

GE 2211 Environmental Science and Engineering

Unit – III

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Noise Pollution

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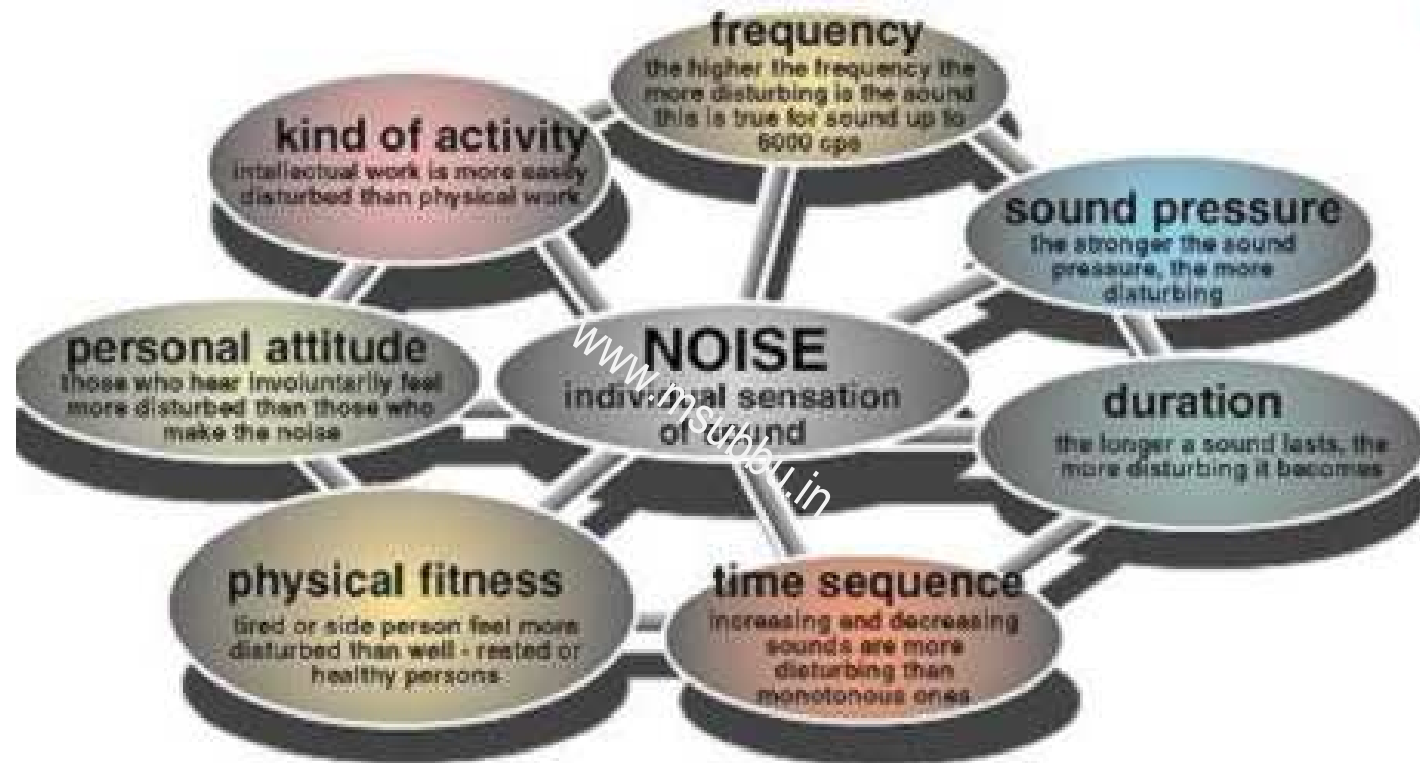
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Contents

- Definition, causes, effects, and control measures of – noise pollution

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Sources of Noise Pollution

- The main sources of noise are:
 - Various modes of transportation (like air, road, rail-transportation),
 - Industrial operations,
 - Construction activities and celebrations (social/religious functions, elections etc)
 - Electric home appliances.

Decibel (dB)

- The scale for measuring intensity of sound is the **decibel scale**.
- Decibel scale is logarithmic
- The threshold of hearing is assigned a sound level of 0 decibels; this sound corresponds to an intensity of 1×10^{-12} W/m².
- A sound which is 10 times more intense (1×10^{-11} W/m²) is assigned a sound level of 10 dB. A sound which is 100 times more intense (1×10^{-10} W/m²) is assigned a sound level of 20 db.

Source	Intensity	Intensity Level	# of Times Greater Than TOH
Threshold of Hearing (TOH)	$1 \cdot 10^{-12}$ W/m ²	0 dB	10^0
Rustling Leaves	$1 \cdot 10^{-11}$ W/m ²	10 dB	10^1
Whisper	$1 \cdot 10^{-10}$ W/m ²	20 dB	10^2
Normal Conversation	$1 \cdot 10^{-6}$ W/m ²	60 dB	10^6
Busy Street Traffic	$1 \cdot 10^{-5}$ W/m ²	70 dB	10^7
Vacuum Cleaner	$1 \cdot 10^{-4}$ W/m ²	80 dB	10^8
Large Orchestra	$6.3 \cdot 10^{-3}$ W/m ²	98 dB	$10^{9.8}$
Walkman at Maximum Level	$1 \cdot 10^{-2}$ W/m ²	100 dB	10^{10}
Front Rows of Rock Concert	$1 \cdot 10^{-1}$ W/m ²	110 dB	10^{11}
Threshold of Pain	$1 \cdot 10^1$ W/m ²	130 dB	10^{13}
Military Jet Takeoff	$1 \cdot 10^2$ W/m ²	140 dB	10^{14}
Instant Perforation of Eardrum	$1 \cdot 10^4$ W/m ²	160 dB	10^{16}

Loudness

- While the intensity of a sound is a very objective quantity which can be measured with sensitive instrumentation, the **loudness** of a sound is more of a subjective response which will vary with a number of factors.
- The same sound will not be perceived to have the same loudness to all individuals. Age is one factor which effects the human ear's response to a sound.

Effects of Noise Pollution

- **Annoyance:** It creates annoyance to the receptors due to sound level fluctuations. The aperiodic sound due to its irregular occurrences causes displeasure to hearing and causes annoyance.
- **Physiological effects:** The physiological features like breathing amplitude, blood pressure, heart-beat rate, pulse rate, blood cholesterol are effected.
- **Loss of hearing:** Long exposure to high sound levels cause loss of hearing. This is mostly unnoticed, but has an adverse impact on hearing function.
- **Human performance:** The working performance of workers/human will be affected as they'll be losing their concentration.
- **Nervous system:** It causes pain, ringing in the ears, feeling of tiredness, thereby effecting the functioning of human system.
- **Sleeplessness:** It affects the sleeping there by inducing the people to become restless and loose concentration and presence of mind during their activities

Effects of Noise Pollution (contd.)

- **Discomfort:** such as ear ringing, ear pains and hearing loss, etc. Noises above 115db can even lead to deafness. According to statistics, about 50 percent of those who are exposed to the noise above 80db for a long time lose their hearing. Noises disturb rest and sleep
- **Decrease of work efficiency** - under the circumstance of noises above 85db, one may feel discomfort and distracted, thus he can not concentrate on his work or study.
- **Harm to blood vessels of human hearts** - Noise is a dangerous factor for heart diseases, speeding up the aging process of hearts, causing high rate of myocardial infarction incidence. Long-term exposure to noises may lead to high blood pressure. Especially in night, noises cause much higher rate of incidence of a disease.
- Noises are more harmful for children's body and mind health than that of adults, because their organs are still weak
- **Environmental effects** - detrimental effect on animals by causing stress
- **Damage to material** : The buildings and materials may get damaged by exposure to infrasonic / ultrasonic waves and even get collapsed.

Permissible Noise Levels (dB)

Category of Area	Day time (6 am - 9pm)	Night time (9pm - 6am)
Industrial area	75	70
Commercial area	65	55
Residential area	55	45
Silence zone (100 m around premises of hospitals, educational institutions, etc.)	50	40

Permissible levels - CPCB, India

Damage risk criteria for hearing loss Occupational Safety & Health Administration (OSHA) regulations

Maximum allowable duration per day hours	Sound pressure level, dB (A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.75	107
0.5	110
0.25	115

No exposure in excess of 115 dB(A) is permitted.

Noise Control Techniques

- Control at source
- Control in the transmission path
- Using protective equipment

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Noise Control at Source

- Reducing the noise levels from domestic sectors
- Maintenance of machines, automobiles
- Control over vibrations
- Low voice speaking
- Prohibition on usage of loud speakers
- Selection of machinery

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Control in Transmission Path

- Installation of barriers
- Using sound absorbers



Noise Management Strategy

