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# Hearing Conservation



## FERMILAB

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## Objectives

- Anatomy and Physiology of the Human Ear
- What is considered hazardous noise
- Sound level measurement
- How noise effects the ability to hear
- The Elements of Fermilab's Hearing Conservation Program
- Ways to protect your hearing
- Q & A

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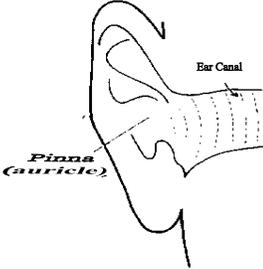
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## Outer Ear



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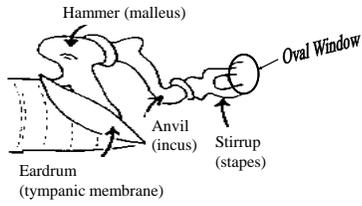
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## Middle Ear



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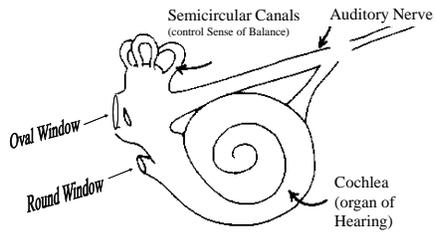
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## Inner Ear



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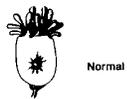
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## Nerve Cells



Normal



Damaged

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## Threshold Limit Values for “Continuous” Noise

T, Duration per Day (hours)	SPL Sound Pressure Level (dBA)
24	80
16	82
8	85
4	88
2	91
1	94
½	97
¼	100

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## Sound level measurement

- Sound level meter (SLM)
- Noise Dosimetry

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## Typical A Weighted Sound Levels

- 80 Vacuum Cleaner
- 70
- 60 Conversation at 1 m
- 50 Urban Residence
- 40
- 30 Soft Whisper at 2 m / Rice Krispies
- 20 North Rim of Grand Canyon
- 10
- 0 Threshold of Hearing (1000Hz)

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## Typical A Weighted Sound Levels

- 140      **Threshold of Pain**
- 130
- 120      **Jet Takeoff at 100 m**
- 110      **Rock Concert**
- 100      **Jackhammer at 15 m**
- 90        **Drilling Concrete**
- 85        **Heavy Truck at 15 m**



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## Typical A-Weighted Sound Levels

- 80      TORO Ground Master 72 Riding Mower (87 dBA)
- 70      Personnel Dosimetry Results (near compressors and performing some grinding operations (73dBA-77 dBA) IB-1 Shop Area (68dBA-70dBA) During Drilling Operations
- 60
- 50
- 40
- 30      Lab Audiometric Testing Booth (< 25 dBA)
- 20
- 10



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## Typical A-Weighted Sound Levels

- 140      Threshold of Pain
- 130
- 120
- 110      Testing of Fire Alarm System in FCC
- 100      MRRF - F0 Compressor Room  
          CHL Nitrogen Plant
- 90        TORO Grounds Master 322-D Riding Mower  
          TORO TV5004 Master Push Mower  
          CUB                      Lab D Compressor Room  
          CDF A/C units          CHL Chiller Room



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<u>Time Weighted Average Exposure (dBA)</u>	<u>Employee Population Experiencing Hearing Loss (%)</u>
< 80	0
80	5
85	10
90	20
100	~100
>100	100

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### Effects of Hearing Loss

- Everybody Mumbling
- Communication with people
- Tinnitus

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### The 4 P's of Hearing Loss

- **Progressive**
- **Painless**
- **Permanent**
- **Preventable**

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## Fermilab Hearing Conservation

- Annual Training
- Annual Audiometric Testing
  - Baseline Hearing Test
  - Annual Hearing Test
  - Medical Department
- Accessibility to Hearing Protection
- Sound Level Measurements/Audiosimetry



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## Hearing Protection Devices (HPD)

- Ear Muffs
- Ear Plugs
  - Pinna Pull
  - Roll and Fit
- Occlusion Effect
- Hear better in louder environments



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## Q & A

- How can I tell when a noise may be harmful to my ears?
- I don't need hearing protection, I am used to the noise!
- Do earmuffs block out noise better than earplugs?



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## Q & A

- I've already lost some or most of my hearing: why should I have to wear hearing protection?
- What is the Noise Reduction Rating and what does it mean?

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## Summary

- Anatomy and Physiology of the Human Ear
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