



Trade Science Inc.

# Environmental Science

*An Indian Journal*

*Critical Review*

ESAIJ, 4(5), 2009 [291-296]

## Noise pollution in Chennai: Sound health or sound ill-health

I.P.Dike

Department of Biological Sciences, College of Science and Technology,  
Covenant University, PMB 1023, Ota, Ogun State, Nigeria

Tel : 0234- 8074658012

E-mail : ejdike@gmail.com

Received: 8<sup>th</sup> April, 2009 ; Accepted: 13<sup>th</sup> April, 2009

### ABSTRACT

Noise is more than just pain in the ear; it is harmful to our health. The word "Environmental Pollution" usually triggers only thoughts of mostly air, water and land pollution, but not the most insidious yet the hazardous pollution known as 'noise pollution'. Periodic noise level surveys in Chennai City clearly indicate that they exceed the permissible limits recommended by the government and WHO yet little attention has been paid to noise pollution and its effects. Noise does not just affect hearing but other body functions too. This article tries to instigate research interest in this arena in order to trigger more action on noise pollution.

© 2009 Trade Science Inc. - INDIA

### KEYWORDS

Noise;  
Chennai;  
Research.

### INTRODUCTION

The history of human civilization is to a large extent, the history of man's exploitation of nature to satisfy his desire for comfort and happiness. During this century however man's lackadaisical exploitation of nature has accelerated to such an extent that it has reduced the earth's natural capacities for self-stabilization. This outright disregard for the environmental impact of such developmental and other activities has created numerous environmental problems and is at present causing the degradation of our environment.

Chennai the capital city of the state of Tamil Nadu is situated in the Eastern Coast of India. This Metropolitan area has a population of 6.2 million in total. The Main Economic activities of Chennai include Small-Scale Industries, Agriculture, Forest-Based industries and Trade and Commerce. Pollution of Air, Water, Land and Noise Pollution are the uncanvassed by products

of economic development, particularly industrialization and urbanization. Thus pollution is an external cost, often referred to as "Spill-Over Cost" or the "Neighborhood Cost".

The word "Environmental Pollution" usually triggers only thoughts of mostly air, water and land pollution, but not the most insidious yet the hazardous pollution known as 'noise pollution'. Noise, a Latin word "Nausea" meaning "Wrong Noise", is a shadowy public enemy, whose growing menace has increased in the modern age of industrialization and technological advancement. Though a soft rhythmic sound in form of music and dance stimulates the brain's activities and also removed boredom and fatigue, its excessiveness proves to be detrimental not only to living things but also to Non-Living things. Noise is generally defines as "Any Loud, Discordant or Disagreeable a Sound". In Short it is an unwanted or offensive sound that unreasonably intrudes into our daily activities.

# Critical Review

## Sources of noise

There are wide and varied ranges of sources of noise pollution which range from small household equipments to jet planes. The sources of noise pollution can be broadly classified into Industrial Sources and Non-Industrial Sources, the later being further categorized into outdoor and indoor sources. Our Ears are continuously exposed to the local environmental noise as depicted in TABLE 1<sup>[21]</sup>.

## Noise level surveys

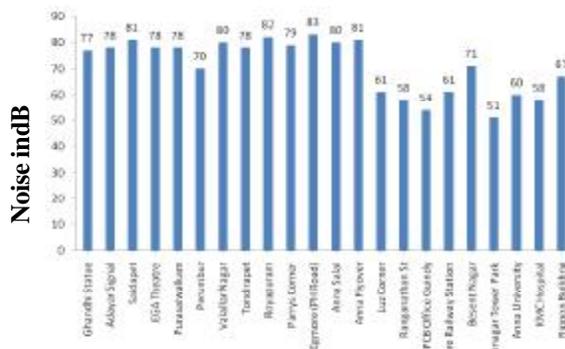
Periodic noise level surveys in Chennai City clearly indicate that they exceed the permissible limits recommended by the government. Data collected by the *Central Pollution Control Board* (CPCB) at 22 different traffic intersections and commercial areas (Figure 1) show that only in 2 placed the noise levels are within the permissible lower limit of 55dB (TABLE 2) and in 5 other areas they are within the permissible upper limit of 65dB. About 75% of the study areas recorded very high levels of noise approximately 12-20 dB higher than the permissible upper limit.

Residential areas in Chennai scaled a noise level of 65 dB during day and 49 dB during night crossing the standard norms prescribed. In the silent and the industrial zones too, the decibel levels were much higher than the prescribed limits<sup>[30]</sup>.

Noise generated by the work on pile foundation at a construction site at Abhiramapuram was exceeding the permissible level by 10 to 15 times<sup>[31]</sup>.

## Impact of noise pollution on human health

The effects of noise pollution vary from uneasiness



Source: Central Pollution Control Board (CPCB)

Figure 1: Ambient noise levels at major traffic intersections

TABLE 1 : Noise levels in most of our environments

| Outdoor sources      | Noise level (dB) | Indoor sources           | Noise level (dB) |
|----------------------|------------------|--------------------------|------------------|
| 1. Road traffic      | 80-100           | 1. Air conditioners      | 120              |
| 2. Air traffic (Jet) | 140              | 2. Air coolers           | 120              |
| 3. Rail traffic      | 100              | 3. Radio(Full Vol.)      | 115              |
| 4. Loudspeakers      | 110-120          | 4. Television            | 110              |
| 5. Fire crackers     | 130-190          | 5. Other home appliances | 75-90            |

TABLE 2 : Ambient air quality standards in respect to noise

| S.no. | Category of area  | Limits in dB |       |
|-------|-------------------|--------------|-------|
|       |                   | Day          | Night |
| 1     | Industrial ares   | 75           | 70    |
| 2     | Commercial area   | 65           | 55    |
| 3     | Residential areas | 55           | 45    |
| 4     | Silence zone      | 50           | 40    |

Source: Central pollution control board (CPCB)

TABLE 3: Harmful effects of noise pollution

| Noise range (dB) | Harmful effects                       |
|------------------|---------------------------------------|
| 90-120           | Hearing Impairment                    |
|                  | 1. Permanent Hearing Loss             |
|                  | 2. Temporary Hearing Loss             |
|                  | 3. Recruitment                        |
| 60-90            | 4. Tinnitus                           |
|                  | Physiological Effects                 |
|                  | 1. Vasoconstriction                   |
|                  | 2. Gastrointestinal modification      |
| 30-60            | 3. Endocrine Stimulation              |
|                  | 4. Respiratory modification           |
|                  | Galvanic skin resistance alterations  |
|                  | Communication Interference            |
| 30-60            | 1. Aural-face-to-face communications  |
|                  | 2. Telephone Conversations            |
|                  | 3. Visual distortion                  |
|                  | 4. Color blindness                    |
| 30-60            | Task Interference                     |
|                  | 1. Reduced Production                 |
|                  | 2. Increased Error rate               |
|                  | 3. Extended Output                    |
| 30-60            | Sleep Interference                    |
|                  | 1. Electroencephalogram modifications |
|                  | 2. Sleep stage alterations            |
|                  | 3. Awakening                          |
| 30-60            | 4. Meditation                         |
|                  | Personal Behaviour                    |
|                  | 1. Annoyance                          |
|                  | 2. Anxiety - nervousness              |
| 30-60            | 3. Fear                               |

to mental disorders. Although the long-term effects of the noise pollution are quite alarming, the gravity of the danger is generally not appreciated by the common man. Noise is known not to spare anything within in wavelength, that is, it is not only affects man but also affects animals and even non-living things. A quiet environment

is Conducive to the physiological and psychological well being of an individual, but this is not always attained. According to Dr. Kameswaran of ENT research foundation 8 non-stop hours of 90 dB noise gives acoustic trauma<sup>[31]</sup>. Study conducted by National Physical Laboratory (NPL) found that people within two meters of the explosion of crackers of “define risk hearing loss”<sup>[14]</sup>. TABLE 3 portrays some of the disturbances and imbalances suffered by human beings due to excessive environmental noise levels. The WHO has documented various categories of adverse health effects of noise pollution on humans<sup>[5]</sup>.

### **Hearing impairment**

Hearing is essential for well-being and safety. Hearing impairment is typically defined as an increase in the threshold of hearing as clinically assessed by audiometry. Impaired hearing may come from the workplace, from the community, and from a variety of other causes (e.g., trauma, ototoxic drugs, infection, and heredity). There is general agreement that exposure to sound levels less than 70 dB does not produce hearing damage, regardless of the duration of exposure<sup>[5,18]</sup>. There is also general agreement that exposure for more than 8 hours to sound levels in excess of 85 dB is potentially hazardous; to place this in context, 85 dB is roughly equivalent to the noise of heavy truck traffic on a busy road<sup>[5]</sup>. With sound levels above 85 dB, damage is related to sound pressure (measured in dB) and to time of exposure. The major cause of hearing loss is occupational exposure, although other sources of noise, particularly recreational noise, may produce significant deficits. Studies suggest that children seem to be more vulnerable than adults to noise induced hearing impairment<sup>[5]</sup>.

Noise induced hearing impairment may be accompanied by abnormal loudness perception (loudness recruitment), distortion (paracusis), and tinnitus. Tinnitus may be temporary or may become permanent after prolonged exposure<sup>[5]</sup>. The eventual results of hearing losses are loneliness, depression, impaired speech discrimination, impaired school and job performance, limited job opportunities, and a sense of isolation<sup>[8,15,27]</sup>.

### **Interference with spoken communication**

In 1974, in an attempt to protect public health and welfare against the adverse effects of noise, the EPA

published so-called safe levels of environmental noise that would permit normal communication both in and out of doors<sup>[18]</sup>.

Noise pollution interferes with the ability to comprehend normal speech and may lead to a number of personal disabilities, handicaps, and behavioral changes. These include problems with concentration, fatigue, uncertainty, lack of self confidence, irritation, misunderstandings, decreased working capacity, disturbed interpersonal relationships, and stress reactions. Some of these effects may lead to increased accidents, disruption of communication in the classroom, and impaired academic performance<sup>[5,1,28]</sup>. Particularly vulnerable groups include children, the elderly, and those not familiar with the spoken language<sup>[5]</sup>.

### **Sleep disturbances**

Uninterrupted sleep is known to be a prerequisite for good physiologic and mental functioning in healthy individuals<sup>[16]</sup>. Environmental noise is one of the major causes of disturbed sleep<sup>[5,10]</sup>. When sleep disruption becomes chronic, the results are mood changes, decrements in performance, and other long-term effects on health and well-being<sup>[3]</sup>. Much recent research has focused on noise from aircraft, roadways, and trains. It is known, for example, that continuous noise in excess of 30 dB disturbs sleep. For intermittent noise, the probability of being awakened increases with the number of noise events per night<sup>[5]</sup>.

The primary sleep disturbances are difficulty falling asleep, frequent awakenings, waking too early, and alterations in sleep stages and depth, especially a reduction in REM sleep. Apart from various effects on sleep itself, noise during sleep causes increased blood pressure, increased heart rate, increased pulse amplitude, vasoconstriction, changes in respiration, cardiac arrhythmias, and increased body movement<sup>[16]</sup>. For each of these, the threshold and response relationships may be different. Some of these effects (waking, for example) diminish with repeated exposure; others, particularly cardiovascular responses, do not<sup>[26]</sup>. Secondary effects (so-called after effects) measured the following day include fatigue, depressed mood and well-being, and decreased performance<sup>[10]</sup>. Decreased alertness leading to accidents, injuries, and death has also been attributed to lack of sleep and disrupted circadian

## Critical Review

rhythms<sup>[13]</sup>.

Long-term psychosocial effects have been related to nocturnal noise. Noise annoyance during the night increases total noise annoyance for the following 24 hours. Particularly sensitive groups include the elderly, shift workers, persons vulnerable to physical or mental disorders, and those with sleep disorders<sup>[5]</sup>.

Other factors that influence the problem of nighttime noise include its occurrence in residential areas with low background noise levels and combinations of noise and vibration such as produced by trains or heavy trucks. Low frequency sound is more disturbing, even at very low sound pressure levels; these low frequency components appear to have a significant detrimental effect on health<sup>[23]</sup>.

### Cardiovascular disturbances

A growing body of evidence confirms that noise pollution has both temporary and permanent effects on humans (and other mammals) by way of the endocrine and autonomic nervous systems. It has been postulated that noise acts as a nonspecific biologic stressor eliciting reactions that prepare the body for a fight or flight response<sup>[2,5,17]</sup>. For this reason, noise can trigger both endocrine and autonomic nervous system responses that affect the cardiovascular system and thus may be a risk factor for cardiovascular disease<sup>[2-6,33,34]</sup>. These effects begin to be seen with long-term daily exposure to noise levels above 65 dB or with acute exposure to noise levels above 80 to 85 dB<sup>[5,27]</sup>. Acute exposure to noise activates nervous and hormonal responses, leading to temporary increases in blood pressure, heart rate, and vasoconstriction.

### Disturbances in mental health

Noise pollution is not believed to be a cause of mental illness, but it is assumed to accelerate and intensify the development of latent mental disorders. Noise pollution may cause or contribute to the following adverse effects: anxiety, stress, nervousness, nausea, headache, emotional instability, argumentativeness, sexual impotence, changes in mood, increase in social conflicts, neurosis, hysteria, and psychosis. Population studies have suggested associations between noise and mental-health indicators, such as rating of well-being, symptom profiles, the use of psychoactive drugs and

sleeping pills, and mental-hospital admission rates. Children, the elderly, and those with underlying depression may be particularly vulnerable to these effects because they may lack adequate coping mechanisms<sup>[5]</sup>. Children in noisy environments find the noise annoying and report a diminished quality of life<sup>[9]</sup>.

Noise levels above 80 dB are associated with both an increase in aggressive behavior and a decrease in behavior helpful to others<sup>[9,20,24]</sup>. The news media regularly report violent behavior arising out of disputes over noise; in many cases these disputes ended in injury or death. The aforementioned effects of noise may help explain some of the dehumanization seen in the modern, congested, and noisy urban environment<sup>[2]</sup>.

### Impaired task performance

The effects of noise pollution on cognitive task performance have been well-studied. Noise pollution impairs task performance at school and at work, increases errors, and decreases motivation<sup>[12]</sup>. Reading attention, problem solving, and memory are most strongly affected by noise. Two types of memory deficits have been identified under experimental conditions: recall of subject content and recall of incidental details. Both are adversely influenced by noise. Deficits in performance can lead to errors and accidents, both of which have health and economic consequences<sup>[5]</sup>.

Cognitive and language development and reading achievement are diminished in noisy homes, even though the children's schools may be no noisier than average<sup>[7]</sup>. Cognitive development is impaired when homes or schools are near sources of noise such as highways and airports<sup>[22]</sup>. Noise affects learning, reading, problem solving, motivation, school performance, and social and emotional development<sup>[1,27-29]</sup>. These findings suggest that more attention needs to be paid to the effects of noise on the ability of children to learn and on the nature of the learning environment, both in school and at home. Moreover, there is concern that high and continuous environmental noise may contribute to feelings of helplessness in children<sup>[7]</sup>.

Noise produces negative after-effects on performance, particularly in children. It appears that the longer the exposure, the greater the effect. Children from noisy areas have been found to have heightened sympathetic arousal indicated by increased levels of stress-related

hormones and elevated resting blood pressure<sup>[7]</sup>. These changes were larger in children with lower academic achievement. As a whole, these findings suggest that schools and daycare centers should be located in areas that are as noise-free as possible<sup>[5]</sup>.

### **Negative social behaviour and annoyance reactions**

Social and behavioral effects of noise exposure are complex, subtle, and indirect. These effects include changes in everyday behavior (e.g., closing windows and doors to eliminate outside noises; avoiding the use of balconies, patios and yards; and turning up the volume of radios and television sets); changes in social behavior (e.g., aggressiveness, unfriendliness, nonparticipation, or disengagement); and changes in social indicators (e.g., residential mobility, hospital admissions, drug consumption, and accident rates); and changes in mood (increased reports of depression)<sup>[5]</sup>.

Greater annoyance has been observed when noise is of low frequency, is accompanied by vibrations that contain low-frequency components, or when it contains impulses such as the noise of gunshots<sup>[5,23]</sup>. Annoyance is greater when noise progressively increases rather than remaining constant. Average outdoor residential day-night sound levels below 55 dB were defined as acceptable by the EPA; acceptable average indoor levels were less than 45 dB<sup>[18]</sup>. To put these levels into perspective, sound levels produced by the average refrigerator or the sounds in the typical quiet neighborhood measure about 45 dB<sup>[18]</sup>. Sound levels above this produce annoyance in significant numbers of people.

### **Muffled noise legislation**

Although a regulatory environment has slowly been built up around many activities, these do not usually address noise pollution specifically. Even when regard for the public is taken into consideration, the laws like The Railways Act, 1980, the Aircrafts Act, 1934, the Motor Vehicles Act, 1939 and the Factories Act, 1948 usually confine themselves to other matters, or do not adequately address noise issues.

The enactment of the noise regulation rules 2000 under Sec.3 of Environmental Protection Act, 1986, is seen as a comprehensive legislation in control of noise

pollution<sup>[6]</sup>.

### **Role of noise producers and noise sufferers in noise abatement**

From the above data it is very clear that this insidious pollution is growing fast and if not controlled, a day will come when man will have to fight merciless noise as the worst enemy of the health. According to Narain, 2002<sup>[25]</sup> the need of the hour is a powerful voice of reason, otherwise, we will continue to become cracker deaf and pollution dumb plummeting towards a gruesome future. Experts fear that 50% of the city dwellers may lose hearing ability by 2017<sup>[32]</sup>. Therefore steps should be taken to nip this budding problem before it is too late.

More researches in this direction should be carried out to address this issue. A few common, simple control measures, which can be adopted, by each one of us are: adoption of proper road manners, sensitizing road-users on noise pollution, replacing Air horns with traditional bulb horns, fitting Silencers in Vehicles, not using Honks at silent zones and avoiding unnecessary use of honks, restricting the use of loudspeakers after 9 pm to 6 am, fencing of Construction sites, bursting of crackers restricted only to festivals, not using crackers having noise impulses higher than 90 dB, making noise producers more aware of the consequences, making noise sufferers more aware of the possibilities to end it and planting trees wherever possible.

This article intends to motivate interest in noise pollution in order to identify the sources of noise pollution, grasp the various adverse impacts of noise pollution, quantify the noise levels, develop methodologies to control noise pollution, document the noise levels in a systematic approach and also get familiar with the Statutory limits for both the ambient noise levels and the noise levels at a workspace environment

Let's be persistent and responsible enough in mitigating noise pollution with the ultimate utopian goal of Sound Health for all citizens and a Soundscape Environment, where the relationship between the *human community and its sonic environment is balanced*.

*Critical Review*

## REFERENCES

- [1] American Academy of Pediatrics, Committee on Environmental Health. Handbook of Pediatric Environmental Health, 2nd ed. Washington, DC, American Academy of Pediatrics, 311-321 (2003).
- [2] W.Babisch; Environ Health Perspect, **113**, A14-15 (2005).
- [3] W.Babisch; Noise Health, **5**, 1-11 (2003).
- [4] W.Babisch, b.Beule, M.Schust et al.; Epidemiology, **16**, 33-40 (2005).
- [5] B.Berglund, T.Lindvall; Community Noise, Archives of the Center for Sensory Research, **2**, 1-195 (1995).
- [6] S.Bhat; Indiatogether.org information for the civil society, (2003).
- [7] A.L.Bronzaft; Noise Health, **2**, 1-8 (2000).
- [8] P.E.Brookhouser; Pediatr.Clin.North Am., **43**, 1195-1216 (1996).
- [9] A.L.Bronzaft; It takes a silent village to harm a child. Available at: <http://www.lhh.org/hrq/24-1/village.htm>
- [10] N.L.Carter; Environ.Int., **22**, 105-116 (1996).
- [11] Central Pollution Control Board, (2007).
- [12] S.Cohen; Psychol.Bull., **88**, 82-108 (1980).
- [13] S.Coren; N.Engl.J.Med., **334**, 924-925 (1996).
- [14] Health and Environmental Newsletter, (2002).
- [15] Healthy People 2000: National Health Promotion and Disease Prevention Objectives. U.S. Department of Health and Human Services. Public Health Service. Washington, DC, (1990).
- [16] J.A.Hobson; Sleep. Scientific American Library, W.H. Freeman and Company, New York, (1989).
- [17] H.Ising, B.Kruppa; Noise Health, **6**, 5-13 (2004).
- [18] Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety (EPA/ONAC Report 550/9-74-004). U.S. Environmental Protection Agency. Washington, DC, (1974).
- [19] V.J.Konenci; J.Person Soc.Psychol., **32**, 706-712 (1975).
- [20] C.Korte, I.Ypma, A.Tappen; Environ.Behav., **12**, 408-420 (1980).
- [21] D.L.Lawrence; Advanced Brain Technologies, (1980).
- [22] Lee CSY, Fleming GG. General Health Effects of Transportation Noise. U.S. Department of transportation. Washington, DC, (2002).
- [23] H.G.Leventhal; Noise Health, **6**, 59-72 (2004).
- [24] K.E.Mathews (Jr.), L.Cannon; J.Pers.Soc.Psychol., **32**, 571-577 (1975).
- [25] S.Narain; Health and Environment Newsletter, (2002).
- [26] E.Ohrstrom, M.Bjorkman; J.Sound Vibration, **122**, 277-290 (1998).
- [27] A.H.Suter; Administrative Conference of the United States, (1991).
- [28] S.A.Stansfeld, M.P.Matheson; Br.Med.Bull., **68**, 243-257 (2003).
- [29] S.A.Stansfeld, B.Berglund, C.Clark et al.; Lancet, **365**, 1942-1949 (2005).
- [30] The Hindu 17<sup>th</sup> April (2001).
- [31] The Hindu 04<sup>th</sup> October (2001).
- [32] The Independent (2002).
- [33] E.E.M.M.Van Kempen, H.Kruize, H.C.Boshuizen et al.; Environ Health Perspect, **110**, 307-317 (2002).
- [34] S.N.Willich, K.Wegscheider, M.Stallmann, et al.; Eur.Heart J., **27**, 276-282 (2006).