



The word noise is derived from the Latin term “nausea”. It has been defined as “unwanted sound, that is dumped into the environment. Noise pollution has attracted much attention due to the increased awareness of its effect on human and animal health. Apart from affecting living beings, noise also adversely affects inanimate beings like buildings, heritage monuments etc.

Based on its origin, noise pollution can be divided into two categories viz., Natural and man-made. Natural sources of noise include air, volcanic eruptions, seas, rivers and thunder etc. Man made noise can be chiefly attributed to machines and modern equipment of various types including automobiles, trains, aeroplanes, explosives, firecrackers and others. Noise affects human life in many ways. It influences sleep, hearing, mental and physical health and communication. Irrespective of the source, noise is a pollutant and besides its contribution to stress levels, impaired hearing, and other body dysfunctions are yet to be fully understood.

Noise pollution can be categorized as below:

- a) Industrial noise: noise emanating from factories, use of heavy machinery etc.,
- b) Transport noise: noise from automobiles like cars, busses, planes etc.,
- c) Community noise: noise from human settlements, including use of loudspeaker, bursting of crackers etc.

## **Noise vs Sound**

Not all people are affected in the same way by the same sounds. Often, we take for granted the sounds we hear everyday. On different occasions and in varying situations, however, common everyday sounds can interfere with our routine task. When this happens, sounds become noise.

What may be a disturbing noise for one person may be a pleasant sound for someone else. For example, some people like to hear music at high volume which may be noise for others. It is not the pitch or loudness of a sound that makes it unbearable. In fact, the repetitive nature, distraction it causes and the lack of control over it are the main reasons why noise causes irritation.

## **Perception of sound**

Ear is the chief organ for perception of sound . The ear is divided into three parts: the outer ear, the middle ear, and the inner ear. Each section performs its own separate function in a process that involves conversion of sound waves into nerve impulses, which are then transmitted to the brain.

The outer ear collects and channels sound, the middle ear, or tympanic cavity works to increase the intensity of incoming sound waves and transforms them into mechanical vibrations that can easily travel through the inner ear. The inner part of ear contains receptor cells, which receive the mechanical vibrations and transmit them to the brain.

## MESSAGE

**Sri. K.M. Shivakumar IAS,  
Principal Secretary to Government,  
Department of Forest, Ecology and Environment.**

All of us have experienced the ill effects of noise pollution in our daily lives. Cities and town are now becoming the epicenters of noise pollution and the impact of this on the population living in these areas is ever increasing. In the course of a day, people are exposed to different types of noise in their homes, offices, schools and while commuting. Urbanization and expansive growth of cities have given rise to many environmental problems. Noise pollution is one of them which has garnered much attention and is a now source of concern among citizens.

Noise pollution has been recognized worldwide as a environmental problem that has wide spread consequences on health and well being of human beings. Unfortunately, we are not doing enough to curb this menace. A lot needs to be done in areas of awareness generation, use of sound proofing measures and research and development initiatives in the automobile sector.

Man's contribution to noise pollution is undisputed and his activities have resulted in the problem attaining such frightening proportions today. Thus the remedy for this problem also lies within us and it is we who should take up the initiative. Each problem presents us with an opportunity to work towards addressing it. Understanding the problem is the first step in this direction.

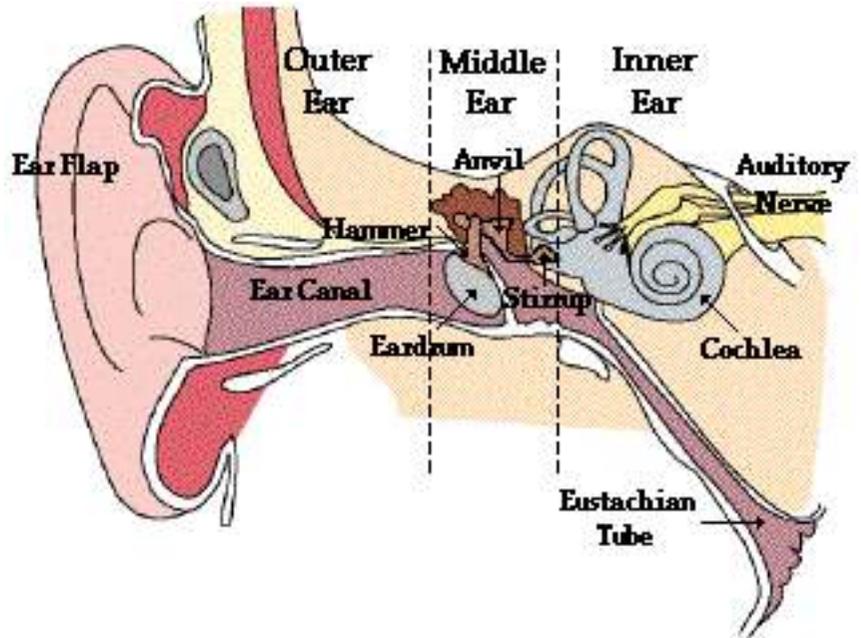
I hope this document will serve to spread awareness on the subject and inform citizens to enable them to act to address the issue.

**Sri. Sadashivaiah, IAS,  
Secretary to Government,  
Department of Ecology end Environment.**

Noise pollution is relevant as we live in a society exposed to high levels of noise. It is emerging as a big problem, combating the noise pollution is a challenge for the government, policy makers, self help groups and citizens. There are many dimensions to the problem of noise pollution which need to be fully understood. Exposure to noise levels in excess of the permissible limits can have short term and long term consequences on health. Noise from sources like vehicles, loud speakers, trains, planes firecrackers etc are now dominating our lives like never before. The problem of noise pollution has reached dangerous proportions in our cities. It can also cause stress, psychological illness and is harmful for everyone irrespective of their age group. Noise also affects inanimate objects like historic monuments and buildings.

Thus there exists an urgent need to sensitize the population on the ill effects of noise pollution. So we have to take steps to minimize and control generation of noise. As responsible citizens, each one of us needs to play a pro-active role in spreading awareness on the issue. The information contained in this document will definitely address some of the information gaps and will provide more information on the subject to interested readers.

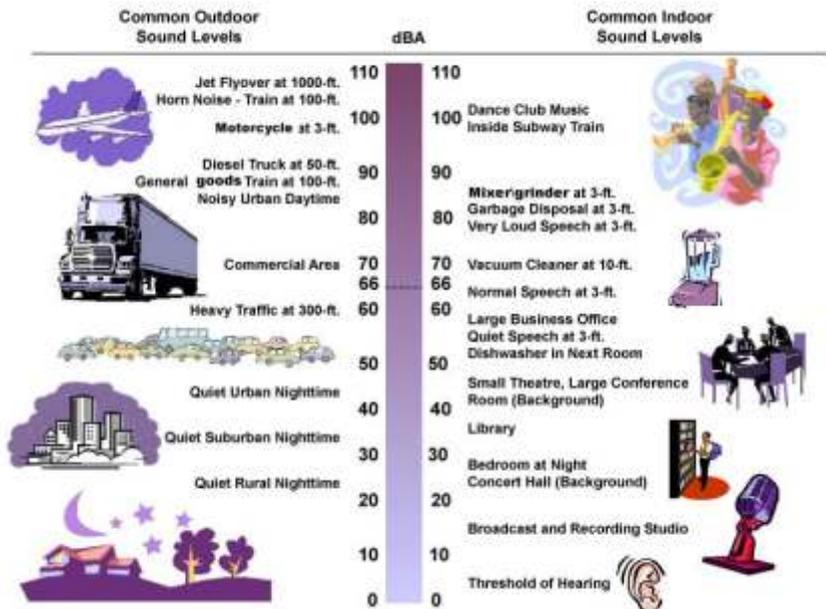
The frequency range of sound audible to humans is approximately between 20 and 20,000 Hz. Frequency is one of the properties of sound or noise. Sound with high frequency is said to be high-pitched and sound with a low frequency is low-pitched. This range however varies among individuals and generally reduces with age. Above and below this range are ultrasound and infrasound, respectively. Sound is technically at its upper limit at 194.09 dB. Above this level it should be called a shock wave. Sounds begin to damage the ears at around 85 dB and sounds above approximately 130 dB (often referred to as the threshold of pain) result in pain and agony for the listener.



Loud and low frequency sounds can be perceived by other parts of the body through the sense of touch. Sounds are used mainly for communication through speech. Bats use echolocation, ships and submarines use sonar, and humans can determine spatial information by the way in which they perceive sounds.

### Measurement of sound

Human perception of loudness also conforms to a logarithmic scale; a 10-decibel increase is perceived as roughly a doubling of loudness. Thus, 30 decibels is 10 times more intense than 20 decibels and sounds twice as loud; 40 decibels is 100 times more intense than 20 and sounds 4 times as loud; 80 decibels is 1 million times more intense than 20 and sounds 64 times as loud. Distance diminishes the effective decibel level reaching the ear. Thus, moderate auto traffic at a distance of 100 ft (30 m) rates about 50 decibels. To a driver with a car window open or a pedestrian on the sidewalk, the same traffic rates about 70 decibels; that is, it sounds 4 times louder. At a distance of 2,000 ft (600 m), the noise of a jet takeoff reaches about 110 decibels approximately the same as an automobile horn only 3 ft (1 m) away.



The average person sleeps well at 45dB(A)-50dB(A). At 120 decibels the ear registers pain, but hearing damage begins at a much lower level, about 85 decibels. The duration of the exposure is also important.

## Impact of noise pollution

There are two types of sounds that can damage the sensitive hair cells in the inner ear that help make hearing possible. The first are extremely loud, sudden noises such as explosions, crackers, gunshots. The second are loud sounds experienced at such events as high-volume music concerts. Regardless of the cause, this form of hearing loss can't be reversed.

Sudden and unexpected noise has been observed to produce marked changes in the body, such as increased blood pressure, increased heart rate, and muscular contractions. Moreover, digestion, stomach contractions, and the flow of saliva and gastric juices all stop. Because the changes are so marked, repeated exposure to unexpected noise should obviously be kept to a minimum. These changes fortunately wear off as a person becomes accustomed to the noise (Broadbent, 1957).

Of the different categories of hearing loss, the sensory hearing loss is of much importance in the context of noise pollution. Sensory hearing loss is caused by damage to the inner ear (cochlea) and is the most common form associated with noise. This type of hearing loss not only involves a reduction in sound level, or ability to hear faint sounds, but also affects speech understanding, or ability to hear clearly. The cochlea contains thousands of tiny hair cells which transmit sound impulses to the auditory nerve. An explosion of 140 dB can cause permanent deafness, for it destroys certain cells in the inner ear that do not regenerate. The middle ear has a reflex action that reduces the transmission of sound and helps prevent damage. It is too slow, however, to protect against sudden bursts of sounds such as gunshots. Extended exposure to excessive noise levels can reduce the ability of the hair cells to transmit sound by flattening or disfiguring them or by causing them to fuse together. Sensory hearing loss is generally irreversible, but further loss can be prevented by using protective equipment.

### Degree of hearing loss:

Degree of hearing loss refers to the severity of the loss. There are five broad categories that are typically used. The numbers are representative of the patient's thresholds, or the softest intensity that sound is perceived:

- \* Normal range or no impairment = 0 dB to 20 dB
- \* Mild loss = 20 dB to 40 dB
- \* Moderate loss = 40 dB to 60 dB
- \* Severe loss = 60 dB to 90 dB
- \* Profound loss = 90 dB or more

Some of the health impacts of noise may not be so apparent and perceivable. Sleep disturbances are probably the most widespread source of annoyance caused by noise, if anecdotal responses are taken as criteria. The World Health Organization has recommended a nighttime average level of 35-40 dB for undisturbed sleep.

The Noise Pollution (Regulation and Control) Rules, 2000, have set the standards for noise levels in various areas in our country.

### Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area/Zone	Limits in dB(A)	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

For purposes of these Rules, the day time refers to the time period between 6.00 a.m. and 10.00 p.m. The period in between has been referred to as night and a Silence zone is defined as an area comprising not less than 100 mts around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.

A study conducted in Bangalore revealed the following levels of noise in various areas:

Type of area	Noise level in dB(A)
Traffic zone	71-111
Residential	51-69
Industrial zone	72-98
Near airport	86-102

Source : Karnataka state of Environment Report and Action Plan-2003.

The maximum noise was attributed to vehicular movement in the high traffic zones, followed by airways, followed by industries.

According to the World Health Organization, health risks associated with noise pollution include:

- \* interferences with social behavior (aggressiveness, protest and helplessness);
- \* interference with speech communication;
- \* affects performance at work/school;
- \* pain and hearing fatigue;
- \* hearing impairment including tinnitus;
- \* annoyance;
- \* interferences with social behavior (aggressiveness, protest and helplessness);
- \* interference with speech communication;
- \* sleep disturbance and all its consequences on a long and short term basis;
- \* cardiovascular effects;
- \* hormonal responses (stress hormones) and their possible consequences on human metabolism (nutrition) and immune system.

Based on the duration of exposure, noise can have multiple effects on human beings. Some of which are listed below:

- \* Eardrum is damaged when exposed to very loud and sudden noises. The hair cells in the inner ear are chronically damaged. Prolonged exposure to noise of certain frequency pattern leads to hearing loss.
- \* According to Kryter in 1970, noise causes heart output to decrease with fluctuations in arterial blood pressure and vaso-constriction (decrease in the diameter) of peripheral blood vessels.
- \* Studies indicate that blood is thickened by excessive noise. Eosinophilia (a symptom of allergy), hyperglycaemia (Abnormally high blood sugar), hypokalaemia (Abnormally low level of potassium in the circulating blood leading to weakness and heart abnormalities) and hypoglycaemia (Abnormally low blood sugar) are caused by alteration in the blood due to noise.
- \* Noise affects sleep and work performance including the ability to concentrate especially of watch-repairers and others where precision is called for.

Exposure to high noise levels for short period of time can result in temporary loss of hearing. Whereas, exposure for long periods of time can result in permanent loss of hearing. High noise levels are also dangerous for foetus and can cause behavioral changes in pets.

## **Standards for noise pollution**

Recognizing the significance of noise pollution, the Hon' ble Supreme Court in writ petition (Civil) No 72/1998 issued various directions restricting the use of loud speakers and high volume sound systems. The main directions issued by Hon' ble Supreme Court in the above mentioned order are:

- \* Complete ban on bursting sound emitting firecrackers between 10 pm and 6 am.
- \* Categorization of crackers in to light emitting ones and those which emit sound.
- \* All manufacturers should necessarily mention the details of the chemical composition of the crackers and that these meet the requirements as prescribed by the Department of Explosives.
- \* In case of loud speakers, the noise level at the boundary of public place where the loud speaker or any public address system is being used should not exceed 10 dB (A) above the ambient noise standards or 75 dB(A), whichever is lower.
- \* Ban on use of drums, trumpets, sound amplifiers between 10 pm and 6 am. Except in case of emergencies.
- \* In case of vehicles, horns should not be used 10 pm and 6 am in residential areas except in exceptional circumstances.

## What can one do to reduce noise pollution?

As citizens, we have a responsibility to ensure that we do not contribute to noise pollution. Some of the measures that we can follow to minimize/prevent noise pollution include:

- ▶ Indiscriminate use of horns should be avoided
- ▶ Avoid use of multi tuned and loud horns
- ▶ Service automobiles regularly
- ▶ Avoid playing tape recorders and televisions at high volume
- ▶ Avoid use of mixers, grinders and equipment that cause noise after 9 PM
- ▶ Avoid use of loud speakers after 9 PM
- ▶ Switch off mobile phones in hospitals, educational institutions etc.
- ▶ Crackers should not be burst in residential areas
- ▶ Avoid use of loud crackers at all times
- ▶ If generators are to be used, they should be enclosed in a sound proof chamber
- ▶ Quiet homes allows the thought process to sustain thus lets all resolve to keep our homes as quiet as possible
- ▶ Report instances of violation of noise pollution norms to the State Pollution Control Board
- ▶ Try to gain more knowledge on the impacts of noise pollution and try to keep noise levels in our homes, offices, schools and public places to the minimum
- ▶ Teach children about the significance of noise pollution

### Types of hearing protection devices

**Earplugs:** The most popular hearing protection device is earplugs, which are inserted into the ear canal to provide a seal against the canal walls. Preformed earplugs are made of flexible, vinyl materials and often come in different sizes to fit different sizes of ear canals. Earplugs are made of materials that can be manipulated to conform to the shape of the wearer's ear canals. The earplugs are made of foam, which is compressed for insertion into the ear canal, then expands to fill the canal and seal against its walls.



**Earmuffs:** Sometimes called circumaural hearing protection device, earmuffs enclose the entire external ears inside rigid cups. The inside of the muff cup is lined with acoustic foam (which must not be removed), and the perimeter of the cup is fitted with a cushion that seals against the head around the ear by the force of the headband. In most industrial environment, earmuffs are less popular than earplugs, but they can provide reliable protection.



**Semi-Aurals or Canal Caps:** These hearing protection devices are small stoppers that seal against the entrance to the ear canal by the force of a band worn under the chin or behind the neck. They generally provide less protection than earplugs or earmuffs. They are most suitable for short-term use, as they are less comfortable than other hearing protection devices for all-day wear.



## **Noise abatement measures**

Noise can be regulated at two levels viz., source and listener. Noise generating devices like generators, motors etc can be placed in sound proof chambers. In places like airports, a vegetation belt consisting of trees to absorb the noise generated will be useful in reducing the noise level reaching adjoining habitations.

Noise arising from vehicles can be regulated by implementing vehicle maintenance measures like air pressure checks, engine tuning etc.

In places where source level measures cannot be implemented, the listeners can be given hearing protection devices (HPDS). The most popular HPDS are earplugs, which are inserted into the ear canal to provide a seal against the canal walls. Ear muffs also fall in this category.

## **Frequently asked questions**

### **What is noise pollution?**

Noise pollution is environmental noise that is annoying, distracting, or physically harmful. It violates the peace and privacy of a citizens life and home, and creates problems for the community.

### **Is noise pollution a health issue?**

Yes, exposure to daily levels of noise pollution causes hearing loss, hypertension, increased blood pressure and headaches. Excessive noise causes depression in many people and can lead to reduced work efficiency and even violence. When people lose sleep at night, it affects the activities that they do during daytime.

### **What levels of noise are harmful to humans?**

Generally, noise levels which can drown a conversation between two people are considered as dangerous. This level is around 75 decibels. To give an example, generally in cinema halls, the noise levels are above 75 decibels and this is why we are not able to talk while the movie is being screened.

### **Why has noise pollution gained much importance of late?**

The health effects of noise pollution are becoming more apparent now. Besides, the level of awareness regarding the ill effects of noise is increasing. The judiciary in the country is also playing an important role in this.

### **What steps have been taken by other countries to tackle noise pollution?**

Noise pollution norms(standards) are more stringent in countries like United States and Great Britain. In these countries noise pollution offenders have to pay exorbitant fines if found guilty. Besides children in schools are taught extensively on various noise pollution related aspects and there is wide spread awareness on the hazards of noise pollution.

### **What do the laws of the country speak about noise pollution?**

The Noise Pollution (Regulation and Control) Rules, 2000, aim to control noise levels in public places from various sources, inter-alia, industrial activity, construction activity, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices that have deleterious effects on human health and the psychological well being of the people. The emphasis is on regulating and controlling noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise.

## Does speed have anything to do with the amount of sound emitted by an automobile?

There is a relation between the speed of travel and the noise emission by an automobile. For example, a car traveling at 20 kilo meters per hour emits 55 decibels and 75 decibels at 100 kmph.

## What are the different indicators for noise impacting ones hearing ability?

- ▶ You frequently are not able to comprehend other people's speech or talk, speech is not clear, or you hear only parts of the conversation.
- ▶ You often ask people to repeat what they said.
- ▶ Your friends or relatives tell you that you don't seem to hear very well.
- ▶ You need to ask others about the details of a meeting that you just attended.
- ▶ Others say that you play the TV or radio too loudly.
- ▶ You cannot hear the doorbell or the telephone.
- ▶ You find that looking at people when they talk to you makes it somewhat easier to understand, especially when you're in a noisy place or where there are competing conversations.

## Is there any recommended maximum allowable exposure times for noise?

Recommended maximum allowable exposure times are:

- 16 hours for 80 dBA sound
- 8 hours for 85 dBA sound
- 4 hours for 90 dBA sound
- 2 hours for 95 dBA sound
- 1 hour for 100 dBA sound
- 30 min for 105 dBA sound
- 15 min for 110 dBA sound
- 7.5 min for 115 dBA sound
- 0 min for above 115 dBA sound (there should be no exposure at this level).

## What can I do in case I observe violation of noise pollution norms in my area?

You should immediately approach the regional office or the Head office of the State Pollution Control Board.

In Karnataka, the Karnataka State Pollution Control Board has set up an IVRS (Interactive Voice Response System) for lodging complaints and for giving quick response to the public. In case you need to lodge a complaint from any part of the state, one can contact the help line at 080-25589111. You can also send an email to them at [kspcbcom@blr.vsnl.net.in](mailto:kspcbcom@blr.vsnl.net.in). KSPCB will give you an immediate written response wherever possible or get back to within 10 days of getting your e-mail or letter.

If you want to obtain some information, the KSPCB will get back to you within 7 days after the receipt of the request.

### A KSPCB advertisement issued on eve of Diwali, October 2005

**Diwali be a Festival of Lights and not of Noise and Pollution**

*Please*

- Do not use crackers generating noise more than 125 decibels
- Do not burst crackers in Silent Zones
- Do not burst crackers from 10 pm to 6 am

**CRACKERS**

- Cause both Noise and Air Pollution
- Emit toxic fumes
- Leave streets littered with debris
- May cause burns

Wish you happy Diwali  
from  
Department of Ecology and Environment  
and  
KARNATAKA STATE POLLUTION CONTROL BOARD  
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