

4.1. INTRODUCTION

Noise is an unwanted sound exposed to any person. It interferes with our every activity-work, rest, recreation as well as sleep. It is unpleasant or disagreeable sound that causes discomfort. The word noise is derived from Latin word **nausea** meaning a feeling of sickness at the stomach with an urge to vomit. When the sound waves are periodic, regular and of long duration, they produce a pleasing effect and such sound is called **musical sound**. On the other hand if sound waves are non-periodic, irregular and short duration, they produce a displeasing effect and such a sound is known as **noise**.

Noise is produced due to congestion in urban areas, vehicles, railways, helicopters, jets, rockets, radio, T.V., call bells, alarm clocks, telephone rings, machines or factories, coolers, loudspeakers, mixer grinders, public broadcasting by religious institutions etc. The waves left by supersonic jets give rise to sonic booms or sudden rattling of doors and windows.

There are two main characteristics of sound, *viz.*,

- (a) Pitch and frequency of sound waves and,
- (b) Loudness or intensity of sound waves.

The pitch of a sound depends on its frequency. A sound of higher frequency has a higher pitch. The pitch of woman's voice is higher than that of a man. The human ear can detect sounds over a wide range of intensities and frequencies. Normally, the human ear is sensitive to sounds having frequencies varying from 17 to 20,000 Hz (1 Hz = 1 cycle per second). Those sound waves which have frequency lower than 17 Hz are termed **infrasonic** and waves which have frequency higher than 20,000 Hz are termed **ultrasonic**.

The other characteristic of sound, *i.e.*, loudness means the intensity of sound wave. The loudness depends on sound frequency as well as sound intensity or pressure. The relative loudness of a sound is measured in terms of **decibels** (deci = 10 and *bel* = named after the scientist Graham Bell). *Decibel or dB is the unit of power level of a sound wave.* The threshold of hearing is taken as 0 dB. Ten times this power level is 10 dB. The fundamental unit is *bel*, but decibel is exclusively used (1 dB = 0.1 bel). A sound level

meter which has a microphone amplifier and weighing networks and an indicating meter measures intensity of sound in dB.

Some of the metropolitan cities in India, e.g., Delhi, Mumbai, Chennai and Kolkata have noise level far in excess of internationally accepted limits. The limit is 45 dB, whereas the major cities have a noise level of 90 dB and never falls below 60 dB. The Table 4.1 shows the average noise levels from different sources.

Table 4.1.

Whisper	20–25 dB
Normal voice	60–65 dB
Threshold of discomfort	120 dB
Threshold of pain	140 dB
Motor cars	80–90 dB
Grinders	90–100 dB
Boeing 707	160 dB
Rocket booster	200 dB

4.2. SOURCES OF NOISE POLLUTION

The main sources of noise are the various means of transport, including motorized vehicles, airplanes and railroads, and the diverse noise arising from the environment, such as the noise produced by factories, loudspeakers, places of entertainments, restaurants, radios, record players, tape recorders and human beings themselves.

As a result of tropical to sub-tropical climate (except the Himalayan range) most of the people of our country spends a relatively large part of their time out doors. Buildings are made of light materials and windows of public and public buildings are kept open almost all the year long. As a result, the environmental noise in residential areas and offices has become a source of annoyance to the population. Its harm is mainly psycho-acoustic and does not usually result in deterioration of hearing.

A characteristic feature of our transportation is the relatively high percentage of buses, motorcycles, scooters and mopeds. These, together with heavy trucks produce high level of noise. Noise produced by trains and highway traffic passing through large cities generally plays also a vital role in noise pollution.

In most of our urban planning, industrial zones does not separate from residential zone, light industry and workshop are scattered among residential quarters in the older parts of the towns and cities. In some places one can find workshops in basements or on ground floors. This causes serious annoyance to the living population.

Loudspeakers are a popular way of expressing ritual favour in our country. Births, marriages and deaths appear to be apt occasions for their use. This produce noise which is not only a nuisance but also a health hazard

Noise from airplanes constitutes an increasing serious problems in city like Delhi and Mumbai. Airport situated in the vicinity of populated centres and the air lanes pass over residential areas. Exercising of military airplanes add a lot of noise pollution in the atmosphere. Therefore, growing air traffic causes a great deal of annoyance.

Agriculture is highly mechanized in some states of India, like Punjab and Haryana. Tractors and other agricultural machines like threshars, combine harvesters, crop protection equipment, powered tillers are a lot noisy. Noise level from 90 dB to 98 dB due to running off arm machines have been recorded in the state of Punjab.

4.3. EFFECTS OF NOISE POLLUTION

Noise affects man adversely in several ways, *i.e.*, having ability to communicate, behaviour etc. Unlike smoke pollution, noise pollution is not visible. Normally, the people remain unaware of noise pollution, till it is too late to overcome it. The human ear has a safety mechanism to protect itself from the damage, provided the exposure to noise is not continuous or for a long period. Excessive noise causes loss of hearing and disturbs mental peace. To determine the level of noise which may be termed as excessive noise, we consider the time of exposure, as given in the Table 4.2.

Table 4.2.

Duration per day (hours)	Sound level (dB)	Duration per day (hours)	Sound level (dB)
0.25 or less	115	3.0	97
0.5	110	4.0	95
1.0	105	6.0	92
1.5	102	8.0	90
2.0	100		

It means that if one is exposed to a sound level in excess of 90 dB for 8 hours per day and that too daily, it will cause permanent loss of hearing. Also, one should not be exposed to a noise level of 115 dB even for a short period.

Other effects of noise pollution are as follows :

1. Noise pollution disturbs rest and sleep. The disturbance induces the development of annoyance and short temper.
2. Constant noise may cause our blood vessels to contract, our skin to become pale.
3. Noise pollution brings about dilation of pupil, tensing of muscles, decrease in gastric secretion and increase in diastolic blood pressure.
4. Noise causes the secretion of adrenalin into blood stream which gives a feeling of fatigue and neuro-muscular tension.
5. Small babies may develop a fear psychosis due to sudden and sharp noise.
6. The noise produced by jet engines causes gastric ulcers and thymus gland atrophy.

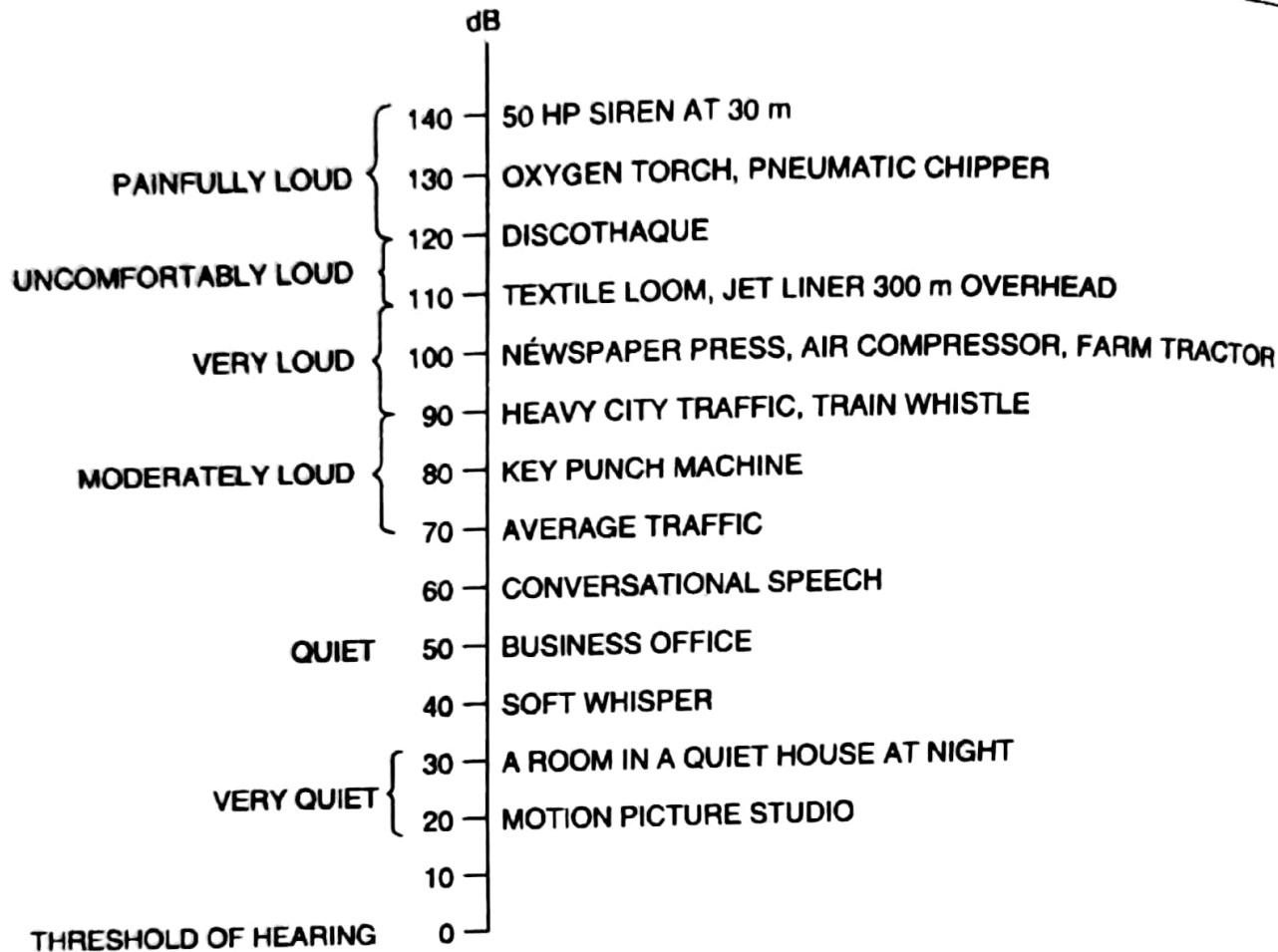


Fig. 4.1.

4.4. CONTROL OF NOISE POLLUTION

Noise is known to be a nuisance, but only recently there has begun to develop an awareness of the scope and seriousness of the problem of noise pollution in our environment. Methods must be developed for quantitative measurement of the annoyance and evaluation of the damage caused. Preventive measures and methods of alleviating the current problem must be studied to maintain the acceptable level of noise pollution to the human beings, as indicated in the following Table 4.3.

Table 4.3. Acceptable Level of Noise Pollution for Human Health.

Activities	Level (in dB)
Talking	50
In household	40
Motor Cycle	65-105
Heavy Vehicles (Trucks, Buses 7 mt distance)	85-100
Hammer (2 mt distance)	120
Aeroplane (50-100 mt height)	90-100
Warplane	Minimum of 140

No doubt that we have the technology to control nearly every kind of noise. We know very well about the sources and impact of noise pollution, but the main problem is that the people are not aware that noise is one of main environmental problems.

Following measures may be taken to have an effective control on noise pollution :

- 1. Ear protection aids.** For noisy industries, the workers should be provided with the ear protection aids like ear plugs, headphones, etc. A unique form of operational modification is employing deaf persons to handle noisy equipment, wherever possible, subject to suitable safeguards.
- 2. Design of doors and windows.** For reducing noise, it is necessary to design carefully the doors and windows of the room. The sound travels through very thin cracks between the door and wall. The space between the jamb and frame may be packed with sound absorbing material. In case of a door, the transmission loss increases with the increase in weight. In case of a window, the transmission loss increases with the increase in thickness of glass. Excellent sound insulation is obtained by constructing glazed windows with double or triple panes of glass. The air space at the edges of such panes is filled with sound absorbing material. Such windows are useful for special construction such as broadcasting studios, etc.
- 3. Improvement in working methods.** The basic principle of controlling noise pollution is to suppress the noise at the source itself. A working method creating less noise may be adopted. For instance, welding may be preferred to riveting. If it is not possible to alter the working method, the machines which are responsible for noise should be provided with such constructions that they create the least possible noise. Usually the machine is enclosed in a box-like structure with sound absorbing materials on its surfaces.
- 4. Legislative measures.** A vigorous pursuit of the existing legislative measures especially during the festival and marriage functions should be made.
- 5. Planting of trees.** A new concept gaining acceptance is the planting of trees like Neem, Tamarind, Coconut, etc. near schools, hospitals, public offices and such sites. The presence of trees is likely to reduce the noise to the extent of about 8 to 10 dB.
- 6. Town planning.** The vibrations from external sources such as railways, cars, traffic, factories, etc. create structure-borne sound. The most effective method for reducing such type of structure-borne sound is to have rational town planning. The city is divided into suitable zones and residential zone is placed away from railways, workshops, factories and main streets.
- 7. Treatment of walls, floors and ceilings.** It is found that floating floors and suspended ceilings help considerably in reducing the noise. Suitable sound absorbing materials like hairfelt, acoustical tiles, perforated plywood and specially porous materials are available and they can be fixed on walls, floors and ceilings to have reduction in noise.
- 8. Use of silencers or filters.** This method is applicable to the control of noise from ducts, exhausts or convey systems, the ends of which must be open to the atmosphere. For this purpose, glass wool or mineral wool covered with a sheet of perforated metal for mechanical protection may be used. The absorptive silencers depend upon sound absorption by suitable fibrous materials placed along with the walls of a transmission duct.

9. Vibration damping. This arrangement is attempted to reduce vibrations. A layer of damping material in the form of resilient pads made of rubber, neoprene, cork and plastics may be adopted for high frequency vibrations. It is desirable to make massive base for a vibrating machine.