Session 2

Noise Control
Introduction on the Available Techniques

Noise Definition

- Noise is unwanted or undesired sound.
- Steady-state noise: Continuous sound which remains relatively constant in intensity for a long period of time.
- Non-steady state noise: Non-continuous sound that is further broken down into fluctuating, intermittent and impulsive (impact) noise.

Noise Effect on Hearing

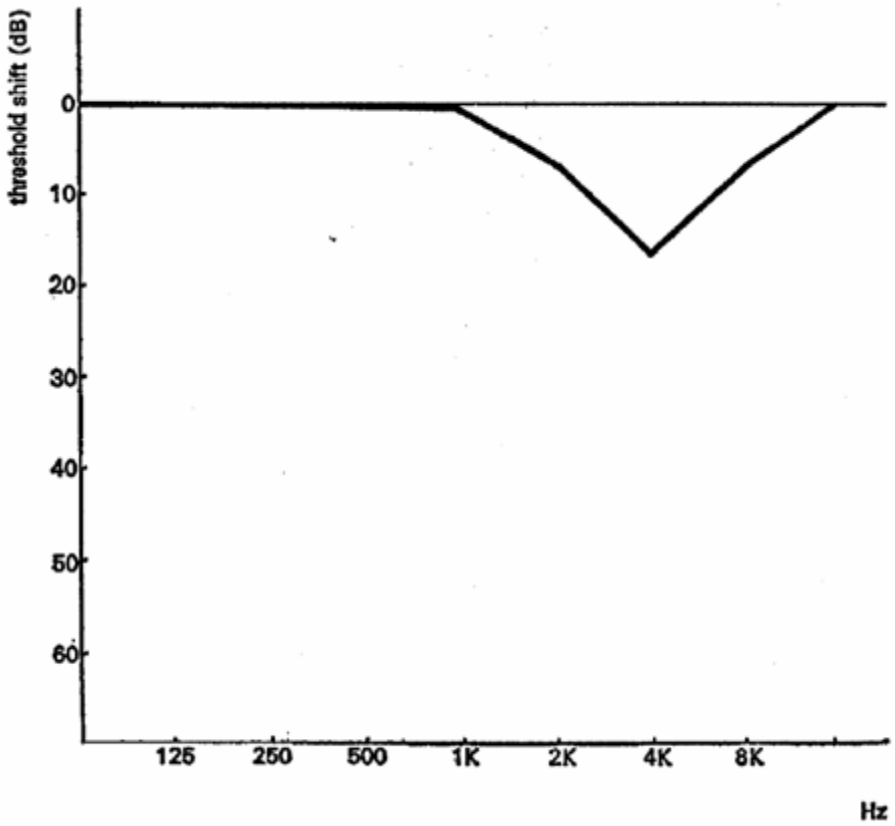


Table 8 - Occupational Noise Exposure Limits

Average Daily Sound Level (dBA)	Maximum Average Daily Exposure
90	88 hours
95	4 hours
100	2 hours
105	1 hour
110	30 minutes
115	15 minutes

Typical hearing loss after a short period of exposure to noise.

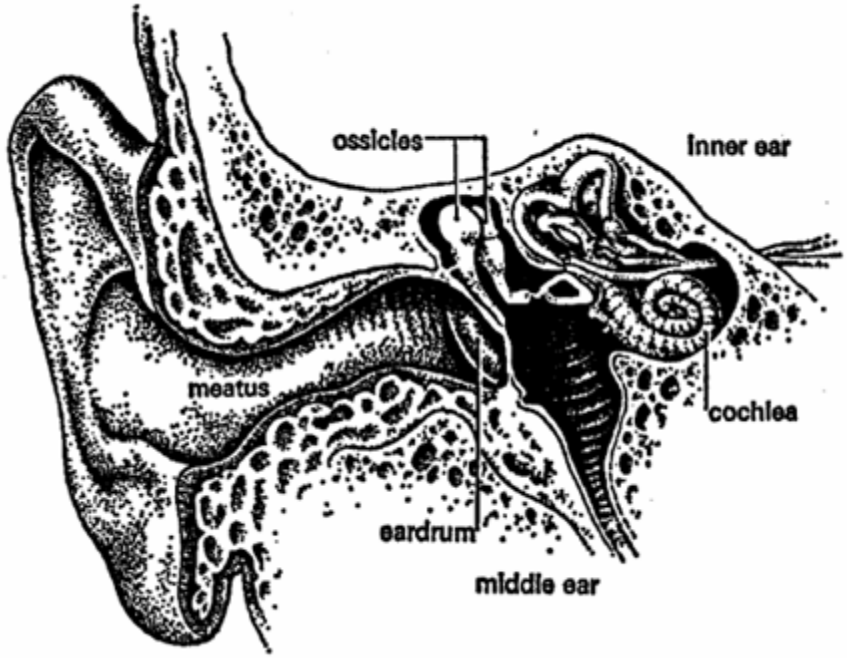
Methods of Noise Control

- Harmful effects of noise on people:

  - auditory (occupational hearing damage)
  - non-auditory (interference speech, annoyance, mental fatigue, etc).

- Noise control methods:

  - protective planning
  - noise reduction at the source
  - reduction of noise at transmission path
  - noise protection measures at the receiving end.



Protective Planning

Should be taken in consideration during the initial stages of planning a new project:

- Noisy operations should be grouped in one area.
- The machines purchased should be those with low noise output.
- Noisy areas should have adequate sound absorption materials on the ceiling and the walls.
- Noisy equipment should be fastened on a rigid and heavy base with adequate isolating elements to avoid propagation of vibration.
- Noise sources (machines) should be enclosed with structures which supply adequate sound insulation.
- Offices and other places where mental work is carried out should be situated far from the noise sources.

Noise Barrier Wall

- Placed between noise source and noise receiver.
- Block the sound and reflect it to the area where noise is ignored.
- Only effective in non-echoic area.

Example of Noise Barrier

Noise Reduction at Source

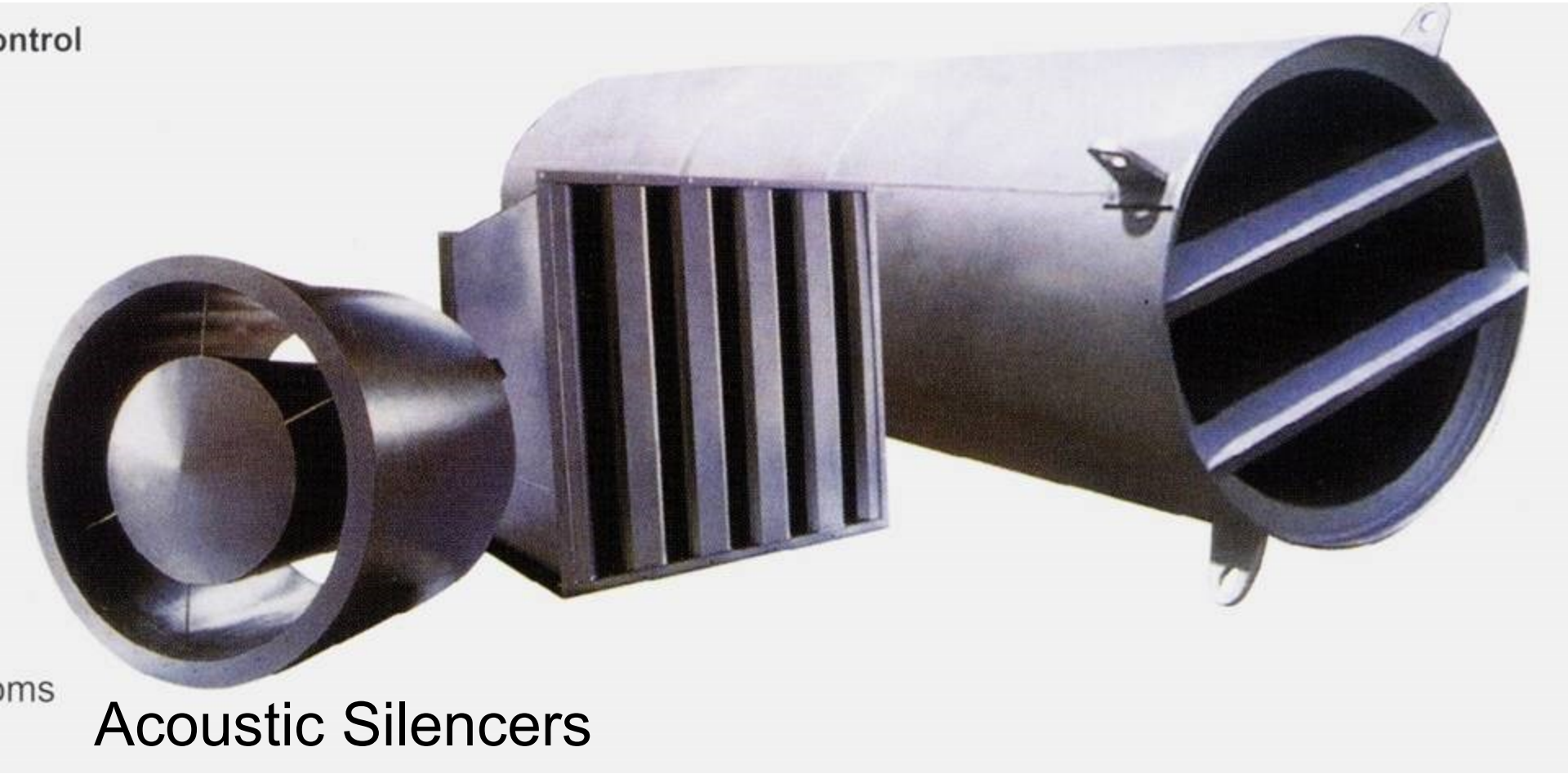
- Method applied depends on the nature of the noise source.
- May be accomplished by reducing the forces generating the noise or by reducing the motion of the vibrating components by means of vibration damping.
- Normally achieved by regular inspection and/or maintenance of machinery (engineering control methods).

Noise Reduction at Source

Great turbo blankets

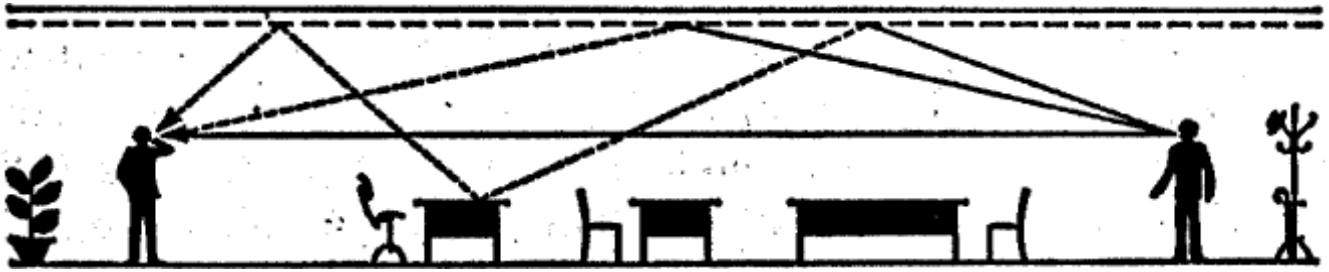
Pipe sleeve

Noise Reduction at Source



Acoustic Silencers

Reduction of Noise Along Its Transmission Path



- Positions (increasing the distance between the noise source and the individual).
- Careful planning of the layout of the building.
- Reflection of the energy back towards its source, by means of discontinuities.
- Use of barriers, enclosures and absorption materials.

Noise Absorption Materials

- Porous Acoustic Materials
- Fiber Acoustic Materials
- Helmholtz or Cavity Resonator
- Composite Acoustic Materials

Noise Absorption Materials

- Can be used if noise from source is reflected by one or more surfaces before it reach the receiver.

- Noise attenuation can be reached through sound absorption that depends on total sound reflection at noise insulated surfaces.

Porous Acoustic Absorption Materials

- Effective for high frequency noise.
- Sound absorption depends on surface area of material and total pores.

Fiber Acoustic Absorption Materials

- Maximum absorption effect at high frequency noise.
- Sound absorption depends on fiber diameter, length and density.

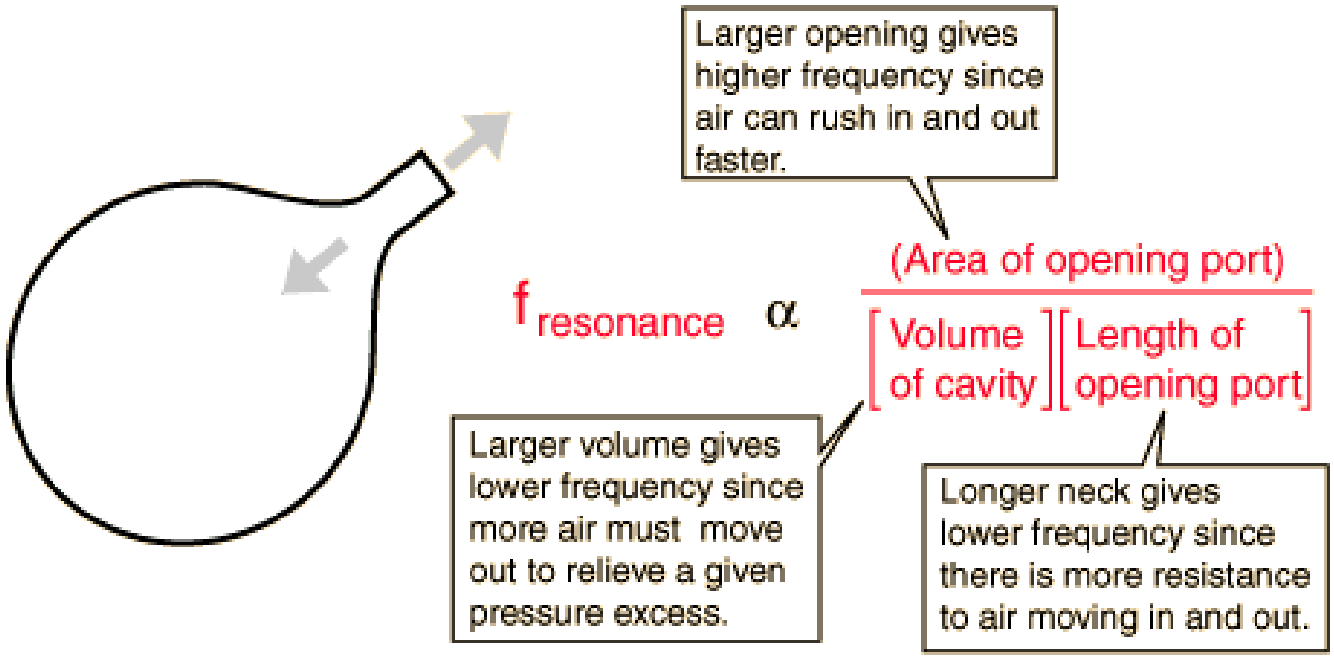
Wall-lining

Acoustic ceiling

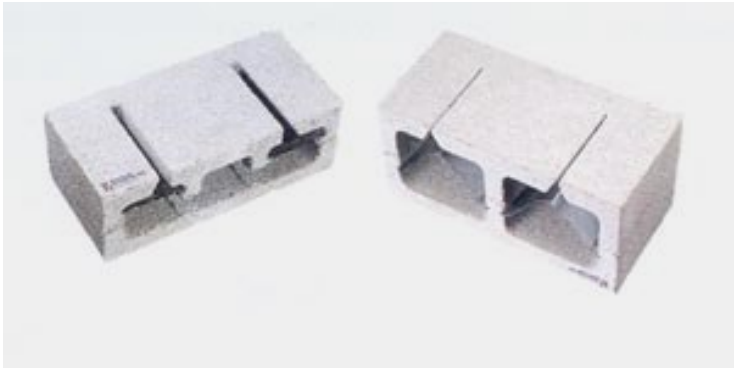
Acoustic wall

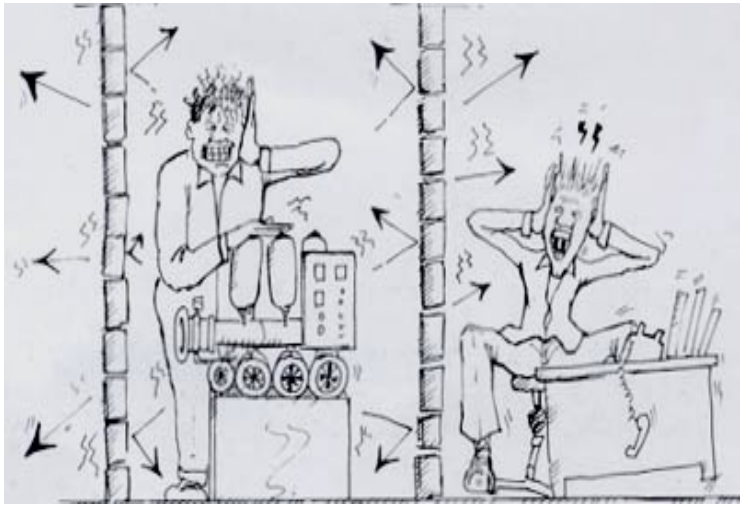
Helmholtz or Cavity Resonator

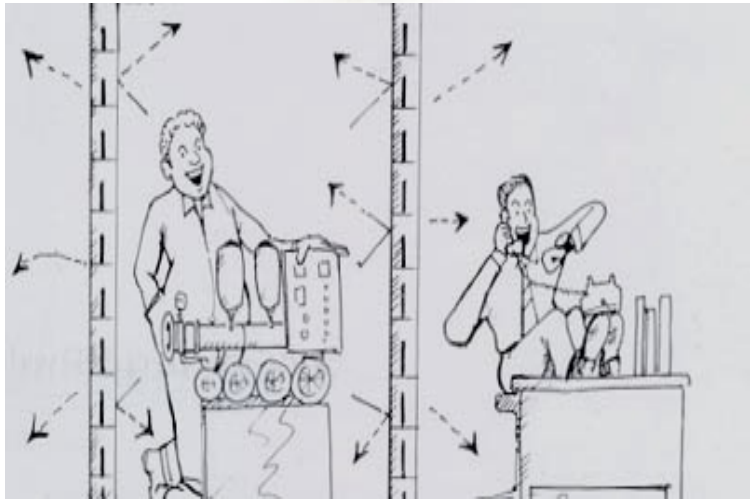
- Effective for low frequency noise.
- This material can be set up to absorb sound at specific frequency.



Helmholtz or Cavity Resonator







A hard wall surface can reflect and amplify the noise within the room. These noise can also be transmitted through the wall.

Resonator has the 2-in-1 function:

1. With Resonator, the noise in the room will be effectively absorbed thus reducing the noise level within the room.
2. Resonator also reduce the noise transmitting through the wall.

Composite Acoustic Absorption Materials

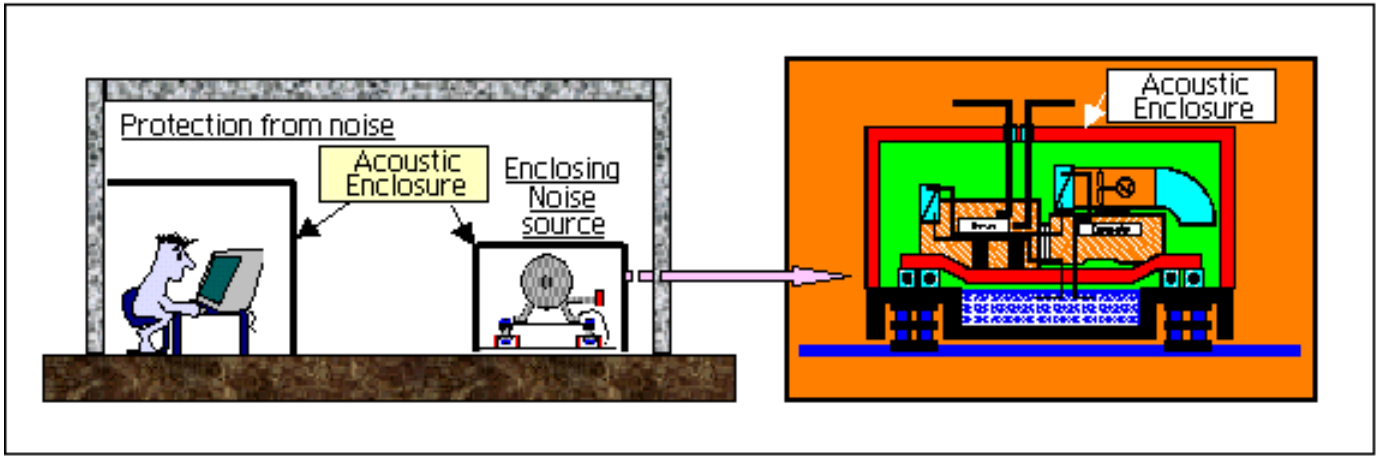
- Combination of materials plus barrier for better absorption.

- Advance absorption is needed because compared to above materials, this material is placed in front of softer surface.

Noise screen

Acoustic Enclosure

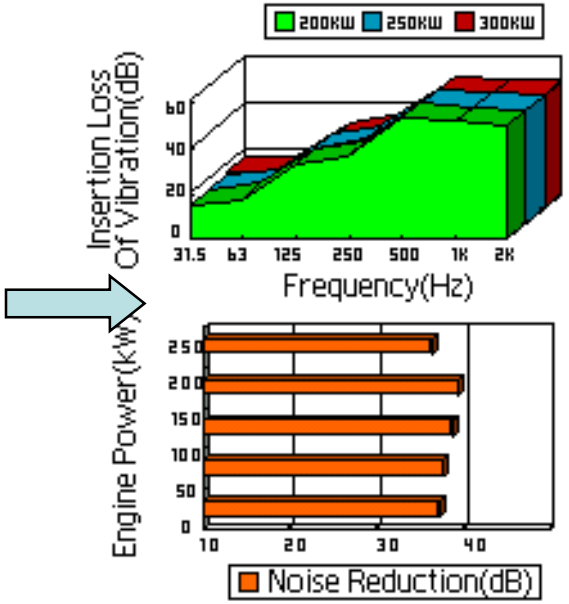
- Final step to control if other methods are not effective.
- Acoustic enclosure is installed at noise source (around the machine)
- Noise attenuation of the machine can be reached up to 50 dB.



Concept of Acoustic Enclosure

Acoustic Enclosure

View of Installed Acoustic Enclosure



Quiet room

Pulpit

Sound Silencer System

- Reactive silencer
- Dissipative silencer
- Absorptive silencer
- Dispersive or Diffusive silencer

Reactive Silencer

- Principle of geometry shape.
- Helmholtz resonator is one of the example of reactive silencer.
- Used for exhausters, blowers.

Dissipative Silencer

- Using flow resistivity to increase the quality of reactive silencer.

Absorptive Silencer

- Porous material at this equipment absorb the sound that gone through it.

- The simplest example is common lined duct.

Dispersive or Diffusive Silencer

- The simplest example is common lined duct.

Noise Protection at The Receiving End

Three techniques :

- Ear protectors
- Hearing Conservation Programme
- Exposure Control

Should be used only when the other control methods are impractical, uneconomical or insufficient.

4 Types of ear protectors:

- Ear plugs
- Ear muffs
- Communication headsets
- Helmets

Ear Plug

- Noise control for receiver
- Type of Hearing Protection Device

- 2 types of ear plug:

  - various size of ear plug – one edge & three edge

  - variable shape sizeable ear plug – silicon and foam

Ear Muff

- One type of Hearing Protection Device.

- 4 parts:
  - sound refractor ear cup.
  - sound reducer ear cup.
  - sound minimizer ear cushion.
  - both ear cups connector spring.

Sound Reduction by Hearing Protection Device

- Capability of sound attenuation by each device is different according to noise frequency.

- e.g. : ear muff reduce sound for 5 – 25 dB at low frequency and 24 – 45 dB at high frequency.

Conclusions

You should now have a good understanding of:

- Methods of noise control
- Protective planning
- Noise reduction at source
- Noise reduction along its transmission path
- Noise protection at the receiving end