Interdisciplinary Minor in Global Sustainability, University of California, Irvine

Student papers, Spring 1998
Instructor: Peter A. Bowler

Cause and Effects of Noise Pollution

by Daniel G. Nunez

Abstract

No one on earth can escape the sounds of noise- an unwanted, disturbing sound that causes a nuisance in the eye of the beholder. Noise is a disturbance to the human environment that is escalating at such a high rate that it will become a major threat to the quality of human lives. In the past thirty years, noise in all areas, especially in urban areas, have been increasing rapidly. There are numerous effects on the human environment due to the increase in noise pollution. In the following paper, the cause and effects of noise pollution will be presented in some detail. Slowly, insensibly, we seem to accept noise and the physiological and psychological deterioration that accompanies it as an inevitable part of our lives. Although we attempt to set standards for some of the most major sources of noise, we often are unable to monitor them. Major sources of noise can be airplanes at takeoff and landing, and a truck just off the assembly line, yet we seem accept and enjoy countless other sounds, from hard rock music to loud Harley Davidson motor cycles. The following areas will be investigated in some detail; adolescent education, neural-effects, sleep, hearing damage, occupational environment, transportation, and physiological effects.

Introduction

Almost everyone has had one experience of being temporarily "deafened" by a loud noise. This "deafness" in not permanent, although it is often accompanied by a ringing in the ears, and one can hear another person if he raises his voice. Likewise, normal hearing comes back within a few hours at most. This sort of partial hearing loss is called Temporary Threshold Shift (TTS) (Bugliarello, et al., 1976). A TTS may be experienced after firing a gun or after a long drive in the car with the windows open. It may not be considered that if exposure to this type of loud noise at a rate of eight hours a day, five days a week can is a threat to develop permanent hearing loss. This type of exposure to noise does not have to be as loud as a gun being fired; it can be as simple as a person shouting across the room. The type of hearing loss is any degree from partial to complete hearing loss. This loss, usually, is permanent and is not satisfactorily corrected by any devices such as, hearing aids. The loss is caused by the destruction of the delicate hair cells and their auditory nerve connections in the Organ of Corti, which is contained in the cochlea (Bugliarello, et al., 1976). Every exposure to loud noise destroys some cells, but prolonged exposure damages a larger amount of cells, and ultimately collapses the Organ of Corti, which causes deafness.

Most of society is now aware that noise can damage hearing. However, short of a threat that disaster would overtake the human race if nothing is done about noise, it is unlikely that many people today would become strongly motivated to do something about the problem. Yet, the evidence about the ill effects of noise does not allow for complacency or neglect. For instance, researchers working with children with hearing disorders are constantly reminded of the crucial importance of hearing to children. In the early years the child cannot learn to speak without special training if he has enough hearing loss to interfere effectively with the hearing of words in context (Bugliarello, et al., 1976). In this respect, there is a clear need for parents to protect their children's hearing as they try to protect their eyesight. If no steps are taken to lessen the effects of noise, we may expect a significant percentage of future generations to have hearing damage. It would be difficult to predict the total outcome if total population would suffer hearing loss. Conceivably, the loss could even be detrimental to our survival if it were ever necessary for us to be able to hear high frequencies. Colavita has consistently been unable to find among university students in his classes any who could hear 20 kHz, although the classical results of Fletcher and Munson show 20 kHz as an audible frequency (Fletcher, 1953).

There are two types of hearing loss: conductive and sensorineural (see fig.1 for anatomy of the ear). In conductive deafness sound-pressure waves never reach the cochlea, most often as a consequence of a ruptured eardrum or a defect in the ossicles of the middle ear (Bugliarello, et al., 1976).

The three bones form a system of levers linked together, hammer pushing anvil, anvil-pushing stirrup. Working together, the bones amplify the force of sound vibrations. Taken together, the bones double, often treble the force of the vibrations reaching the eardrum (Bugliarello, et al., 1976).

Mitigation of potentially harmful amplification occurs via muscles of the middle ear. These muscles act as safety device protection the ear against excessive vibrations from very loud noises, very much like an automatic damper or volume control.

When jarring sounds with their rapid vibrations strike the eardrum; the muscles twist the bones slightly, allowing the stirrup to rotate in a different direction. With this directional shift, less force is transmitted to the inner ear: less, not all (Bugliarello, et al., 1976).

The human ear is a delicate and fragile anatomical structure on the other hand it's a fairly powerful physical force. These muscles act quickly but not always as in examples of when the ear catches the sound of gun being shot unexpectedly. The muscles of the ear were relaxed and were unprepared for such a blast, because of this damage was done.

Conductive hearing loss can be minimized, even overcome by use of the familiar hearing aids. The most common is worn over the mastoid bond behind the pinna. It picks up sound waves and transmits them through the skull to the cochlea.

Sensorineural hearing loss, the most common form in the United States, occurs as a result of advancing age as well as exposure to loud noises. In both instances there is a disruption of the organ of Corti. The organ serves two functions: converting mechanical energy to electrical and dispatching to the brain a coded version of the original sound with information bout frequency, intensity, and timbre. The hair cells of the organ of Corti send their electrochemical signals into the central nervous system, where the signals are picked up by thousands of auditory nerve fibers and transmitted to the brain. It is the decoding of all the information that enables a person to distinguish the unique ant separate sounds of a violin, trumpet, and clarinet, even all three are playing the same note.

The organ of corti, a gelatinous mass, is on of the best protected parts of the body, encased as it is within the cochlea which in turn is deeply embedded in the temporal bone, perhaps the hardest of the 206 bones (Bugliarello, et al., 1976). None the less, loud noise can damage the hair cells and the auditory nerve, producing at times, depending on the type of noise, sudden and often total deafness.

Sustained noise over a period of time can also engender sensorineural deafness in the form of gradual losses in hearing. This is the most common loss in teenagers today listening to loud rock music (Bugliarello, et al., 1976).

Until a few years ago, sensorineural deafness could not be helped by hearing aids. However, with advances in electronic wizardry and miniaturization, devices for insertion into the auditory canal are available.

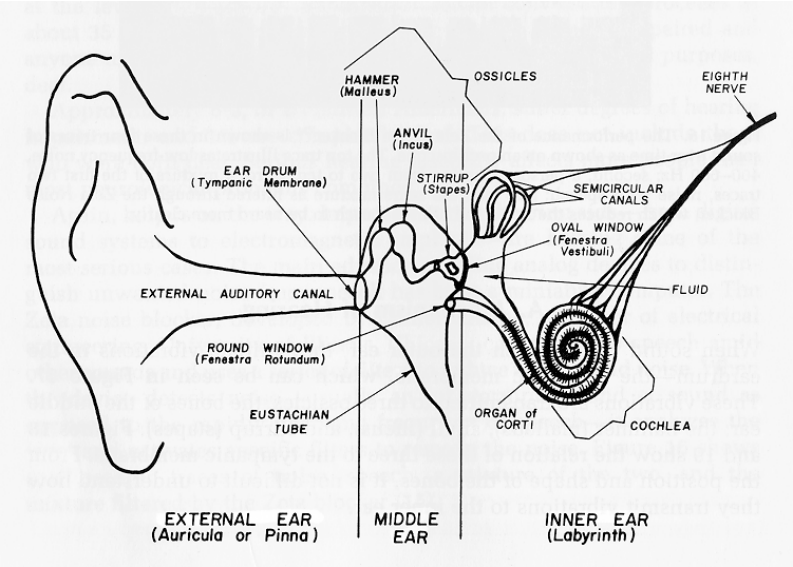

Figure 1. Anatomy of the Ear
(von Bekesy, 1957)

The question is now; how much noise communities will tolerate or at what point the citizenry will have reached its threshold has never had greater currency. The number of towns enacting strict and enforceable ordinances to reduce and control noise levels, both day and night suggests the point have been reached.

Barking dogs, lawn mowers, leaf blowers, power saws, snow blowers, church bells, jackhammers, motorcycles, airplanes, car stereo systems, and traffic generally have combined to such a degree that noise induced irritation, annoyance, discomfort, and hearing impairment have become a significant public health issue, certainly enough of one to motivate a political response.

Tables 1 and 2 indicate the magnitude of the U.S. population exposed to noise, and the percentage expressing annoyance with specific sources of noise. Considering that 60-dB is akin to the sound of an air conditioner at a distance of 20ft, it is evident that with a population in excess of 280 million approximately 7%, or 17+ million people are exposed to noise levels, from traffic alone, of from 70 to over 80 dB (U.S. EPA).

Table 1

U.S. Population Exposed to Noise, by Level and Source, (1980)

(Million People exposed)

Decibels	Traffic	Aircraft	Construction	Rail	Industrial
More than 80	0.1	0.1	----------	------	--------
More than 75	1.1	0.3	0.1	-------	--------
More than 70	5.7	01.3	0.6	0.8	---------
More than 65	19.3	4.7	2.1	2.5	0.3
More than 60	46.6	11.5	7.7	3.5	1.9
More than 55	96.8	24.3	27.5	6.0	6.9

US Environmental Protection Agency, 1980

Table 2

Population Reporting "Highly Annoying" Noise Sources

Population per square mile

More than 20,000 3,000-20,000 Less than 3,000

Source	Rank	% of Respondents Highly Annoyed by Source	Rank	Percentage of Respondents Highly Annoyed by Source	Rank	Percentage of Respondents Highly Annoyed by Source
Motorcycles	1	12.7	1	13.2	1	9.4
Automobiles	2	9.4	3	7.4	3	4.2
Large trucks	3	7.3	2	10.0	7	2.6
Construction	4	6.5	4	7.2	4	3.7
Sport cars	5	5.9	5	7.0	6	3.1
Constant traffic	6	4.7	6	5.5	10	1.5

Buses	7	4.7	8	3.5	11	1.1
Small trucks	8	4.1	7	4.1	9	1.5
Helicopters	9	3.9	10	3.1	2	5.3
Airplanes	10	3.6	9	3.4	5	3.2
Power garden tools	11	1.2	11	2.1	8	1.8
Total		66.0		62.2		55.9

Council on Environmental Quality, 1980

Results and Discussion

Hearing loss can be entrapping in onset. Years of traumatic exposure to high levels can occur before symptoms become manifest. The popularity for portable sound equipment such as Walkman-type radios and tape players has already has already produced a sharp increase in clinically verified hearing loss, especially among rock music addicts who prefer their music very loud (Benarde, 1989).

Obviously, the Walkman-radio industry believes it is not their products that are the problem; rather it is improper use. If, they say, the volume is kept down, there would be no problem, which is equivalent to saying that if we all drove cautiously there would be no accidents.

Considering that earphone listening has been around for some 20 years, why has the problem only recently surfaced? Apparently the pattern of listening has changed. Currently, earphones are used while walking or running on noisy easy streets rather than in the privacy of the home or other relatively quiet area where the listener did not wish to disturb others. Now the volume must be turned up to overcome the noise of city traffic. The listener wants the Walkman to blot out the "noises of the city." Doing those courts hearing disaster. A similar result occurs to users in noisy factory or industrial environments.

Since to these people, louder is better, the makings for an epidemic of hearing loss are at hand.

The Occupational Safety and Health Agency (OSHA) has set the danger level at 95 decibels (dB) and above for 4 or more hours per day as likely to induce permanent hearing impairment (Benarde, 1989).

Related to the Walkman study, a recent study conducted in New York City by Jane Mandell. Her data showed that much of the ambulatory music is played at levels well beyond the 95-dB—upward of 100 and 125- close to the sound level of jackhammers it may be that OSHA's 95-dB is far to lenient and the damage occurs below 90-dB.

Another example was during the spring and summer of 1983; Sweden's security was sorely tried. Russian submarines tried to penetrate restricted naval installations in the Hors Bay area along Sweden's northeast coast. According to initial reports by officials of the Naval Ministry, underwater sound-detecting gear functioned poorly making it difficult to pinpoint the location of the subs.

It was later determined that the problem lay elsewhere. The young Swedish sailors manning the monitors had in fact developed hearing losses as a consequence of excessive exposure to rock music. On learning this, other governments moved quickly to ascertain the hearing acuity of detectors. Consequently, the problem of exposure to sound levels detrimental to hearing takes on new and more serious dimensions (Benarde, 1989).

Yet it has been argued that because noise produces no dramatic ill effects, the public has been largely uninterested in its suppression. It may be more to the point to say that the degree of annoyance and discomfort that people will endure is astonishing.

Although noise is an integral part of civilization, it would appear that unless some definite steps are taken to reduce the present inordinate levels in both industry and community generally, more people will become auditory cripples.

Fortunately, in the past few years' large portions of the population have expressed an increasing determination to revolt against noise. A measure of this is seen in the number of communities moving forcefully to reduce noise levels in their home areas.

Vexation and anger with increasing noisy communities is not a uniquely American problem. Between May and July 1984, over 70% of the adult population of Yamato, Japan, signed petitions demanding cessation of the U.S. Navy's flight activities over their city, Yamato, with a population of 175,000, is a bedroom community for Tokyo, some 20 miles to the northeast. U.S. Navy fighter aircraft, F-4, A-6, and E-2 jets, 100 of them on station aboard the aircraft carrier U.S.S. Midway, fly over Yamato as they come in for landings at nearby Atsugi Air Base. As the jets sweep low they rattle houses and residents. The evenings are the worst with more takeoffs and landings at full power and thus maximum noise, at a time, of curse when the people are trying to sleep (Benarde, 1989).

Kenichi Ohsakas, a Yamato City official who keeps track of noise levels, has been reported as saying, "it's just like living inside a subway car." Yamato holds regular weekly takeoff and landing exercises to keep its pilot's skills honed, and night sessions are particularly important. Be that as it may, the residents are unimpressed, cannot sleep, and prefer the training sessions to be moved elsewhere. But where else? No one wants them and there wretched noise.

Airplane noise can be a much greater disturbance to sleep than other noises. Research indicates that near a major airport-London (Heathrow) Airport- the number of people awakened by airplanes is about 50% greater than the number awakened by other noises (Holland-Wegman, 1967). If we don't isolate the problem it is going to overtake the country.

Aircraft noise began to be a major problem with the great surge in air transportation that followed World War II. The introduction of jet airplanes, which came into widespread use by the end of the 1950'(Bugliarello, et al., 1976) led to a second revolution in aviation, as well as to an escalation of the noise level from aircraft's. Since then, annoyance to people living near airports caused by the noise of jet takeoffs and landings has become a psychophysiological and economic problem of enormous magnitude and complexity. Still a third escalation in aircraft noise will occur when supersonic transports come into commercial operation, and if general aviation and, above all, vertical take off and landing.

As a result of the diffusion of air traffic, airports tend to occupy very large land areas with multiple runways, and large airspace's involved in landing and takeoff procedures. At the same time, under the pressure of population, communities tend to expand toward airports and thus to enter into zones of higher noise. For instance, in the area around London (Heathrow) Airport, the population has increased by 30% since 1963 (Wilson, 1983). Also, an increasing number of people are working in airports and in other areas of the aviation industry. There are signs that people's tolerance to airport noise is decreasing, particularly as socio-economic status improves.

In the United States airport noise has been hit the hardest, than any other developed country due to the large geographic area. In 1966, in the United States there were 500 commercial air passengers per 1000 inhabitants, versus 106 for the United Kingdom, 85 for West Germany, and 36 for France (Alexandre, 1970). By the end 1971, U.S. scheduled airlines carried nearly 80% of all U.S. inter-city passengers traffic traveling by common carrier (NIPCC, 1970); the major portion of the fleet of passenger and cargo planes was powered by jet engines, and accounted for the near totality of the capacity flown.

Studies of both traffic noise and noise in communities hard by major airports have concluded that elevated blood pressure, heart disease, and psychological trauma are direct consequences of noise exposure. Although these associations have been reported, others contradict or do not bear them out. Hypertension, heart disease and psychological trauma, as well as irritation and annoyance can be engendered by a variety of risk factors or by several operating simultaneously. Accordingly, establishing direct causal relationships can be exceedingly difficult. If research studies are methodologically deficient, complications arise to further confound relationships between the independent variable noise, and such dependent variables as elevated blood pressure, reading impairing, annoyance, anxiety, accidents, and heart disease. Obviously, with the number and variety of factors known to contribute to these events, there is good reason for contradictory results.

One example of psychological trauma is the research of Jenkins and his group at the London Institute of Psychiatry (Jenkins et al., 1979). It was reviewed the findings of two studies conducted in the area of London is Heathrow Airport. These studies had compared rates of admission at Springfield Psychiatric

Hospital among residents living near Heathrow. Findings suggested that areas closest to the airport, with presumably higher levels of noise, also had the highest rates of hospital admission.

Aircraft noise is not simply a problem for those trying to sleep. Well- designed, well-controlled studies have demonstrated that exposure to high levels of aircraft and environmental noise can adversely affect reading ability in school-age children. One example is Maser and coworkers (Maser, et al 1978) reported that children who attended school beneath the Seattle-Tacoma airport lnflight paths showed a deficit on standardized tests of scholastic achievement compared to students in quiet schools.

The problem of aircraft noise is complicated by the great economic significance that the aviation industry holds to the economies of developed countries. For instance, at the end of 1971 the U.S. scheduled airlines alone had revenues of close to $10 billion, and employed almost 300,000 employees. Without airlines, a number of economic activities of great importance to notional economies from business and tourism, to the transportation of mail, would be severely affected.

Sleep disturbances are probably the most widespread source of annoyance caused by noise, if anecdotal responses are any criteria. Recently, French investigators (Vallet, 1979) studied the problem under real-life conditions in bedrooms of people living close to freeways and airports. Using miniaturized electronic units; they recorded EEG, eye movements, muscular activity, and heart rhythm with remote-reading equipment. Noise inside the rooms was recorded continuously. With the noise from the highways, subjects took longer to fall asleep and had less deep sleep so that the young to middle-aged group became more like the 50-60-year old group in their depth of sleep. Rapid eye movement (REM) sleep was also reduced. If both deep and REM sleep are physiologically and psychologically important, this type of alteration may well be damaging. But this remains to be substantiated by further study.

According to the investigations of Cohen and colleagues (Cohen, et al., 1981), reading and math scores of third grade students in noise abated classrooms were higher than those in classrooms were without that quality were.

More recently, Green and co-workers (Green et al., 1982) of New York University's Institute of Environmental Medicine found that for all elementary schools in get boroughs of Brooklyn and Queens "an additional 3.6% of the student in the noisiest schools read at least one year below grade level". They went on to remark that "the dose response relationship indicated that the percent reading below grade level increased as noise level increased."

Other researchers have found the same kind of relationship. For example Cohen and colleagues (Cohen et al., 1973) determined that elementary school students living for at least 4 years in the lower floors of an apartment complex near heavy traffic show greater impairment of reading ability than children living on higher floors away from the traffic. In the studies, indoors sound levels varied form 66-dB on the lower floors of an apartment to 55-dB on the higher floors. In a recent U.S. EPA classification, "noisy residential areas" averaged 58-dB and were rated low socioeconomic, while "quiet residential" averaged 38-dB and were rated affluent neighborhoods. These, of course, were outdoors sound levels. With indoor levels of 55-66-dB, concentration, the ability to pay attention, may well be difficult to nonexistent. If that is true, it may be pertinent to ask why far more children are not reading impaired.

Recently Peterson and co-workers (Peterson et al., 1981) of the Department of Otolaryngology, University of Miami School of Medicine, appeared to demonstrate in rhesus monkeys that moderate levels of realistic noise can produce sustained elevations in blood pressure without significant alterations in the auditory mechanism. The unique aspect of this investigation was the finding that changes in auditory sensitivity did not necessarily follow changes in such physiological paramentes as blood pressure.

Given the concern over noise, one wonders just how desirable a quiet town would be. Darlington, near Newcastle, England, was almost such a place. Between 1976-1978, Darlington was designated a "quiet town experiment" (Gloag, 1980). Noise abatement zones and better traffic management was instituted, as were vehicle noise testing and stricter enforcement of noise regulations.

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). However, even

when a person is accustomed to an environment where the noise level is high, physiological changes occur.

Noise has psychological effects is undoubted. The question is how these effects can be assessed and whether they lead to damage. No clear case has been made thus far for psychological damage caused by moderately high levels of noise, the levels that would cause hearing damage to only a small fraction of the people exposed. Indeed, fears have been expressed that ". . . over emphasis on damage may backfire when people come to realize that the truth of the matter seems to be simply that people can express violently their dislike about being disturbed by noises. This is recounted vividly by Connell (1972):

> . . . A middle-aged woman living in Soho became affected by the incessant noise from a newly open discotheque. She complained to the management, the Police, the Local Authority but nothing was done to reduce the noise. Her action took the form of suicide. In Italy a 44 year old man took an overdose of drugs because his eleven children made too much noise while he was watching the Olympic Games on television. . . In a quiet part of Middlesex with an ambient noise level of 30 to 40 decibels lived Fred, a lusty, healthy builders laborer. The M4 Motorway was built within a few feet of his cottage home. The resultant traffic caused the noise level to rise to 80 and 90 decibels so this poor man suffered an increase of 100,000 times in the noise level. He took it for some weeks. Discovered there was nothing he could do about it and his action was also directed against the self. He left a note which read "The noise; the Noise; I just couldn't stand the Noise". . .

These are clearly extreme cases of reaction to the intrusion of noise into one's life. But without question the ubiquitousness of the intrusion, even if less severe or less fatally resented, leads to demands for acoustic privacy which are psychologically no less important than those for visual privacy (Cohen, 1969; EPA, 1971a).

Future Aspects

In this paper, it has been discussed of the important aspects of a complex socio-technological problem, noise pollution. It now remains to elaborate upon some of the deeper issues that we have broached. There is no doubt that the problem of noise is serious. Large segments of the population and industrialized society are exposed to high levels of noise, not only at their place of work, but also in their residences and in their leisure activities. In the United Kingdom, for example, more than 10 percent of the population is disturbed the noise at a single airport, London Heathrow (Wilson, 1983).

Even with the relatively ambitious steps currently being taken or envisioned to control noise in most countries, sound levels and exposure to noise will remain high, and possibly increase. At the same time rising living standards will bring about demands for better environmental quality and probably lead to more vigorous and more organized protests against noise. These protest may even be triggered by lower noise levels than in the past, for it is highly likely that as the public acquires more amenities it will want to be exposed to "comfortable" rather than merely tolerable levels of sound (Bauer, 1970).

According to a WHO report to the UN Conference on Environment. Of all environmental problems, noise is the easiest to control". But the question of control will arise only after these in awareness among the people of the need for control and for the government to find some solution for it.

1. The first approach has been to reduce noise at source. Design and fabrication of silencing devices and their use in aircraft engines, trucks, cars, motorcycles, industrial machines and home appliances would be an effective measure. Protection to workers can be provided through wearing devices such as earplugs and earmuffs.

2. Making a change in design and operation of machines, vibration control, sound proof cabins and sound-absorbing materials can reduce it.

3. It can get reduced by prescribing noise limits for vehicular traffic, ban on honking of horns in certain areas and planning main traffic arteries, industrial establishments, amusement areas, residential colonies, creation of silent zones near schools and hospitals and resigning of building to make them noise proof. Other measures can involve reduction of traffic density in residential areas giving preferences to mass public transport system.

4. ***Control of Indoor Noise.*** Where outdoor noise levels have been high, the following methods can be applied for reducing their effect.

a. Locate in the building as far as possible from noise source. The noise level drops about 6dB each time the distance is doubled.

b. Trees and shrubs may be planted in front of building to provide some absorption for the sound.

c. Locate non-critical areas such as corridors kitchens, bathrooms, elevators and service spaces in the noisy side and critical areas each as bedrooms and living spaces on the quiet side.

d. Back to back bathrooms or toilets should be avoided unless they are effectively sound isolated. Bathrooms, kitchen and laundry rooms should not be adjacent to the floor.

e. Bathroom walls, floor and ceiling should be sound insulated using construction of high sound insulation glasses.

f. Noisy toilets, is bettered by quiet siphon jet type flush toilets should be installed to reduce the noise from the source. Commode seats with double siphon system are now available and may be adopted wherever possible.

1. ***Road Noise.*** Vegetation buffer zones must be created in different parts of the city. Efforts should be made for roadside plantations.

2. ***An Urgent Need for Legislation to Control Noise Pollution.*** We have seen that in India, in absences of a specific legislation for control and prevention of the noise pollution, one has to seek provisions in various branches of law and regulations. There has been no doubt that the available provisions in various branches of law and regulations. There has been no doubt that the available provisions in various branches of law are adequate, unscientific and crude. In most of the developed countries specific legislations have been made and scientific methods for investigation of noise pollution have been invented. The science of audiometer and other branched related to sound have been developed and it becomes comfortable to device various legal provisions to control and prevent noise pollution.

   As present, there is no specific and detailed legislation to control the noise

   pollution. However, there is an urgent need that the Central Government of India should manage to get a legislation passed for the control of noise pollution. Some legislation regarding water and air pollution have been made in India.

   Government should pass the 'Noise Pollution control Act' to meet special India condition. Apart from such kind of Central legislation, there should be a city noise control code for all major cities in India. Creation of unnecessary noise has to be prohibited and should be punishable under law.

3. ***Education.*** People can be educated through radio, TV, newsreels in cinema halls about noise pollution. In the family, elders can teach children to keep the radio volume low, low voice talking not to horn unnecessarily on the roads, avoid quarreling amongst each other and so on. There should be complete ban of loudspeakers form 8 p.m. to 7 a.m.

4. ***Public Awakening and the Control.*** It is also important that public awakening is also very essential for the control and prevention of the noise pollution. In India, most of the persons lack any idea about the ways in which noise pollution could be controlled. Very few scientist are aware of the problem and its control. Masses are still ignorant of the grave effects of the noise pollution. In this regard television, radio, internet, and newspapers should give a campaign for wide publicity.

   It is also true that in the present set up of industrialization one should be able to face the noise pollution to a certain extent. If somehow form a machinery noise producing gadget has been taken out completely, in such cases noiseless machinery may become more dangerous, then with noise creating gadget. Take the example of a locomotive engine. Noise of a locomotive engine especially the noise of its whistle has been very useful in keeping humans and animals away form the tracks. In such cases a limit of noise in terms of decibels may be recommended.

   The most important body of people who are or should be involved in noise control are the manufactories of noise-producing devices, since in their hands lies the most effective way of

controlling noise at the source. However, we live in a society where even the most enlightened manufacturers need an incentive to invest in the extensive research, development, design and tooling that might be required to reduce noise emissions form their products. Such incentives are provided, in essence, by legislation enforced either centrally or locally. To appreciate the number of people and organizations involved in legislation for noise control and with ways in which they influence this legislation require a look at the history of governments concern with problem of noise.

These standards or "ideas" may be easily controlled of all environmental problems, but just as every other problem, do we want to change for the sake of noise pollution? If the question is answered with integrity and honesty, it is sure that not many would want to change over some small portion of noise pollution. With the exceptions of the throwing the blame at someone else makes it so much easy to control noise, since its not the life of yourself being at stake to change.

Literature Cited

Alexandre, A., 1970. Pervison de la gene due au bruit autour des aeroports et perspectives sur les moyens d'y reedier. Laboratoire d'Anthropologie Appliquee, Faculte de Medecine, Paris,

Bauer, R. A. Predicting the Future. Transportation noise---a symposium on acceptability criteria, Washington, D.C., 1970

Broadbent, D. E. 1967. Personal communication

Broadbent, D. 1957. Noise in Relation to Annoyance, Performance and Mental Health. J. Acoust. Soc. Am. Vol. 68(1): 15-17

Bugliarello, G. The Impact of Noise Pollution, New York, 1976

Cohen, A. 1969. Effects of noise on psychological state. In W. Ward and J. Fricke, Noise as a public health hazard. Washington: American Speech Hearing Association

Cohen S.; Glass, D. C.; and Singer 1973. Apartment Noise, Auditory Discrimination and Reading Ability in Children. J. Exp. Soc. Psycho. Vol. 9: 407-422.

Connell, J. 1972. The biological effects of noise. Paper given at the Annual Meeting of the British Association for the Advancement of Science.

Fletcher, H. 1972. Speech and Hearing in Communication. Princeton, NJ: Van Nostrand, 1953. Noise Control Center, Wymondkam, Leicestershire, U.K. Personal communication.

Gloag, D. 1980. Noise and Health: Public and Private Responsibility. Br. Med. J. Vol. 281: 1404-1406

Green; Pasternack; and Shore. 1982. Effects of Aircraft Noise on Reading Ability of School aged Children. Arch. Environ. Health Vol. 37: (1) 24-31.

Holland-Wegman Productions. 1967. Inc. Public Relatins for Buffalo Airport. Personal communication,

Jenkins, L. M.; Tarnapolsky, A.; Hand, D. J.; and Baker, S. M. 1979. Comparison of Three Studies of Aircraft Noise and Psychiatric Hospital Admissions Conducted in the Same Area. Psychol. Med Vol. 9: 681-693.

Maser, A.; Sorensen,; and Krypter, K. 1978. Effects of Intrusive Sound on Classroom Behavior: Data from a Successful Lawsuit. San Francisco.

Peterson, W. H. and Northwood, T. D. 1981. Noise raised blood pressure without impairing auditory sensitivity. Science Vol. 211: 1450-1452.

United States National Industrial Pollution Control Council (NIPCC), 1970

Vallet, M. Psychophysiological 1979. Effects of Exposure to Aircraft or to Traffic Noise. Proc. Inst. Acoustics Vol. 3: 1-4.

Von Bekesy, George. 1957. The Ear, Scientific American, 197: 61-67

Council on Environmental Quality. 1979. US Government Printing Office, Washington D.C.

US Environmental Protection Agency. 1980. The Extent of the Noise Problem.

WHO Report. 1990. UN Conference.