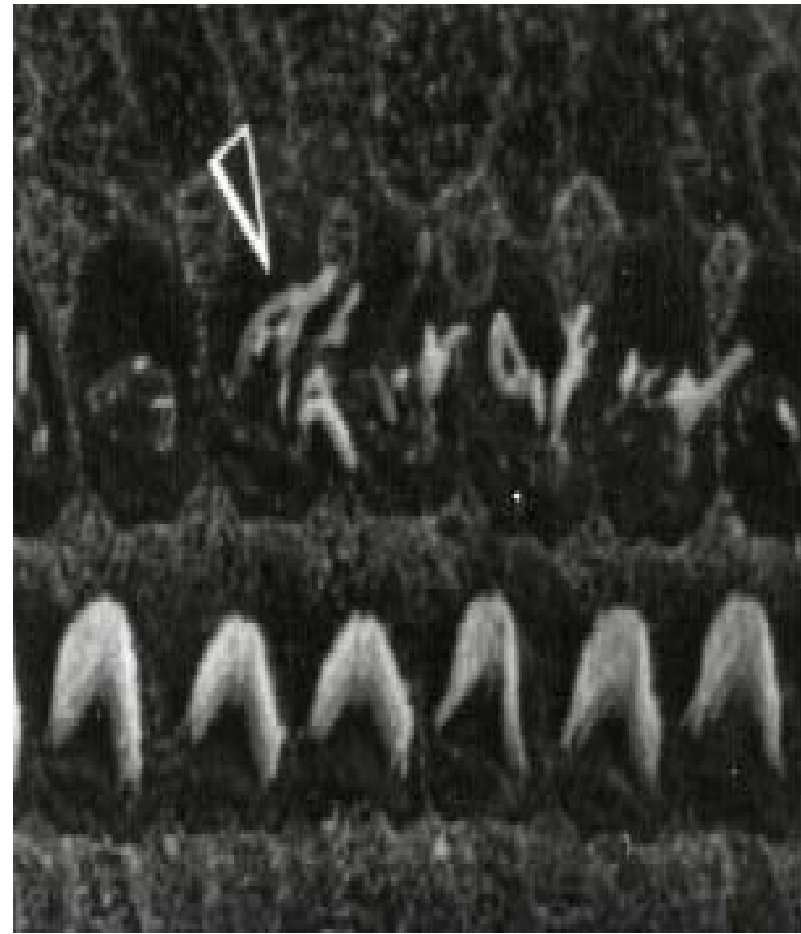
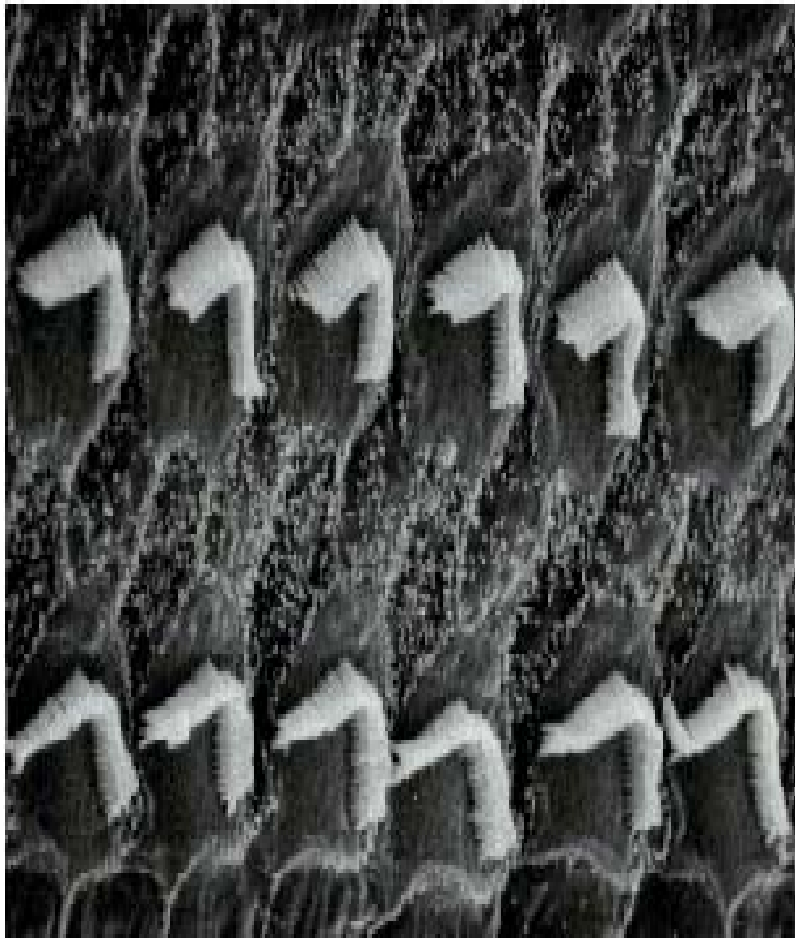
# Health Effects

## Auditory

- Acoustic trauma
- Temporary hearing loss
- Tinnitus
- Permanent hearing loss







# Health Effects (2)

## Non-Auditory

- **Stress (physiological and psychological)**
- **Cardiovascular (new studies)**
- **Performance**
  - Annoyance
  - Interference
  - Decreased productivity
- **Safety**



# Causes of Hearing Loss

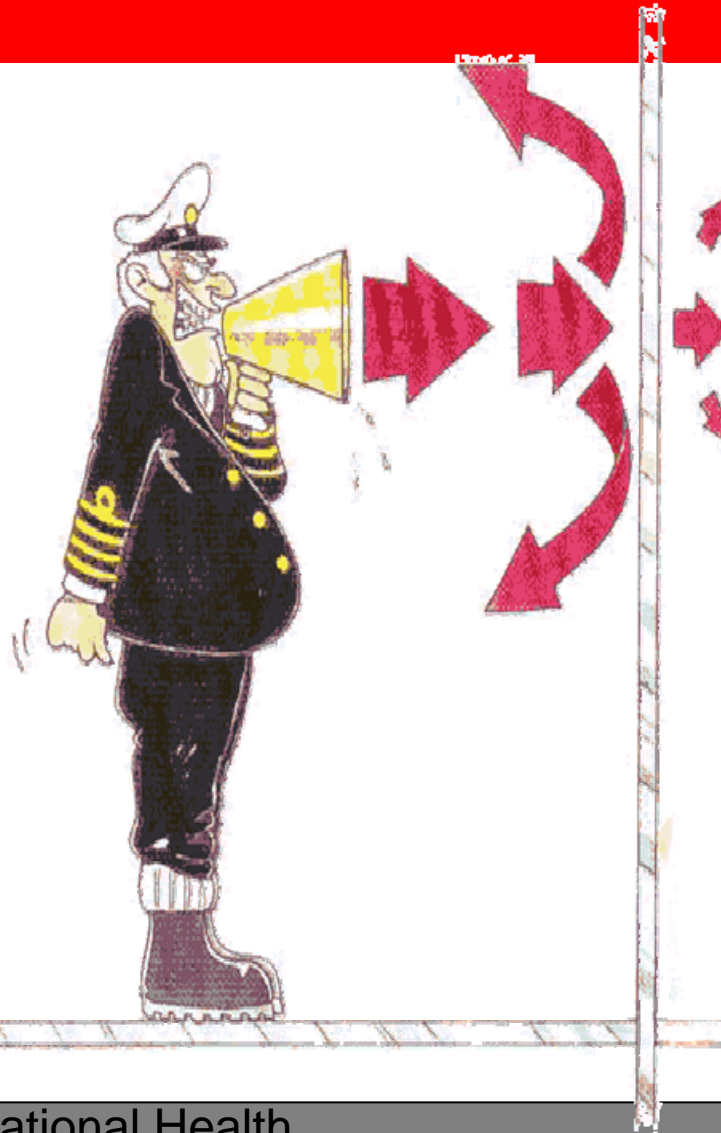
- **Noise**
- **Vibration (whole body, hand-arm)**
- **Exposures to chemicals**
  - Toluene, benzene, solvents
- **Metals**
  - Lead, arsenic, tin
- **Aging**
- **Medications**
- **Diseases**



**> Combined exposures should not be overlooked.**



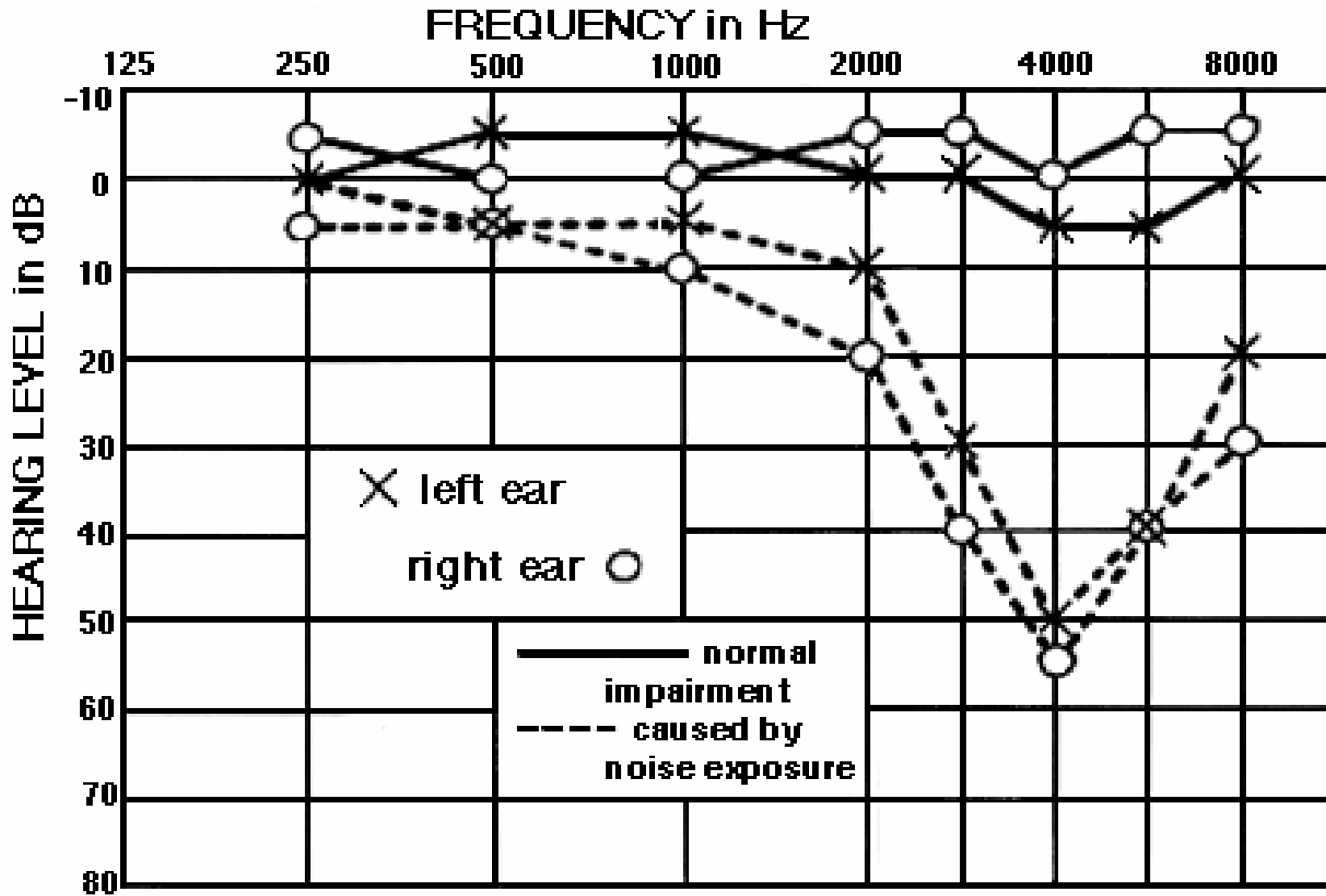
# Noise Induced Hearing Loss (NIHL)



- **Typical pattern noted on an audiogram (4000 Hz)**
- **History of noise exposure**
- **Absence of other conditions that cause hearing loss**

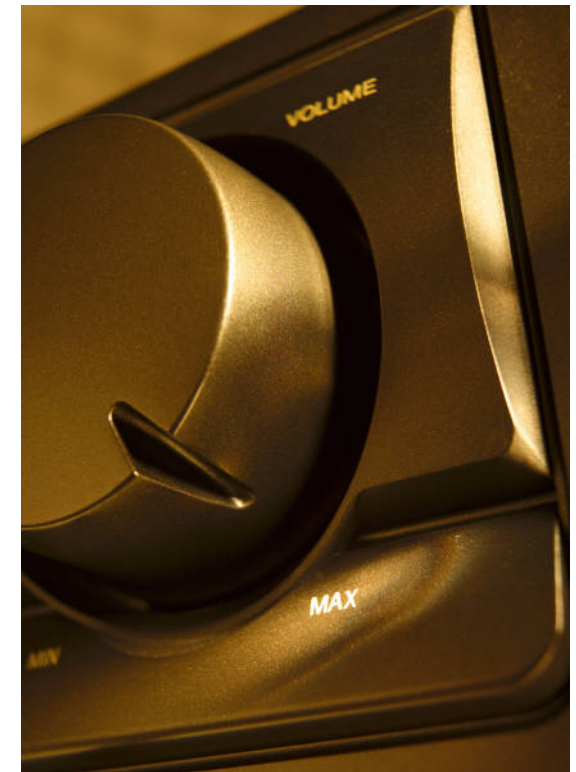


# Audiogram



# Recognizing Hearing Loss

- **Trouble hearing on phone**
- **Trouble with more than one person talking**
- **TV too loud for others**
- **Trouble hearing in a noisy environment**
- **Ask people to repeat themselves**
- **Misunderstand what people say**
- **Strain to understand a conversation especially women or children**



OEL's	Continuous Noise		Impulse Noise	
	Max. 8 hr dB (A)	Exchange Rate	Max. Peak	Max. #
Canada	87	3	--	--
BC	85	3	140	--
Alberta	85	5	140	100
Manitoba	90	3	--	--
<b>Ontario</b>	<b>90 (85)</b>	<b>5(3)</b>	<b>--</b>	<b>--</b>
Nova Scotia	85	5	140	100
USA - OHSA	90	5	140	100
ACGIH NIOSH	85	3	140	--



# Limits when Criterion Level = 90 dB (A)

<b>3dB exchange rate</b>	<b>Maximum Permitted Daily Duration (hours)</b>	<b>5dB exchange rate</b>
<b>Allowable dB(A)</b>		<b>Allowable dB(A)</b>
90	8	90
93	4	95
96	2	100
99	1	105
102	0.5	110
105	0.25	115



# Limits when Criterion Level = 85 dB (A)

3dB exchange rate	Maximum Permitted Daily Duration (hours)	5dB exchange rate
Allowable dB(A)		Allowable dB(A)
85	8	85
88	4	90
91	2	95
94	1	100
97	0.5	105
100	0.25	110



# What can be done?

- **Noise Monitoring**
- **Noise reduction**
  - **Engineering**
  - **Administration**
  - **Personal Protection**
- **Hearing Conservation Program**



# Noise Monitoring

- **Identify workers exposed to high levels of noise, locations where there are noise problems.**
- **Identify locations, equipment, workers in need of controls.**
- **As part of ongoing noise assessment.**
  
- **Noise survey**
- **Personal vs. Area**



# Noise Monitoring Instruments

- **Sound Level Meter**
- **Integrated Sound Level Meter**
- **Dosimeter**



# Engineering Controls

- **Eliminating or reducing noise levels.**
  - **At the source**
  - **Along the transmission path**



# Engineering - *at the source*

- **Reduce height of fall**
- **Cushion impact**
- **Use non-metallic materials**
- **Reduced impact over longer time**
- **Minimize overshoot, backlash, loose play in cams, followers, gears linkages etc.**
- **Reduce machine speed, fluid flow and pressure**



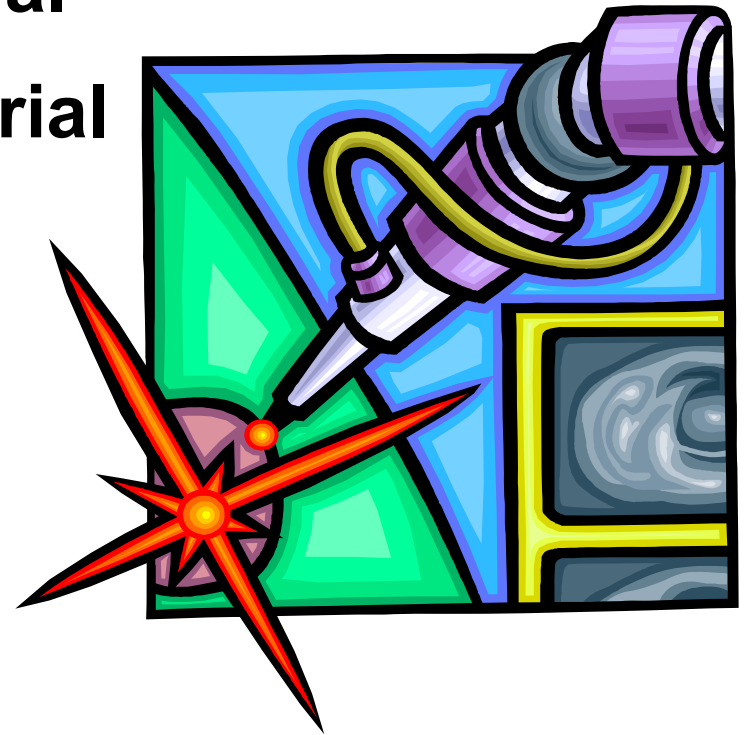
# Engineering - *at the source* (2)

- **Balance rotating parts**
- **Reduce friction**
- **Reduce resistance**
- **Isolate/dampen vibration**
- **Reduce noise leakage from inside machines**
- **Mufflers**



# Engineering - *along the path*

- **Sound absorbing material**
- **Sound attenuating material**
- **Absorb**
- **Deflect**
- **Contain/enclose**



**Maintenance is key in reducing sound levels.**



# Administrative Controls

- **Reducing worker exposure to noise.**
  - **Changes to work schedule or operations**
  - **Limiting number of workers to areas**
  - **Non-noisy areas**



# Personal Protective Equipment

- **Hearing protection**
  - **Should be the last line of defence**
  - **115 decibels in Ontario**
  - **Noise Reduction Ratings**



# Noise Reduction Ratings (NRR)

- Based on dB(C) weighting
- If using dB(A) measurements
  - Effective = measured – (NRR-7)
- Maximum obtained in controlled laboratory
- NIOSH de-rating for user fit data
  - Muff's – subtract 25%
  - Formable earplugs – subtract 50%
  - All other plugs – subtract 70%
  - Double PPE – 5 dB higher than the better protector



# Ear Plugs

- **Compressed down and expand in ear**

- **Foam Plugs**

- expandable foam, disposable, inexpensive, easy to carry
- typically one size fits all



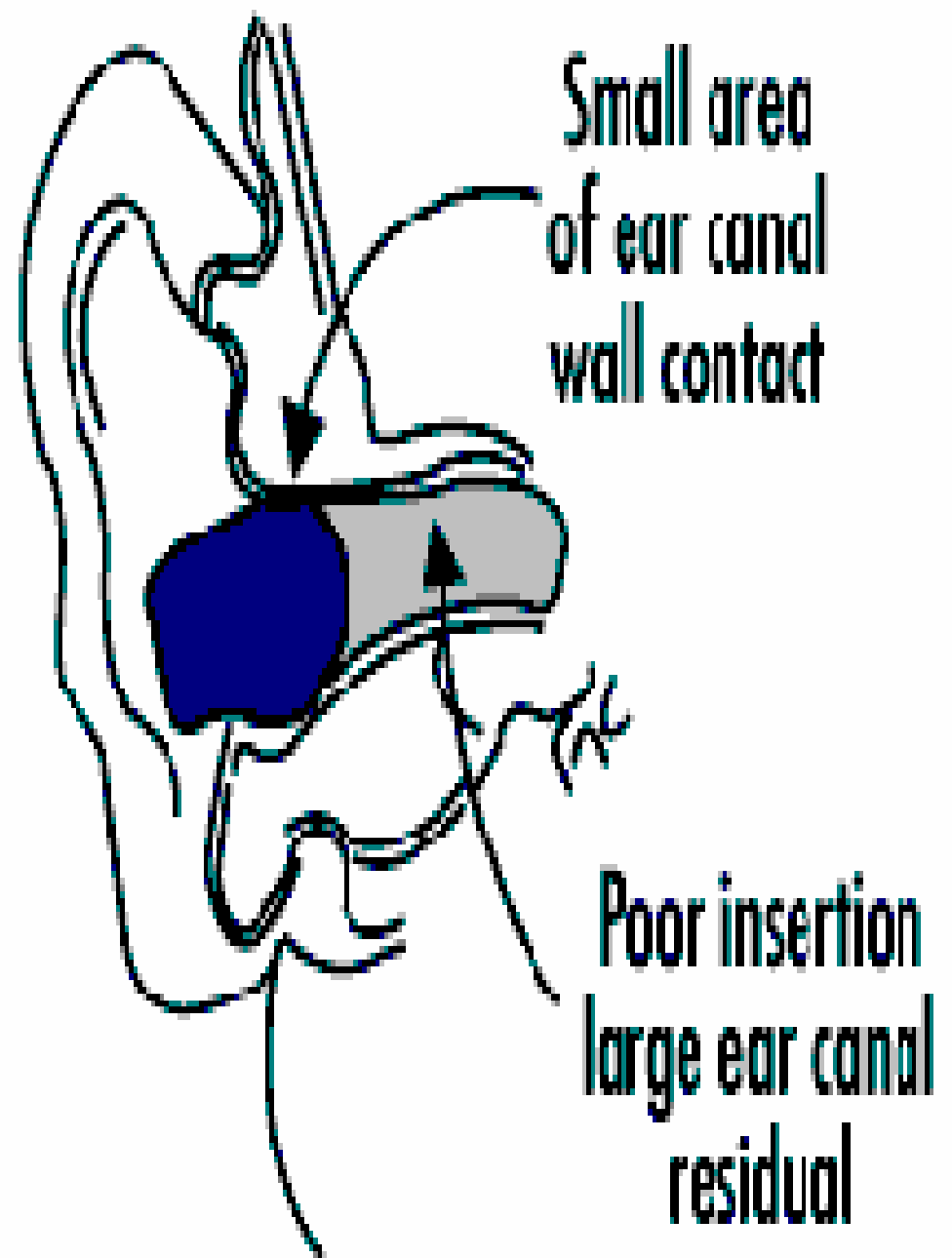
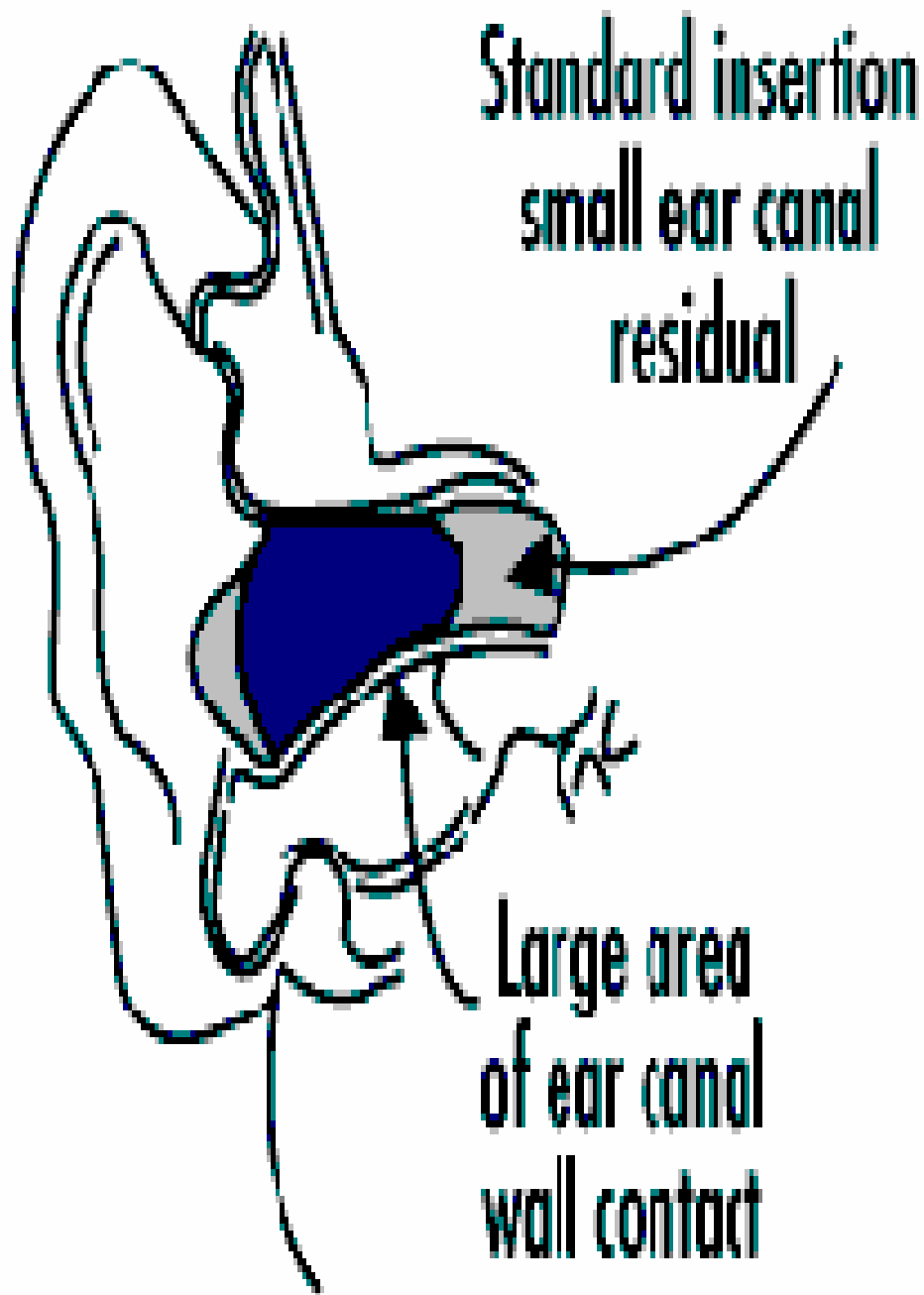
- **Pre-molded Plugs**

- as above (disposable, reusable, washable)
- single flange/multiple flanges, multiple size



**Disadvantage: difficult for some to insert, needs healthy ear canal, easily soiled**

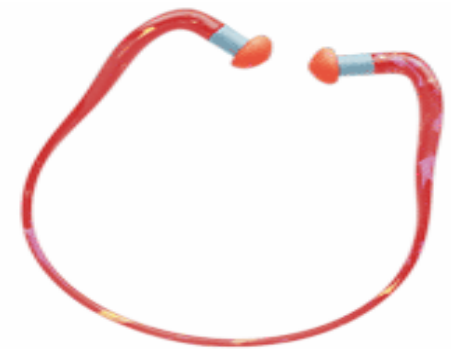




- Source: Encyclopaedia of Occupational Health and Safety, 4th Edition (1998).

# Semi-Inserts

- **Form a seal around entrance to ear canal**
- **Do not penetrate as deeply and therefore, come out of ears easily**
- **Attached with metal band that is spring-loaded**



→ QB3<sup>®</sup>-HYG



# Ear Muffs

- 2 insulated plastic cups attached to metal or plastic band, provide a good seal around each ear with soft cushions
- Worn separately or with plugs
- Multiple sizes, types, easy to put on & position

**Disadvantages: uncomfortable in hot/close quarters, poor seal with glasses and some facial shapes, expensive**



→ **Leightning®**



→ **LM-7H™**



# Remember...

**The best hearing protection is the one  
the employee will wear  
*consistently and correctly!***



# Hearing Conservation Program (HCP)

- Noise measurement
- Education and training
- Noise control
- Hearing protection
- Posting of noise hazard areas
- Hearing tests
- Annual program review

**WARNING!**

**Noise Area**

**Use of hearing protection  
required.**



# Summary

- **Noise as an RSI**



# Thank you for your attention

Thank you for your attention.

If you have any questions about ergonomics or any other occupational health concern contact OHCOW at:

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