

# Chapter 1

## Introduction

# 1. INTRODUCTION

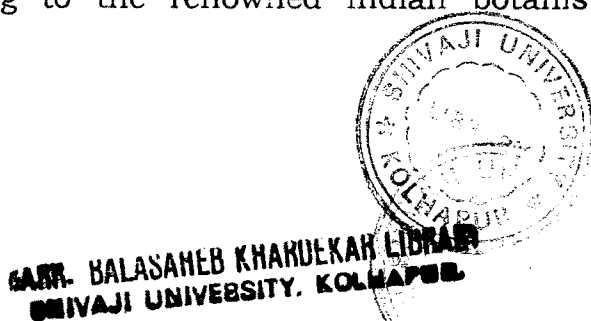
## 1.1. Introduction:

A world without sounds is impossible to comprehend. It is the different sounds in nature that make life more rich and meaningful on this planet. The great diversity of sounds from melodious chirping of birds to the sound of waves, all that comes under the greatest of the wonders on the planet.

Humans have been on Earth for some 2 to 3 million years, living most of the time in harmony with nature. Man, from his origin, has been dependent on nature for all his needs. It will be appropriate to say that nature can exist without man, but man cannot survive without nature

. The Mother Nature sings her lullaby in the form of the soft whispering sounds of streams running down the hills, the sweet melodies of the birds, the hushing sounds of the winds, the roar of the waves dashing against the rocks, all the masterly compositions of the creator, making it a wonderful place to live in.

Inspired by the sound of music of the Mother Nature, man created melodious tunes with the help of musical instruments of varying shapes and sizes and became convinced of the powerful influence, that music has on human life. Apart from relaxation, researchers have found that light music can also improve one's mind power and concentration too. (Times of India, 2000). According to the renowned Indian botanist



Jagadish Chandra Bose, even the plants respond to sound by showing better signs of growth and yields when allowed to grow in presence of music. Same is reported to be true in case of milking animals.

The industrial revolution that took place about 200 years ago, has positively changed the living styles and standards of mankind. The activities, which demanded a heavy muscle work force in the past, and which was replaced by machine power, are just a touch of a button away.

In today's world, thanks to improved nutrition and medical care, more babies survive their first few years of life and people live longer. While this is good news, it is a major cause of rapidly growing population. World population is now increasing at an alarming annual rate of 1.8 percent. If this rate continues, the number of people on earth will be double in about 40 years (Corson, 1990). The ever-increasing population and unplanned developmental activities have caused serious damage to the natural environment.

One of the most visible results of present development is the enormous growth of industry. Though it is necessary that the industries should expand to support growing needs of the populations and to raise the standards of living. Yet this development must not be at the cost of reduction in the quality of life and destruction of the environment. This should not undermine the natural potential of the future populations by exhausting natural resources. It is an observed fact that, all aspects of manufacturing affect the environment, including the raw material

exploration, extraction, production process, energy consumption, waste generation and the use and disposal of products by consumers.

As the impacts of human influences have grown, the risks of irreversible damage to the earth's natural systems are becoming significant, posing a threat to the rich and diverse biodiversity on this planet. More and more biodiversity is becoming endangered as a result of destruction of the natural habitats and environmental pollution (Pickering & Owen 1997). Richard Maybe (Corson, 1990), in his 'Handbook on Pollution' observes that "root cause of pollution probably lies in the sort of world we have chosen to build to ourselves, and in our thoughtless worship of progress at any cost". This amply illustrates that pollution is the progress crisis. The most common forms of environmental degradation have been water pollution, air pollution, soil pollution, global warming, acid rains and radioactive pollution to name a few. Significant but rather ignored cause of degradation of environmental quality in daily life is Noise pollution.

## **1.2. What is Noise Pollution?**

Sounds have existed on the face of the earth since time immemorial. It has indeed made life more meaningful and beautiful on this planet. According to the sixteenth century physician Paracelsus, "All substances are poisons. It is the right dose which differentiates a poison and a remedy" (Hill, 1997). This is true even in case of sounds. Any sound, no

matter how melodious it be, when it exceeds a certain limit, becomes a nuisance. It is no longer sound, but noise.

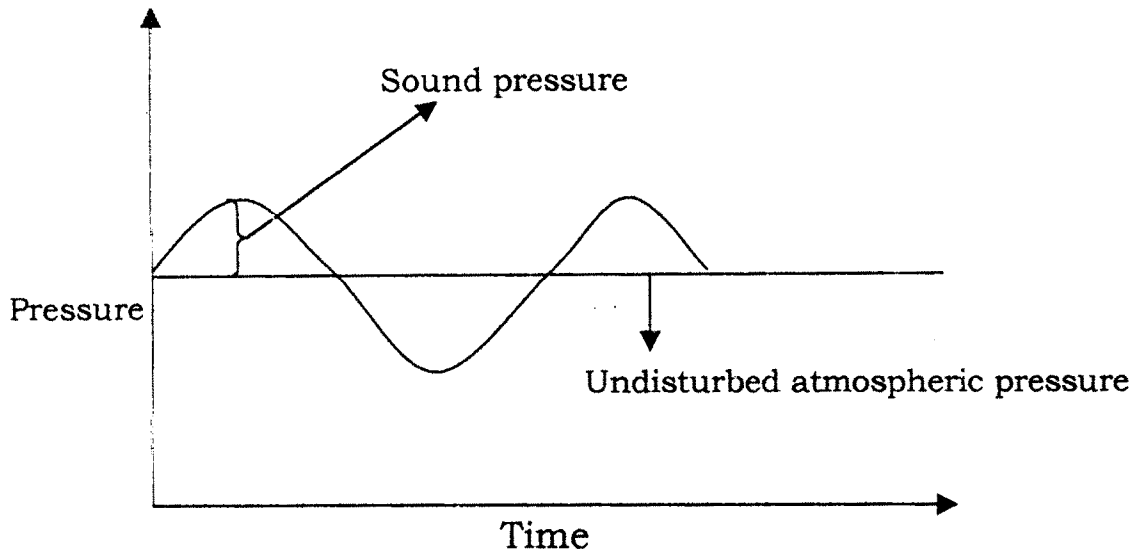
Encyclopaedia Americana states, "Noise by definition is unwanted sound. What is pleasant to some ears may be extremely unpleasant to other, depending on a number of psychological factors. Sweetest music, if it disturbs a person who is trying to concentrate or to sleep, is noise to him, just as the sound of a pneumatic riveting hammer is noise to nearly everyone. In other words, any sound may be noise if circumstances cause it to be disturbing".

Encyclopaedia Britannica states, "In acoustics noise is defined as any undesired sound, usually a mixture of many tones combined in a non-musical manner".

Therefore noise pollution refers to the unwanted sound being dumped into the atmosphere, leading to possible health hazards.

### **1.3. Measurement of Noise:**

Sound, as a disturbance propagating through a medium (air) is a wave phenomenon. This disturbance in air can be sensed by some physical quantity in the air, which is disturbed from its equilibrium value. The physical quantity of interest here is the sound pressure (McGraw Hill Encyclopaedia of Science and Technology, 1977). This physical quantity is the pressure disturbance or variation in pressure above or below the atmospheric pressure ( $1.01 \times 10^5$  Pa)



**Fig. 1.1: Pressure disturbance with the undisturbed atmospheric pressure**

As the sound pressures are extremely small, it does not provide practical units for noise measurements for two basic reasons, viz.

1. A tremendous range of sound pressure can be produced; i.e. from  $2 \times 10^{-5}$  Pa which is the lowest audible pressure to approximately 200 Pa which is the threshold of pain. This represents a range of pressure by a factor of  $10^7$  (ten million).
2. The human ear does not respond linearly to increases in sound pressure. The human response is essentially logarithmic (Larry Canter, 1996)

Therefore, noise measurements are expressed by the term “sound-pressure level” (SPL) which is the logarithmic ratio of the sound pressure to the reference pressure and is expressed as a dimensionless unit of power, the decibel (dB). It is expressed as follows:

$$\text{SPL} = 20 \log_{10} (P/P_0)$$

Where P = sound pressure

$P_0$  = reference pressure ( $2 \times 10^{-5}$  Pa)

The human ear is particularly sensitive to the frequencies of around 4000 Hz. Therefore the noise measurements are carried out by the use of A-weighting system incorporated in the noise measuring instruments (Rau and Wooten, 1980). This system emphasizes the frequencies around 4000 Hz and de-emphasizes the higher and lower frequencies. Therefore the A weighted sound level is representative of human hearing response. The measurements made, using the A-weighted system are reported as dB(A) i.e. (A- weighted decibels). [Canter, 1996]

Some of the different parameters involved in the study of noise pollution are: Equivalent sound level ( $L_{eq}$ ), Day-night sound level ( $L_{dn}$ ),  $L_{90}$ ,  $L_{50}$ ,  $L_{10}$  etc. (Gaur, 1999)

#### **1.4. Effects of Noise Pollution on Wildlife:**

Most researchers agree that noise can affect animal behaviour and physiology; and if it becomes a chronic stress, noise can be injurious to animal energy budget, reproductive potential and long term success.

1. One of the immediate effects of noise is the adverse impact it has on the animal's energy budget. They are found to take less food and also tend to be in chaotic movement. As a result there is more energy expenditure and thereby leads to energy deficit.

2. The animal like Bat, which depends on the echo-location to find its food, is unable to find it due to the interference produced by natural or mechanical means. A similar threat exists for marine mammals like the Whale which depend on echo-location for finding prey, mates or determining the migratory routes. Noise in the marine ecosystems are produced by commercial and naval ships, oil exploration, military and scientific tests. The Whales were found to have damaged ear bones and ear canals filled with blood and pus when exposed to loud noises.
3. The animals in the zoo, particularly the deer, lion and rhino, were found to be adversely affected from the adjoining traffic noises, according to a study conducted in Delhi zoo (Shastri & Trivedi, 1988). It was reported that the animals become dull, inactive and their health deteriorated.
4. According to a similar study (Shastri & Trivedi, 1988) conducted in Malaysia, it was found that the Kangaroo rats exposed to noise become more vulnerable to its predators
5. Many of the bigger animals in the wild, tend to move out of their natural habitats in search of calmer places. This may lead to an unnatural and unhealthy competition among the animals for food and space.
6. There are reports of decline in the migratory birds visiting a habitat if it becomes noisy. This may adversely affect their feeding and breeding habits and ultimately health.





7. Experiments conducted on rabbits, rats and monkeys show development of duodenal ulcer, swelling and discoloration of adrenal glands. (Sharma and Kaur, 1994)

### **1.5. Effects of Noise Pollution on Human Beings:**

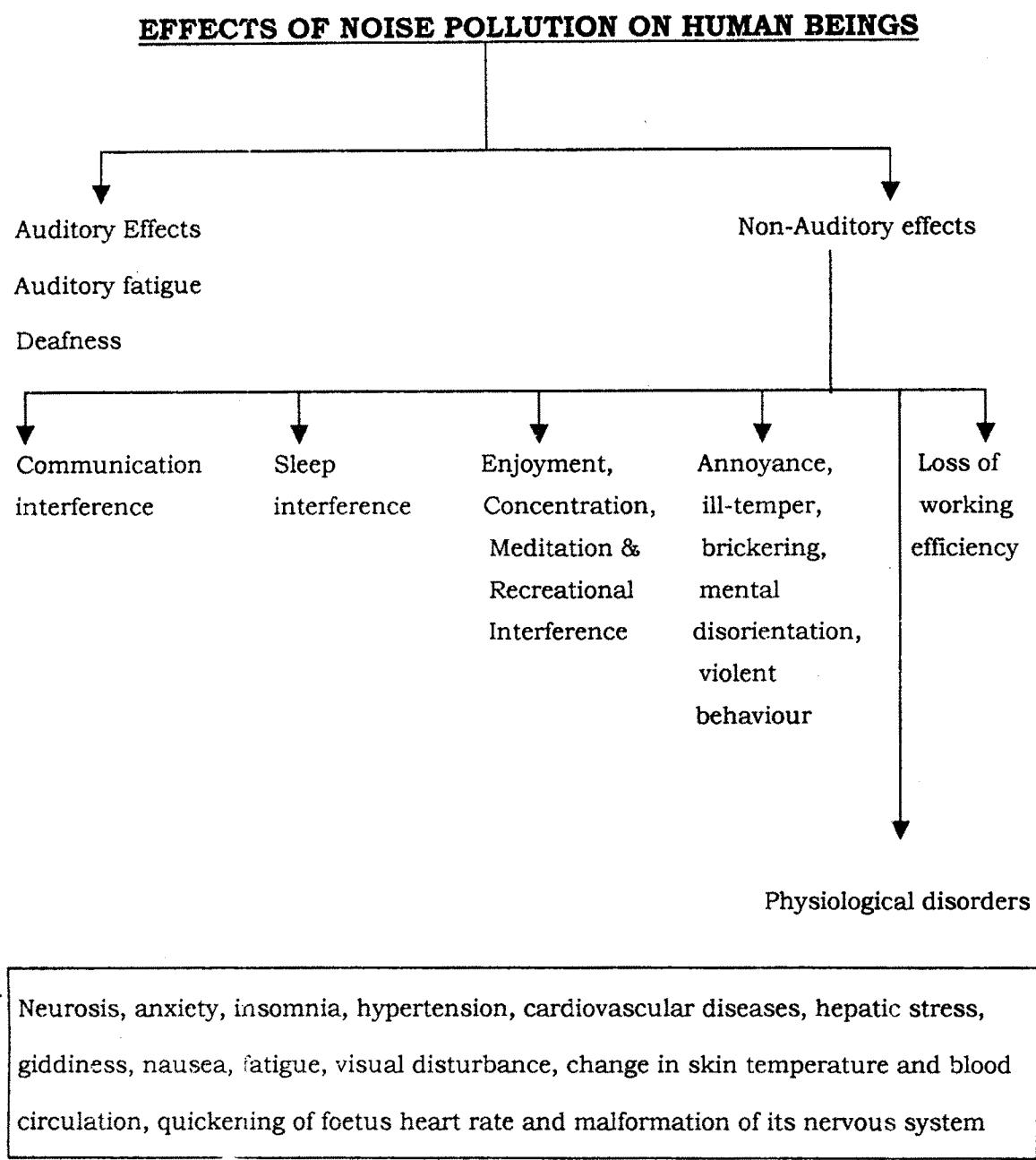
Effects of noise pollution on human beings can be broadly classified into two categories viz. Auditory effects and Non-Auditory effects.

#### **Auditory Effects:**

- (a) Auditory fatigue: This is commonly observed among people continuously exposed to noise levels of about 90 dB and may be associated with side effects such as whistling and buzzing in the ears.
- (b) Deafness: The most immediate and acute affect of noise is the impairment of hearing, which diminishes by the damage of some part of auditory system. When exposed to very loud and sudden noise, acute damage occurs to the eardrum. Prolonged exposure to noise of certain frequency pattern will lead to chronic damage to the hair cells in the inner ear. The hearing loss may be temporary or permanent. The permanent hearing loss occurs at continuous exposures of 100dB and above. Besides chronic hearing loss, there may be instantaneous damage or acoustic trauma, which may be caused by very high intensity impulsive noise resulting from an explosion or sudden excessive noise of more than 140 dB (Kamboj, 1999).

### Non-Auditory Effects:

- (a) Noise pollution affects human health, comfort and efficiency. It causes contraction of blood vessels, makes the skin pale and leads to excessive secretion of adrenaline hormone into the blood stream, which is responsible for high blood pressure.
- (b) It causes muscles to contract leading to nervous break down, tension and insanity.
- (c) Noise causes anxiety, stress and fright. These adverse reactions are coupled with a change in hormone content of blood, which in turn produces increased rate of heart beat, constriction of blood vessels, digestive spasms and dilation of pupil of eye.
- (d) Noise affects health efficiency and behaviour. It may cause damage to brain, heart, kidneys, liver and also causes emotional disturbances.
- (e) It causes physiological disorders such as neurosis, insomnia, hypertension, increase in sweating, hepatic diseases, giddiness, peptic ulcers, undesirable change in gastro- intestinal activities, behavioural and emotional stress.
- (f) It causes frustrations and is associated with difficulty in concentration, disturbance of rest, physical and mental fatigue. Low frequency noise of 50 to 60 dB affects the higher centres of brain and causes alteration in the normal sleep pattern and prevents sound sleep. The important effects of noise pollution on human being are given in the Figure 1.2.



**Fig.1.2: Chart showing the effects of noise pollution on humans**

- (g) Noise mainly interferes with man's communication. It prevents people from what they want to hear and enjoy. It is easy to visualise that a conversation can be carried on in a still place, while one has to shout to make sense in a noisy factory.
- (h) Noise causes heart output to decrease and creates fluctuations in arterial blood pressure and vasco-constriction of peripheral blood vessels. Vasco-constriction occurs even for short noises and persists for several minutes after cessation of the noise. It causes severe headache, fatigue and nausea.
- (i) Brain is also adversely affected by loud and sudden noise such that of jet and aeroplane noise, leading to psychiatric illness. It is also injurious to the health of pregnant woman and foetus.
- (j) The recent research has shown that excessive noises may lead to the thickening of blood. Changes in breathing amplitude have also been reported due to impulsive noise.
- (k) The optical system is also a prey for noise pollution. Pupillary dilation, impairment of night vision and decrease in the rate of colour perception are some of its effects (Shastri and Trivedi, 1988).

**Table 1.1: Noise levels and common human health hazards  
(Shastri & Trivedi, 1988)**

<b>Noise level (dB)</b>	<b>Health hazards</b>
80	Annoying
90	Hearing damage (8 hr.)
95	Very annoying
110	Stimulation of reception in skin
120	Pain threshold
130-135	Nausea, vomiting, dizziness, interference with touch
140	Pain in ear, prolonged exposure causing insanity
150	Burning of the skin, significant change in the pulse rate
160	Other minor permanent damages if prolonged
180	Ear drum ruptures; major permanent damage
194	Lung damage

### **1.6. Effects of Noise Pollution on Non-living things:**

The high intensity of noise, emanating from the heavy machinery, cause shattering of window glasses, loosening the plaster of house-walls, cracks in walls, cracks in house hold crockery and breaking down of hangings in the house. Sometimes, it may even cause the shattering of

the foundation of the buildings. At times the noise from fast moving jet planes, and heavy vehicles cause damage to building structures. The noise may also cause depreciation of the residential property located nearby airports, highways, industrial areas and other noise prone places.

### 1.7. Sources of Noise Pollution:

The sources of noise are either natural like the thunder, or man-made. The man-made sources are broadly classified into two types; viz

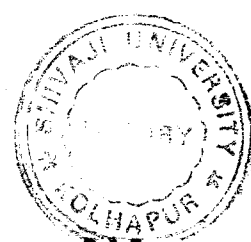
- (a) Industrial, and
- (b) Non-Industrial

#### Industrial sources

Noise originates from various machines in the industries involved in the act of crushing of different materials, grinding, drilling, weaving, forging, pressing, blasting operations etc. Noise levels in some of the Indian industries are given in table 2.

**Table 1.2: Noise levels in some of the Indian industries (Kamboj, 1999)**

Industry	Noise levels [dB(A)]
Aircraft repair workshop	100-110
Heavy vehicle factory	110-115
Glass blowing workshop	70-108
Ammunition factory	85-101
Saw mills	90-112
Brass band units	90-112
Silver foil manufacture	90-112
Vanaspati (filling section)	76-87
Auto vehicles(engine testing)	80-90



Petroleum industry	74-98
Synthetic power industry	90-116
Power plant	90-100
Sugar industry	81-104
Light engineering units	78-82
Plastic industry	87-94
Leather industry	75-80
Heavy engineering unit	84-83
Fabrication unit	75-80

The noise levels prevailing in most of the industries in India are found to be quite high (Table 1.2) as compared to the standards. Therefore, it is clear that the noise pollution has a significant impact on the workers by way of health effects. An important criteria, in addition to exposure, is the duration the workers are exposed to, in the noisy work environment.

**Table 1.3: Permissible noise exposure, if unavoidable (Kamboj, 1999).**

Noise level [dB(A)]	Duration of exposure (day <sup>-1</sup> hr <sup>-1</sup> )
90	8.0
92	6.0
95	4.0
97	3.0
100	2.0
102	1.5
105	1.0
110	0.5
115	0.25

### Non-industrial sources

The non-industrial sources can be broadly classified as:

- (a) Domestic noise
- (b) Loud speakers
- (c) Construction work
- (d) Traffic noise
- (e) Crowded markets
- (f) Theatres, fairs and carnivals
- (g) Religious rituals and festivals
- (h) Trains
- (i) Aircraft
- (j) Projection of satellites and
- (k) Atomic explosions.

**Table 1.4: Some of the common noise sources and its noise levels**  
(Sharma, 2000)

Sr. No.	Noise source	Noise level [dB (A)]
1	Telephone	60
2	Air-conditioning unit (at 20 ft)	60
3	Restaurant noise	60-70
4	Office noise	60-80
5	Alarm clock	70-80
6	Children playing	60-80
7	Lawn mover	60-80
8	Vacuum cleaner	80
9	Traffic noise	50-90
10	Train horn (at 50 ft)	110
11	Pneumatic drills	110-120
12	Commercial jet aircraft (at 100 ft)	120-140
13	Space rockets (launching)	170-180



### **1.8. Legal Aspects:**

It is seen that various environmental laws have failed to offer sufficient remedial measures for the individual sufferers, and the criminal liability created there under is mostly generalised and is of little avail to the person or persons who become victims of any pollutant. Another vital aspect lacking in the environmental laws is that there is no independent law on noise pollution in our country.

In India, the use of loudspeaker assumes the status of a fundamental right by virtue of Article 19(1) and Article 25 of the Constitution. Article 19(1) provides that all citizens have the right

- (a) to freedom of speech and expression;
- (b) to assemble peaceably and without arms;
- (c) to form associations or unions;
- (d) to move freely throughout the territory of India.

Although the right as specified in (10, (b), (c) and (d) above is subject to reasonable restriction imposed or impossible by law in the interest of -

- (i) the sovereignty and integrity of India;
- (ii) the security of the State;
- (iii) friendly relations with foreign States;

(iv) public order, decency or morality or in relation to contempt of court, defamation or incitement to offence;

(v) general public.

It may not be missed that restrictions to be placed in the interest of general public to obtain in relation only to the right to move freely throughout the territory of India, which right has not so much to do with the use of a loudspeaker. With the result that the right to freedom of speech and expression.

Speeches of leaders or office bearers of any political party or union, the assemblage of guests or visitors at marriage or birthday functions or at fairs, meals or exhibitions, street processions or shobha yatra betokening a social or religious festivity, inaugurations and celebrations of anniversaries and marriages, periodic election campaigns where use of loud speakers, fire crackers and the loud stereo music is inevitable today. All these are subject to reasonable restrictions on ground, not as noise being a pollutant, but only the grounds of the fundamental rights.

One thing that, can conceivably cover a ban on noise by loudspeakers and other means can, of course, be decency, but the difficulty again is that the word 'decency' being itself undefined, public shall have to wait until some verdict of higher judiciary might declare noise as contrary to decency. A bye-law of a municipality requiring

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permission for using a loudspeaker does not infringe Article 19(1)(a). State can regulate the use of loudspeakers and mechanical or other contrivances to amplify sound, and does not amount to an infringement of the right under Article 19(1) (a). Similar is the case with explosives, fire cracker, etc

This right is made subject only to public order, morality and health. Since this right is subject to health, noise caused by loudspeakers, use of fire-cracker and explosives can be prohibited in interest of health, but then again, nexus between noise and health will have to be judicially established. As to other categories of noise pollution, aeroplanes, trains, automobiles, radio and television sets, have the common symptom to add to the noise which is now considered to be the most dangerous pollutant of man's environment.

Some of the existing legal provisions in India for controlling noise include:

**1. Indian Penal Code:** Noise pollution can be dealt under sections 268, 290 and 291 of the Indian Penal Code, as a public nuisance. Under sections 268 of this code, it is mentioned that, 'A person is guilty of a public nuisance, who does any act, or is guilty of an illegal emission which causes any common injury, danger or annoyance to the public or the people in general who dwell or occupy property in the vicinity or which must necessarily cause injury, obstruction, danger or annoyance

to persons who may have occasion to use any public right. A common nuisance is not excused on the ground that it causes some convenience or advantage'. Sections 290 and 291 of the Indian Penal Code deal with the punishment for public nuisance. .

**2. Criminal Procedure code:** Under section 133 of the Criminal Procedure Code, the Magistrate has power to make conditional order requiring the person causing nuisance to remove such nuisance.

**3. The Factories Act, 1948:** The Factories Act does not contain any specific provision for noise pollution control. However, under the third schedule sections 89 and 90 of the Act, noise induced hearing loss is mentioned as a notifiable disease. Under section 89 of the Act, any medical practitioner who detects any notifiable disease, including noise induced hearing loss in a worker, has to report the case to the Chief Inspector of Factories, along with all other relevant information. Failure to do so is a punishable offence.

**4. Motor Vehicles Act, 1988:** The Motor Vehicles Act 1988 and the rules framed thereunder sections 119 and 120 of the Central Motor Vehicles Rules, 1989, deal with the reduction of noise.

**(A) Under section 119, Horns:**

(a) Every motor vehicle shall be fitted with an electric horn or other device approved by the Bureau of Indian Standards and the registering authority for use by the driver of the vehicle and capable of

giving audible and sufficient warning of the approach or position of the vehicle.

(b) Every motor vehicle shall be so constructed and maintained as to conform to the noise standards as approved by BIS from time to time.

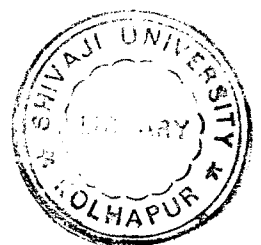
**(B) Under section 120, Silencers:**

Every motor vehicle shall be fitted with a device which by means or an expansion chamber or otherwise reduces as far as practical, the noise that would otherwise be made by the escape of exhaust gases from the engine. Every motor vehicle shall be so constructed and maintained as to conform to the noise standards as approved by BIS from time to time. .

**5. The Air (Prevention and Control of Pollution) Act, 1981:** Noise was included in the definition of air pollutant in the Air (Prevention and Control of Pollution) Act, 1987. Thus the provisions of the Air Act, become applicable in respect of noise pollution also. .

**6. The Environment (Protection) Act, 1986:** Although there is no specific provision to deal with noise, the Act provides powers to Government of India, to take measures to deal with various types of pollution including noise pollution.

**7. According to the Gazette of India: Extraordinary (MoEF Notification),** dated 25<sup>th</sup> September 2000, the new limits for vehicles to be applicable from 1<sup>st</sup> January 2003 are as follows.



**Table 1.5: Noise Limits for vehicles with effect from 1<sup>st</sup> January, 2003.**

<b>S.No.</b>	<b>Type of Vehicle</b>	<b>Noise Limits, dB(A)</b>
1.	Two wheeler	
	Displacement upto 80 cm <sup>3</sup>	75
	Displacement more than 80 cm <sup>3</sup> but upto 175cm <sup>3</sup>	77
	Displacement more than 175 cm <sup>3</sup>	80
2.	Three wheeler	
	Displacement upto 175 cm <sup>3</sup>	77
	Displacement more than 175 cm <sup>3</sup>	80
3.	Passenger car	75
4.	Passenger or commercial vehicle	
	Gross vehicle weight upto 4 tonne	77
	Gross vehicle weight more than 4 tone but upto 12 tonne	80
	Gross vehicle weight more than 12 tonne	82

### **1.9. Justification:**

The menace of noise pollution can be mainly attributed to the rapid urbanisation, changing trends and the life styles of the present day. It is observed that, more and more people have been migrating from rural areas to the urban set-up in search of jobs and better standards of living.

This has resulted in an unplanned population rise in most of the big cities and the growing towns. The increased density of population in such growth centres has brought with it various factors, which are responsible for creating noise. The quest for higher standards of living has brought about substantial breakthroughs in the areas of science and technology. The invention of various machines and equipments has made life much easier to live. But all this development has also brought with it side effects as new challenges. One of that is noise pollution.

Knowing the impacts that noise can have on the people, it becomes essential to have a closer look at the problem. Moreover, today we tend to live in a world which is unaware of this serious but silent killer. The present day ways of celebrations have further aggravated this menace. Trying to understand the exact levels to which the general public are exposed to can help better understand the seriousness of the problem and work out measures to tackle it. Therefore the topic of noise pollution in a growing city like Kolhapur was chosen for the present study.