Noise Pollution

Noise

- The word noise comes from the Latin word noxia meaning "injury" or "hurt“.
- Noise—Excessive or unwanted sound which potentially results in annoyance and/or hearing loss.
- Sound—A pressure variation (wave) that travels through air and is detected by the human ear.
- Physically there is no distinction between sound and noise.
- Sound is a sensory perception and the complex pattern of sound waves is labeled as noise, music, speech etc.
- Noise has become a very important "stress factor" in the environment of man.

Noise Pollution?

- When there is lot of noise in the environment, it is termed as noise pollution.
- Sound becomes undesirable when it disturbs the normal activities such as working, sleeping, and during conversations.
- It is an unrecognized environmental problem because of the fact that we can't see, smell, or taste it.
- WHO stated that "Noise must be recognized as a major threat to human well-being".


NOISE
POLLUTION
NO

Sources

- Street traffic
- Rail roads
- Airplanes
- Constructions
- Consumer products

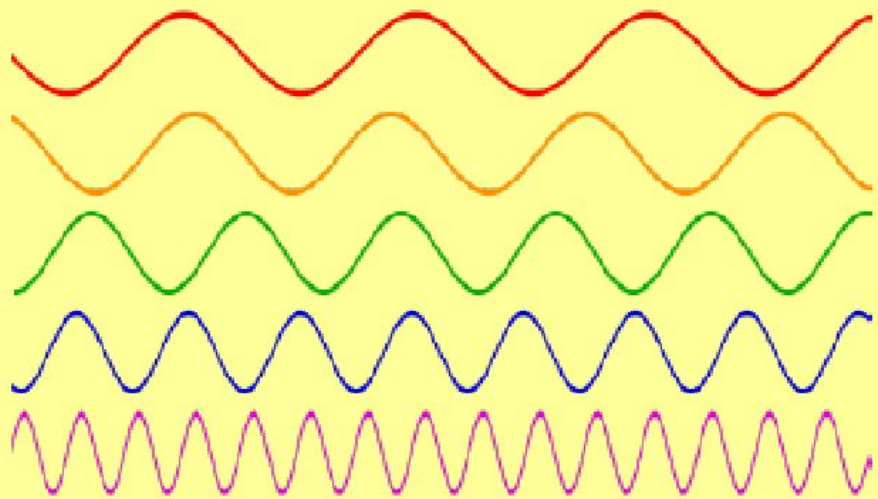
Physics of Sound

- The vibration of a source causes pressure changes in air which result in pressure waves
- Perceived sound is comprised of numerous pressure waves of varying characteristics
- Amplitude—The amount of sound pressure measured in decibels (dB)
- Frequency—The rate of vibration per unit time measured in cycles per second, more commonly known as hertz (Hz); range of normal perception for young person is 20–20,000 Hz

The nature of sound

Sound, a manifestation of vibration, travels in wave patterns through solids, liquids and gases.
The waves, caused by vibration of the molecules, follow sine functions, typified by the amplitude and wavelength (or frequency)

Sound waves of equal amplitude with increasing frequency from top to bottom



Sound Pressure Level

Decibel scale

$$\text{decibel} = 10\text{Log}\left(\frac{\text{acoustic energy}}{\text{reference energy}}\right)$$

- Reference energy is the threshold of human hearing
- 10 * Bel = decibel (dB)
- Sound pressure level (SPL)

Sound Pressure Levels

Since SPLs are based on a log scale, they cannot be added directly–I.e., 80 dB + 80 dB ≠160 dB

$$SPL_T = 10 \times \text{Log}\left(\sum_{i=1}^{n} 10^{\left(\frac{SPL_i}{10}\right)}\right)$$

Where: SPL_T is the total sound pressure level, and SPL_i is the ith sound pressure level to be summed.

Sound Pressure Levels

- Given two machines producing 80 dB each, what is the total SPL?

$$SPL_T = 10 \times \mathrm{Log}\left(\sum_{i=1}^{n} 10^{\left(\frac{SPL_i}{10}\right)}\right)$$

$$= 10 \times \mathrm{Log}\left(10^{(80/10)} + 10^{(80/10)}\right)$$

$$= 10 \times \mathrm{Log}\left(2 \times 10^{8}\right)$$

$$= 83\,dB$$

Sound Pressure Levels

- Given four machines producing 100 dB, 91dB, 90 dB, and 89 dB respectively, what is the total sound pressure level?

$$SPL_T = 10 \times \mathrm{Log}\left(\sum_{i=1}^{n} 10^{\left(\frac{SPL\,i}{10}\right)}\right)$$

$$= 10 \times \mathrm{Log}\left(10^{(100/10)} + 10^{(91/10)} + 10^{(90/10)} + 10^{(89/10)}\right)$$

$$= 10 \times \mathrm{Log}\left(10^{10} + 10^{9.1} + 10^{9} + 10^{8.9}\right)$$

$$= 101.2dB$$

Measurement of Noise

- "A decibel is the standard for the measurement of noise"
- 20 db is whisper.
- 40 db the noise in a quiet office.
- 60 db is normal conversation.
- 80 db is the level at which sound becomes physically painful. And can be termed as noise.

Sound level and human's perception

perception | sound level (dB) | example

100
80
60
30
10
0

quiet
very quiet sound



soft whisper (25 dB)
breathing sound (10 dB)

the lowest sound level that can be heard

Sound level and human's perception

perception | sound level (dB) | example

100
80
60
30
10
0

acceptable
quiet



normal conversation (60 dB)
soft conversation in libraries (30 dB)

Sound level and human's perception

perception	sound level (dB)	example
annoying	100	
	80	alarm clock (80 dB) busy traffic (70 dB)
noisy		
	60	
acceptable		
	30	
quiet		
	10	
	0	



Sound level and human's perception

perception	sound level (dB)	example
very noisy damage our ears	100	crying baby (100 dB) passing train (90 dB)
annoying		
	80	
noisy		
	60	
acceptable		
	30	
quiet		
	10	
	0	



Sound level and human's perception

perception	sound level (dB)	example
very noisy damage our ears	100	road drilling disco (120 dB)
annoying	80	
noisy	60	
acceptable	30	
quiet	10	
	0	



Sound level and human's perception

perception	sound level (dB)	example
very noisy damage our ears	100	rocket taking off (190 dB) jet plane taking off (130 dB)
annoying	80	
noisy	60	
acceptable	30	
quiet	10	
	0	



- The following photos show two different kinds of decibel meters:





Effects of Noise Pollution

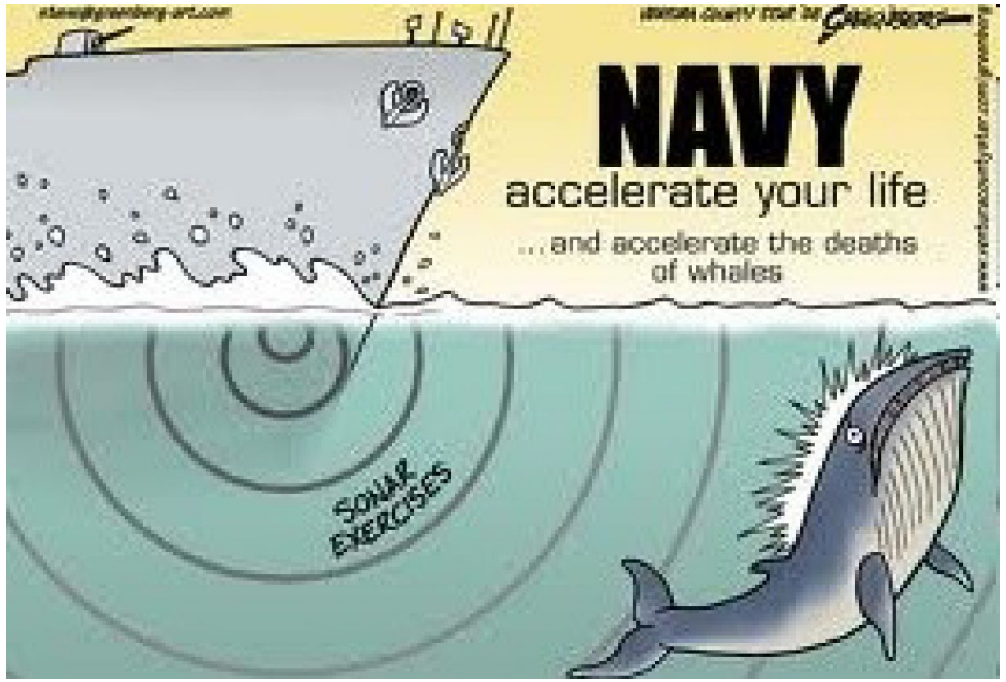
In human, noise pollution can cause:

- annoyance and aggression
- hypertension (high blood pressure)
- high stress levels
- tinnitus (ringing in the ears)
- long-term hearing loss
- sleep disturbances



Effects of Noise Pollution

Noise can also harm animals, changing the delicate balance in hunter or prey detection and avoidance, and interfering the use of the sounds in communication especially in relation to reproduction and in navigation.





Control of Noise Pollution

Roadway noise can be controlled by the:

- noise barriers
- limitation of vehicle speeds
- alteration of roadway surface texture
- limitation of heavy vehicles
- traffic controls to reduce braking and acceleration
- tire design

Control of Noise Pollution





Noise Barrier

Control of noise pollution

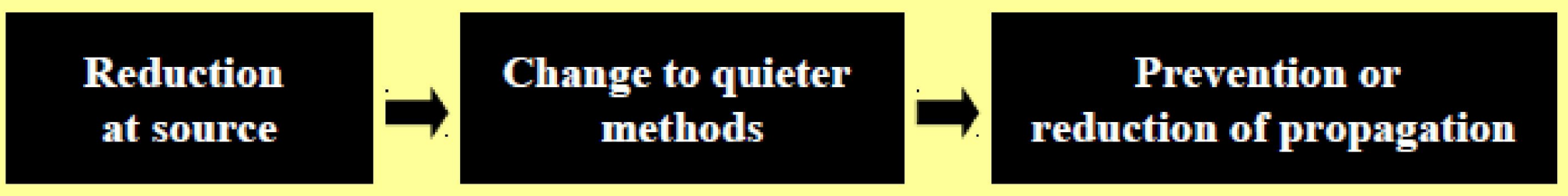
Control of Noise Pollution by obstructing the path of Noise

- By constructing soundproof buildings, the menace of sound pollution can be minimized.
- Plants also help in controlling noise pollution because they absorb high frequency sound waves. Thus, planting trees along the roads help in controlling noise pollution.

Noise Control

- General control measures include alteration of machines and equipment to gather up-dated machinery regarding noise prevention.

- Noise can be tackled through:



NOISE GUIDELINES

- For all noise control efforts a target noise level must be set.
- A highest level must be defined for each place of equipment or room

Guideline noise levels for specific locations

Type of room	Highes sound level guideline (dB)
Conference room	35
Office	40
Workshop office, rest room	45
Laboratory, measurement room	50
Canteen	50
Changing room	55
Repair shop	60
Production areas	75
Fan room, compressor room	90