

# Training Program for Health Protection in the Mining Industry



## *Module I* *Protect Your Hearing*



# Training Program for Health Protection in the Mining Industry

## *Protect Your Hearing*



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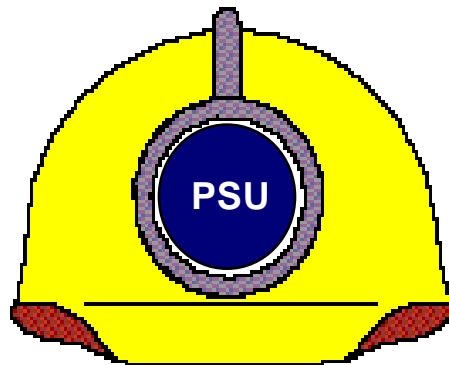


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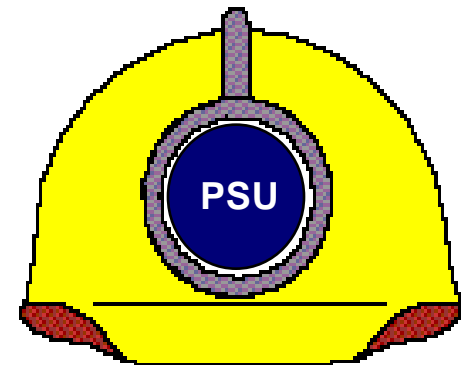
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# **Module I**

## **Protect Your Hearing**

# Introduction

Hearing is a precious sense!

The ear is a brilliantly designed organ that converts sound waves in the air into nerve impulses that reach the brain

We often take our ability to hear for granted. After all, it's not something that we can turn on or off

Hearing is like breathing, we do it automatically

# Some sounds we hear are pleasant

- Your baby saying “Mama” or “Dada” to you for the first time
- A deer coming through the woods on the first day of buck season
- A nice song on the radio while you are lying in your hammock



# Some sounds we hear are unpleasant

- The screech of brakes!
- Fingernails running across a chalkboard!
- Your neighbor's loud stereo at 2:00 A.M.!



Noise  
is  
unwanted  
sound



Exposure to  
too much noise  
can cause you to  
lose your hearing!

We do not get used  
to loud noises,  
we only lose our  
ability to hear  
them adequately!

If you think that  
you can get used  
to loud noises,  
you are only  
fooling yourself!

# Noise sources that can cause hearing problems exist at both home and work

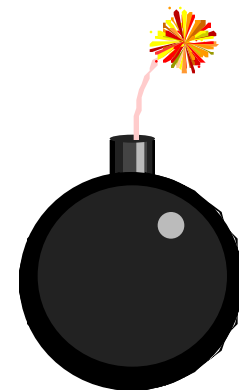
## Noise sources in the home

- Loud music
- Lawn and garden tools



## Noise sources in the workplace

- Running machinery
- Explosives



# Examples of Noise Sources in the Mining Industry

Roof Bolting Machines

Explosives

Mobile Equipment

Hand Tools

Ball Mills

Crushers

Drills

The idea of this program is to help you become more aware of

- What sound is
- How we hear
- How too much noise can affect your ability to hear
- What can be done to control noise

The bottom line is:

We only get two ears.

It is up to us to  
take care of them!

The more aware you are  
of noise hazards,  
the better chance you  
have to protect your  
own precious sense of  
hearing, and pass on  
what you know to your  
coworkers and family.



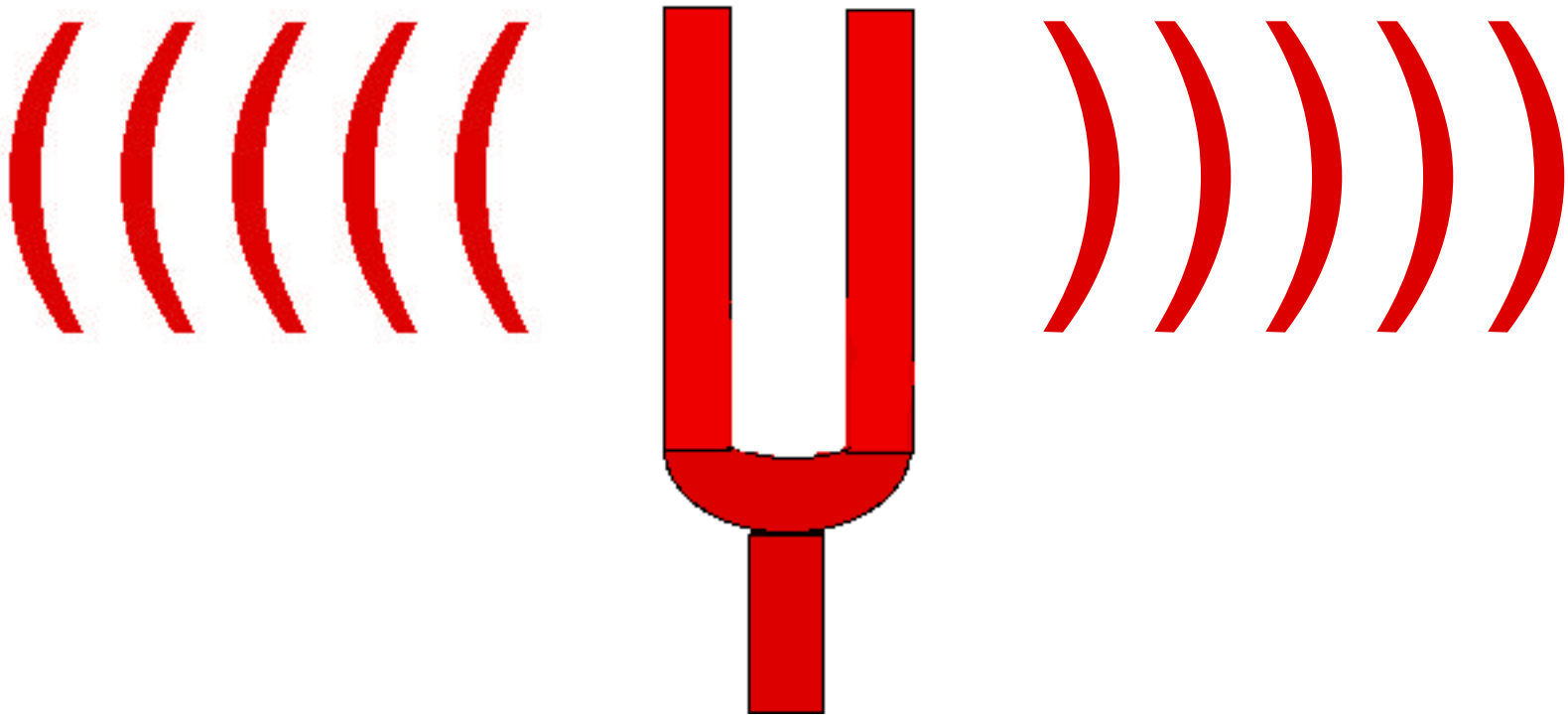
# On with the show!



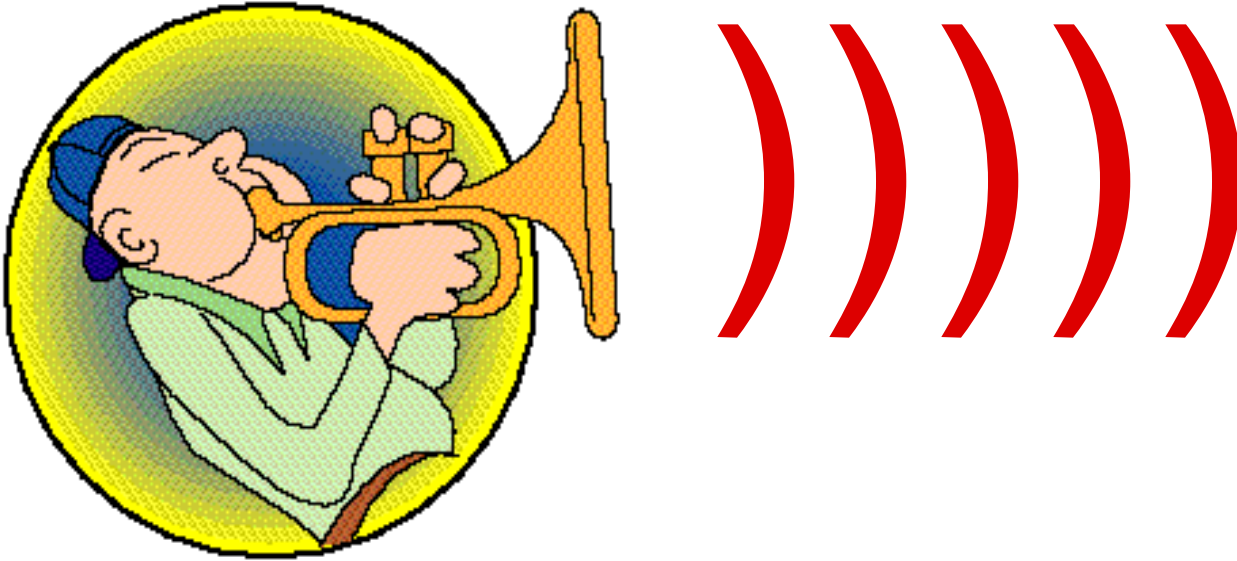
# Basics of Sound and Noise

Sound is vibrating energy

Sound is created when something moves back and forth rapidly, and causes vibrations in the air

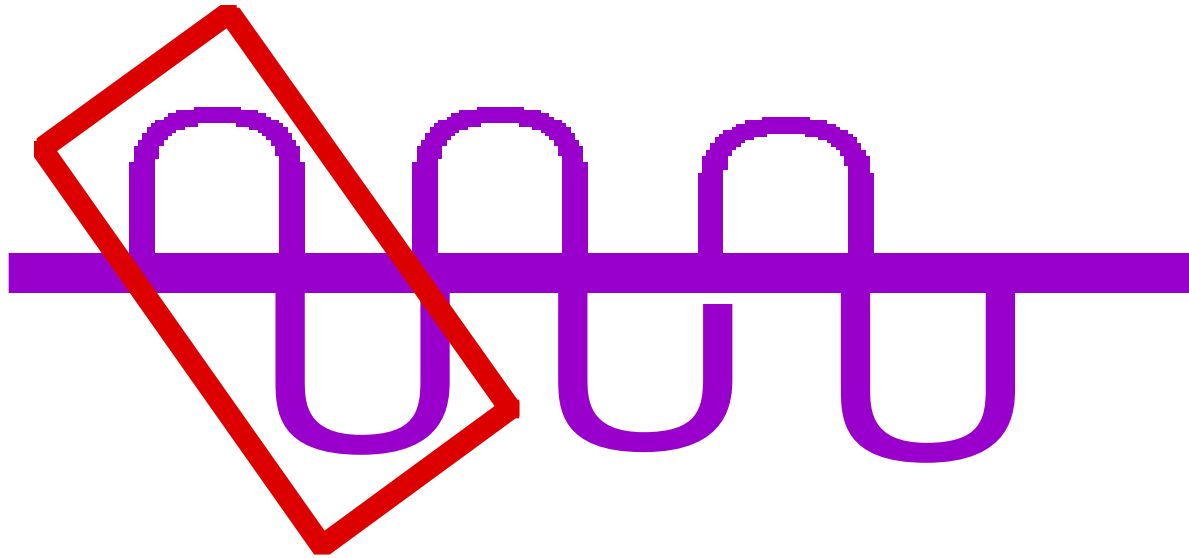


The waves in the air cause rises and drops in air pressure



Sound waves can be measured

One full rise and drop in pressure is called a cycle

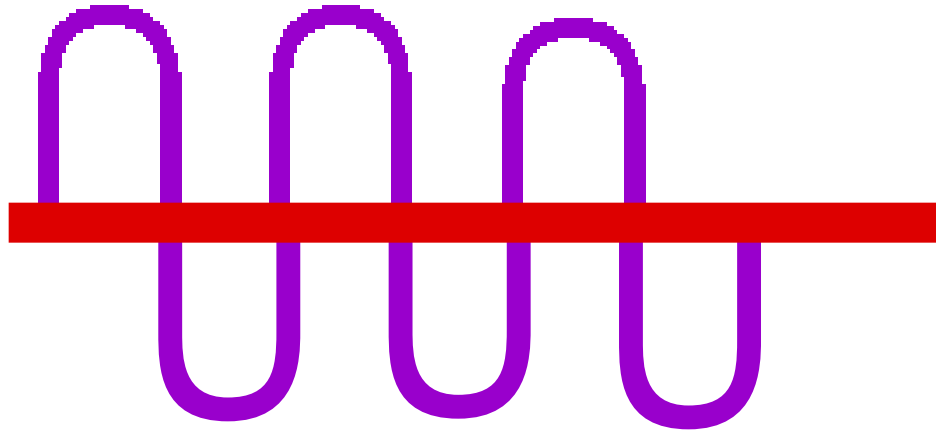


One Cycle

# Cycles can be counted

The number of cycles in one second is called

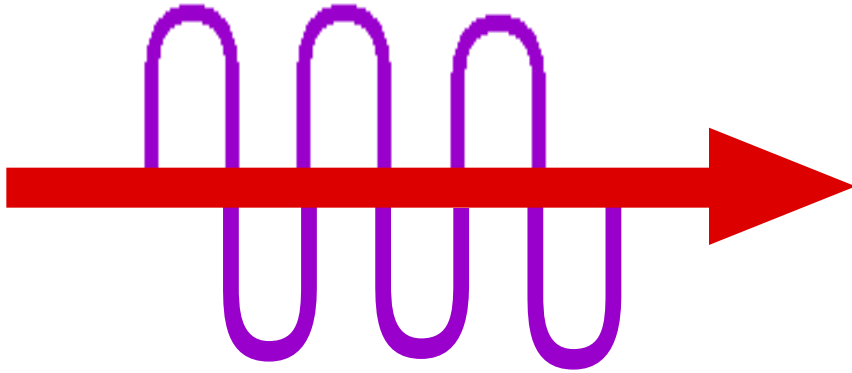
- Frequency, Pitch, or Hertz (Hz)
- 1 cycle per second = 1 Hz



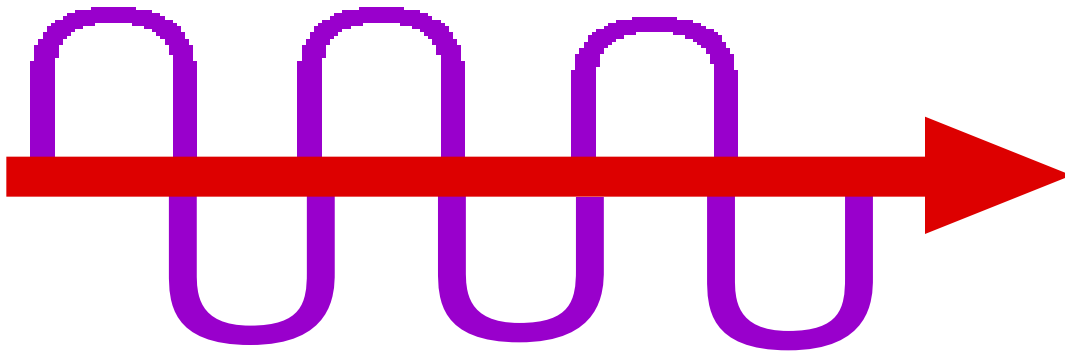
Time

1 cycle = 1 Hz

Faster cycles create higher frequencies



Slower cycles create lower frequencies



The power of sound is the amount of pressure created

Loud noises have a lot of pressure

Sound pressure is measured in units called Decibels (dB)

Most sounds have a combination of frequencies



Humans hear in the frequency range  
of about 20 – 20,000 Hz



# Examples of Various Sound Levels at Home and Work

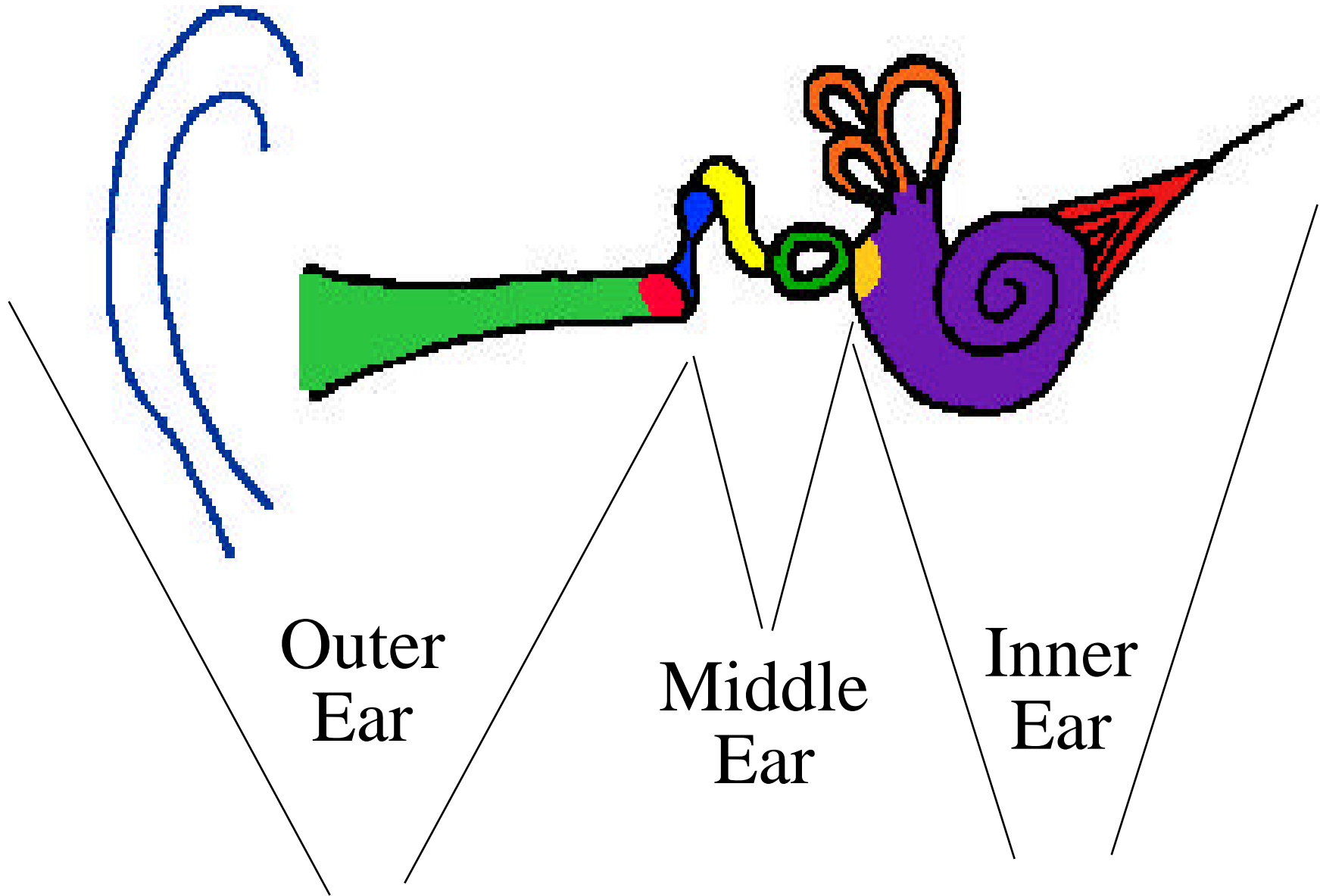
<b>Types of Sounds</b>	<b>Decibels (dB)</b>
<b>Whispered conversation</b>	<b>25</b>
<b>Room in average home</b>	<b>45</b>
<b>Typical conversation at 3'</b>	<b>60</b>
<b>Alarm clock</b>	<b>80</b>
<b>Power Lawn Mower (at ear)</b>	<b>95</b>
<b>Wood planer</b>	<b>104</b>
<b>Car horn</b>	<b>110</b>
<b>Rock band (playing)</b>	<b>120+</b>
<b>Jet engine</b>	<b>130</b>
<b>Bulldozer</b>	<b>90-100</b>
<b>Continuous Miner</b>	<b>95-105</b>

# Basics of the Hearing Process

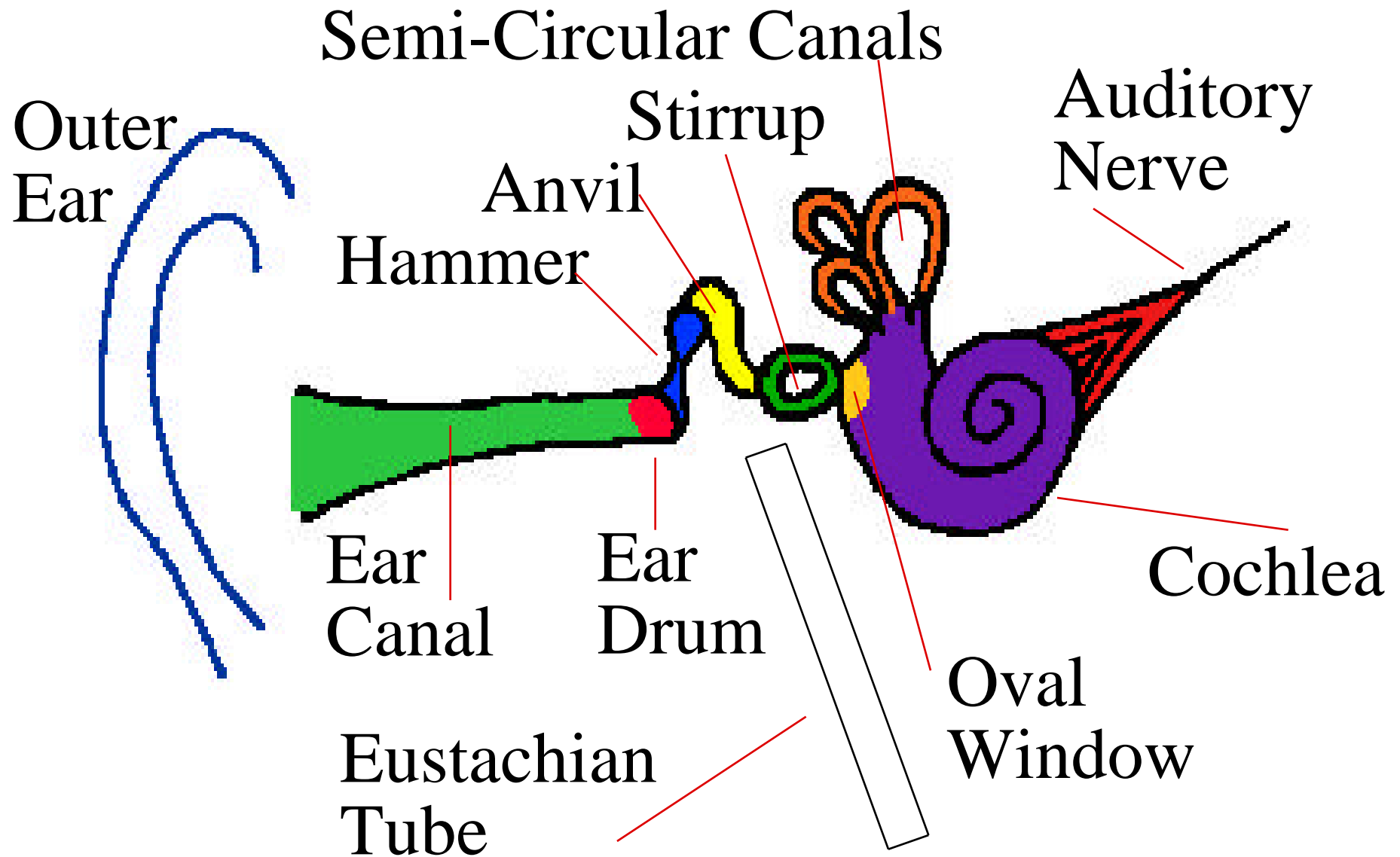
The ear is comprised of three major sections

- **Outer ear** collects and funnels sound waves to ear drum
- **Middle ear** transfers sound waves from mechanical-in-air to mechanical-in-liquid
- **Inner ear** converts mechanical energy to neuro-chemical energy

# Major Sections of the Ear



# Basic Anatomy of the Ear



# Basic Principles of Hearing

The three sections work together to gather and convert mechanical sound waves in the air into nerve impulses that go to the brain

- The outer ear collects and funnels the sound into the ear canal and the eardrum
- The vibrations from the eardrum cause three small bones “Hammer,” “Anvil,” and “Stirrup,” to move and vibrate against each other

- The stirrup vibrates against a membrane called the “Oval Window”
- Movement of the Oval Window causes a vibration of fluid in a snail-shaped organ called the Cochlea
- Movement of fluid in the Cochlea stimulates very fine hair cells in the Cochlea to move
- Movement of the hair cells causes a nerve impulse that travels through the Auditory Nerve to the brain

Additionally, the ear has two other major components

- Eustachian Tube

Located in the Middle Ear, and helps keep pressure balanced

- Semi-Circular Canals

Located in the inner ear, and helps maintain balance and orientation



Pretty elaborate process, isn't it?

Unfortunately, exposure to too much noise, especially noise levels above an average of 85 decibels can lead to hearing loss.

There are several  
major types of noise.  
You may be exposed  
to some or all of them  
throughout the day.

# Major Types of Noise

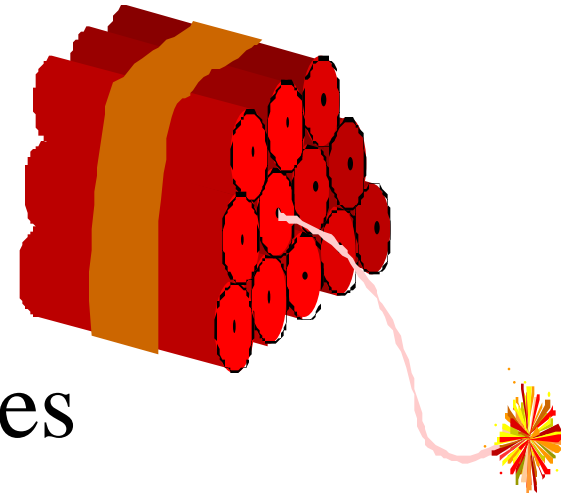
## Intermittent Noise

- Noise that starts and stops at different times



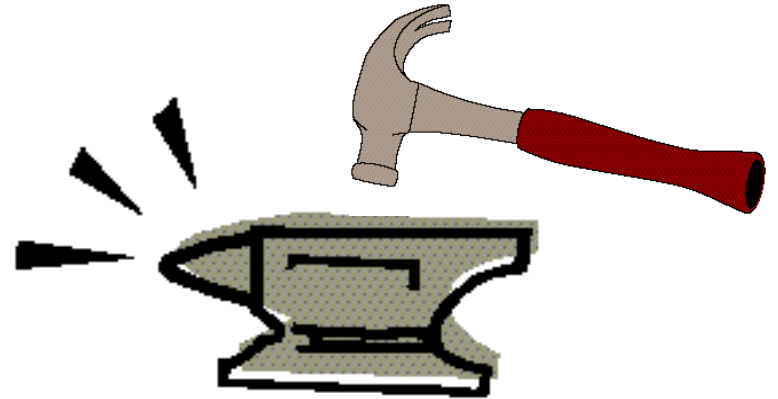
## Impulsive Noise

- Loud noises that start and stop quickly
- Example: gun shots, explosives



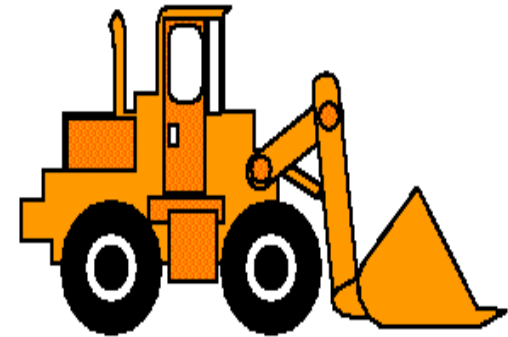
## Impact Noise

- Sharp "striking" types of sounds
- Example: hammer striking metal, slamming car door



## Continuous Noise

- Steady sounds for lengthy periods
- Example: operating mining equipment



Exposure to noise can  
affect all parts of our lives,  
both on and off the job.

The effects can be  
physical, psychological,  
temporary or permanent.

# Effects of Noise

Permanent hearing loss

Temporary hearing loss

Interference with communication

Startling effect

Inability to hear warning signals

Fatigue

Anxiety

Sleep disruption

## Physical Effects of Noise

- Elevated blood pressure
- Higher incidence of circulatory problems
- Ringing in ears

## Social Effects of Noise

- Frustration levels with/by others
- Distraction from others



There are numerous factors that affect whether or not we suffer a hearing loss. Some, we can control. Some, we can't control. It's a good idea to focus on those factors over which we have control, and use good judgment to protect our hearing!

# Factors That Affect Hearing Loss

The types of noise(s)  
that you are exposed to

The intensity of noise(s)  
that you are exposed to

The frequencies of noise(s)  
that you are exposed to

The length of time that you are exposed

Age

Physical condition of the ears

Personal genetics

The length of employment in  
noisy environments

There are several major types of hearing loss.

Ask yourself,  
“Could I be a candidate  
for a hearing loss?”

# Types of Hearing Loss

## Temporary Hearing Loss

- Sometimes called “Threshold Shift”
- After exposures, you lose your hearing, but it returns after a period of time
- Usually results from short exposures to loud sounds
- Hair cells in Cochlea are affected
- A **major warning sign** of overexposure!

# Conductive Hearing Loss

- From overexposure to impact and impulsive noises
- Affects the middle ear
- The inner ear is not able to “conduct” sounds from the middle ear
- Can also be caused from infection or ruptured ear drum
- Hearing loss is greatest in lower frequencies
- Possible treatment: surgery, hearing aids

# Sensori-Neural Hearing Loss

- Sometimes called “Nerve Deafness”
- Results from overexposures to continuous noise
- Affects the inner ear
- Hair cells in the Cochlea cannot transmit nerve impulses properly

- Usually has a slow, painless onset
- Often, hearing loss goes unnoticed for many years
- Not treatable
- Hearing loss is greatest in higher frequencies



How's your hearing?

Following,

are several major signs and symptoms of hearing loss.

The only way to verify hearing loss is to consult your health care provider.

# Possible Signs of Hearing Loss

ringing in the ears

Failing to hear others when they speak

Frequently asking others to repeat things to you

Misunderstanding what others say to you

Talking loudly without being aware of it

Headaches

# Controlling Noise

There are three major locations at which to try and control noise

- At the source of the noise
- Along the pathway of the noise
- At the receiver of the noise (the worker)

There are three major  
locations to control noise

Where it starts

Along it's pathway

At your your ear

# Three Major Managerial Strategies to Control Noise

- Engineering controls
- Administrative controls
- Personal Protective Equipment controls

Do you know if any of  
the following noise control  
measures are used at  
your work site?

Could any of the following  
strategies help reduce noise  
levels at your work site?

# Examples of Engineering Controls

- Redirect the noise source
- Isolate (or enclose) the noise source
- Isolate the receiver of the noise
- Interrupt the noise along the pathway
- Insulate the noise source
- Insulate the receiver of the noise
- Redesign machine for less noise output
- Design and install sound baffles (mufflers)

# Examples of Administrative Controls

- Monitor the workplace to determine high noise areas
- Take corrective action to address high noise areas
- Support the maintenance program
  - Lubricate noisy parts
  - Keep machines balanced
  - Replace worn parts
  - Mount machines on pads



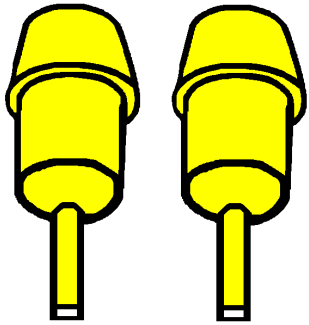
- Reduce the time workers have to spend in noisy environments
- Cycle workers in noisy environments
- Purchase acoustically treated machines and equipment
- Solicit noise control suggestions from employees
- Establish and maintain a hearing protection program

- Provide adequate hearing protectors for noises encountered
- Provide training for workers about noise hazards and use of noise controls and personal protective equipment

# Examples of Personal Protective Equipment

- Ear plugs
  - Pre-molded
  - Custom molded
  - Formable/disposable
- Ear canal caps
- Earmuffs

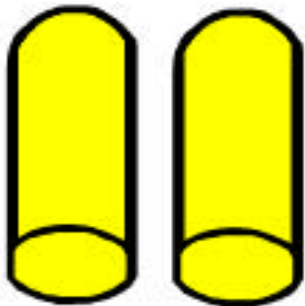
# Ear Plugs



Pre-molded  
May have various types of flanges

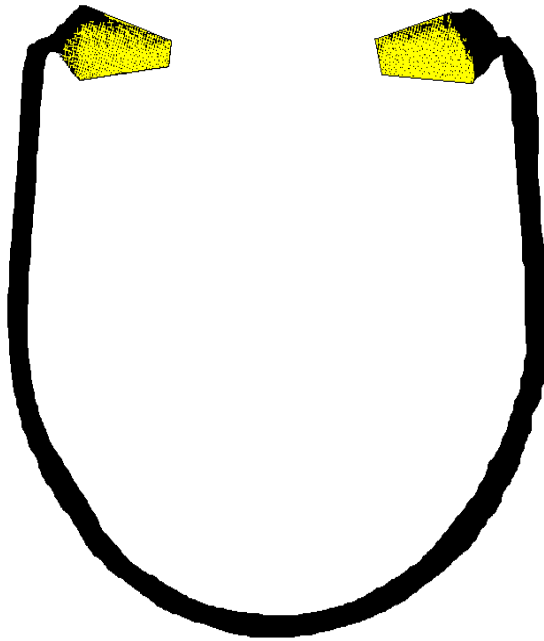


Custom Molded  
Made by health care professional



Formable  
May be foam, fiberglass or silicone

# Ear Canal Caps



Caps block entrance  
to ear canal

May fit over head,  
or behind head

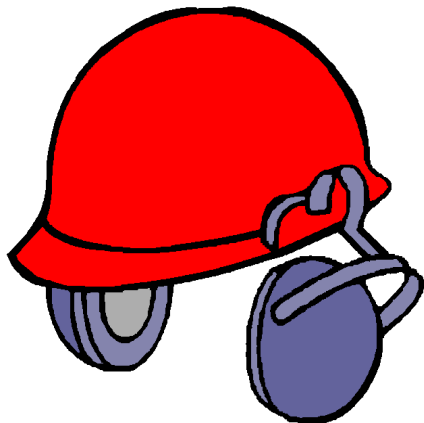
May have adjustable  
head band

# Ear Muffs



May have adjustable head band

Contains cup for ears with acoustical material inside and a cushion that goes against the skin



Some models may attach to a hard hat

One thing that all hearing protectors  
should have is a  
Noise Reduction Rating  
“NRR.”

The NRR is the amount of sound  
(in decibels) that the manufacturer of  
the hearing protector states the device  
will block from entering your ear.

Ratings depend on the type of  
device, and can range from  
the teens to the low 30's.

Another word that is often used to describe the sound blocking ability of hearing protectors is

**"ATTENUATION"**



The protection you typically receive during day-to-day work is usually less than the stated NRR of a hearing protector.

Several reasons:

Inadequate training in fitting and use

Failure to insert ear plugs correctly

Failure to adjust earmuffs

## Several management considerations regarding hearing protection

- Have all engineering and administrative controls been evaluated?
- Have all types of noise that employees may be exposed to been evaluated?

- Have the proper types of hearing protectors been selected regarding:
  - Types of noise
  - Fit
  - Hearing abilities
  - Personal preferences
  - Communication needs

- Has proper hands-on training been provided to the employee regarding
  - Selection of hearing protectors
  - Fitting of hearing protectors
  - Use of hearing protectors
  - Maintenance of hearing protectors

You have a responsibility to use  
and care for your hearing protection!

Hearing protection is just like any  
other type of personal protective  
equipment—take care of it,  
and it can help take care of you!

If, at any time, you have  
questions regarding your  
hearing protection,  
talk to your supervisor  
or safety director.

## Several employee considerations regarding hearing protection

- Wear the hearing protection consistently
- Follow all training and manufacturer suggestions
- Examine protectors before use, and replace any worn or broken parts
- Be sure that ear plugs are inserted correctly

- Be sure your hands are clean when inserting ear plugs
- Allow formable ear plugs to expand in the ear canal
- If using earmuffs, be aware that earrings, sideburns, hair or glasses may break the seal
- Encourage other employees to wear their hearing protection consistently

# How Much Noise Can You Be Exposed To

Remember, your hearing can be damaged at exposure levels greater than 85 decibels

Currently, MSHA regulations allow a maximum average exposure of 90 decibels per shift

When an inspector takes a noise level reading, he/she will probably use a dosimeter or sound level meter.



A dosimeter is a small box, with a microphone, and it measures the amount of sound you are exposed to over a period of time.

A sound level meter is a hand-held instrument that provides direct sound level readings.

The amount of noise that you can be exposed to is based on the level of the noise and how much time you spend in the noise.

The average of the noise you are exposed to over a period of time is called a "Time-weighted average"

MSHA has permissible exposure levels for how long you can be exposed to certain noise levels

These permissible exposure levels are the same for both metal/nonmetal and coal operations

# MSHA Permissible Exposure Levels

Sound Level	Time Allowed
90 dB	8 hrs.
92 dB	6 hrs.
95 dB	4 hrs.
97 dB	3 hrs.
100 dB	2 hrs.
102 dB	1.5 hrs.
105 dB	1 hr.
110 dB	0.5 hr.
115 dB	<.25 hr.

Exposures are based on time-weighted averages.

Violations require engineering or administrative controls be the first alternative to gain compliance.

Highlights of  
MSHA Noise Regulations  
Scheduled to Become Effective  
September 13, 2000

- Each miner must be monitored
- Monitoring results cannot include the use of hearing protection
- Miners and representatives can observe noise monitoring
- Operator must notify miner if noise

- Operator must notify miner if noise exposure exceeds the "Action Level" of 85 dBA Time-weighted average (TWA)
- Operator must use feasible engineering or administrative controls to reduce noise
- If miner's exposure exceeds Action Level, or Permissible Exposure Level, miner must be enrolled in a Hearing Conservation Program (HCP)

- HCP includes:
  - Monitoring
  - Use of hearing protectors
  - Audiometric testing
  - Training
  - Record keeping
- Miner in HCP must be given 2 types of earmuffs and ear plugs to choose from
- Hearing protectors will be provided at no cost to miner

- Miner must wear hearing protectors if enrolled in HCP
- Operator must provide baseline audiogram within 6 months of entering HCP
- Operator must provide annual audiogram to those enrolled in HCP
- Operator must provide training to those in HCP

- Training required in HCP:
  - Effects of noise on hearing
  - Purpose/value of wearing hearing protectors
  - Advantages/disadvantages of hearing protectors
  - Requirements of MSHA noise regulations
  - Both operator and miners' responsibilities in maintaining noise controls
  - Purpose, value, and process of audiometric testing



# Several Things YOU Can Do To Help Protect Your Hearing

- Commit yourself to take care of your hearing
- Ask questions-lots of them
- Wear your hearing protection faithfully
- Encourage coworkers to wear their hearing protection

- Find the types of hearing protectors that work best for you—not all people can wear all types of hearing protectors
- Take care of your hearing protectors
- Think about ways to lower noise levels in your work area, and make suggestions
- Recognize that there are numerous types of noise, and that excessive noise can cause hearing loss

- Wear hearing protection when you are working around the house
- Tell your kid to turn the stereo down
- Have your hearing tested
- Ask yourself if you may have any of the signs and symptoms of hearing loss
- Keep the seals and acoustical material in your mobile equipment in good repair

# Discussion Points

- What types of physical effects can noise have on an individual?
- What are several signs of hearing loss?
- What locations in your facility either do, or might have elevated noise levels?
- What types of engineering controls are used at your facility to control noise?

- What types of administrative controls are used at your facility to control noise?
- What types of personal protective equipment is used at your facility to limit your noise exposure?
- What is the approximate “NRR” of the hearing protectors that you use?
- Where can you obtain hearing protectors at your facility?

- When was the last time you read the directions for the care, fitting, and use of your hearing protectors?
- What were the results of your last sound level tests ?
- What can you do, or suggest, to limit your exposures to noise at work?
- What are several sources of excessive noise at home?

- What can you do to limit your noise exposures at home?
- What can you tell someone else to make them more aware of the hazards of excessive noise?
- Why is it a false belief to think that you can get used to noise?

Thanks for participating,  
and

**PROTECT  
YOUR  
HEARING!!!!**



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