

Noise Pollution and the Environment: A Review

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Abstract

*This paper is a review of the impacts of noise pollution on the environment, human beings and animals (domestic and wildlife). The concern about noise pollution is because noise pollution is not given much attention compared to the other types of pollution, therefore the impacts of noise pollution have not been assessed especially in urban areas where excessive sound can have devastating impacts on the health of human beings, animals and even the quality of the environment. Noise pollution can affect human mental, physical and emotional well-being; in the ecosystem, it interferes with the diversity of plant life, cycles and rearing and hastens the extinction of some species. Noise pollution is commonly generated inside many industrial facilities, workplaces, households, highways, railways, air traffic and outdoor construction activities. Existing methods of mitigating noise pollution include sound insulation by construction of glazed windows with double or triple panes, floating floors and suspended ceilings; fabricating sound-absorbing materials like acoustic walls and perforated plywood to reduce noise. Tree planting acts as a barrier to noise, and should be planted in hospitals, schools etc. Noise control in urban planning is through noise mapping, to enforce noise policies in hotspots, efficient city traffic management, and noise zoning for a healthier and quieter environment. **Keywords:** Noise, Pollution, Environment, Effects, Control.*

Introduction

Noise pollution is the spread of unwanted sounds into the environment. It is almost always around us, whether natural, such as bird song, or from human activity, such as vehicle traffic. However, noise build-up can have a significant impact on the well-being of humans and animals. (Manketi and Agunwumba, 2015).

The problem of noise pollution affects many biological groups such as birds, amphibians, reptiles, fish, mammals and invertebrates. It spans several types of ecosystems including terrestrial, aquatic and coastal ecosystems. Many types of sounds produced by human activities would seem to be a form of noise pollution affecting biodiversity including traffic, ships, aircraft, and industrial activities. Noise pollution can also act in synergy with other disturbances for example light pollution. Seismic surveys also produce a loud blast of sound within the oceans the sound blast can damage the ears of marine animals and cause serious injury (Sordello, *et. al*, 2019).

Noise pollution is an invisible danger. It cannot be seen but it is present nonetheless, both on land and under the sea. It is considered to be any unwanted or disturbing sound that affects the health and well-being of humans and other organisms. Noise pollution impacts millions of

people daily. The most common health problem it causes is noise-induced hearing loss (Farooqi, *et al.* 2019).

With rapid urbanization and the rise of cities, people are becoming regularly exposed to high levels of unpleasant noise whether it is from road traffic, construction industries, or other sources. This regular exposure to elevated sound levels is noise pollution and it is fast becoming a major issue in cities worldwide when it comes to the health of its inhabitants. According to estimates by the European Environmental Agency more than 72,000 hospitals and missions, and 16,000 premature deaths are caused by noise pollution every year in Europe alone. (Medicos, 2021).

Environmental noise contributes to 48,000 new cases of ischemic heart disease, and subsequently, 12,000 premature deaths every year. Furthermore, it is estimated that 22 million people suffer chronic high annoyance and 6.5 million people suffer chronic high sleep disturbances due to noise pollution. Children are particularly susceptible to the negative impacts of noise pollution. Studies have shown that behavioral problems in children are related to noise. Similarly, noise had negative impacts on the cognitive development of infants. It also reduces attention span and increases recovery time after mild stress—residential noise delays early cognitive development in children (EEA, 2020).

Noise pollution has an impact on mental health as well, in 2017, a multi-level analysis of noise pollution in Beijing on the mental health of the people was conducted it showed that higher noise pollution was significantly associated with worse mental health. (WHO, 2017). Other studies have shown that annoyance caused by the noise affects the complexity of brain activities and EFG signals. This may cause psychological problems like reduced attention and it can also affect the function of individual and their cardiovascular condition. Hammer, *et al.* (2016) argued that annual noise exposure is high enough to cause harm to human health. However, even though noise exposure is widespread, this type of pollution has been perceived and treated differently than other forms of pollution such as radiation and chemical hazards (Cohen *et al.*, 2014).

Despite its ubiquitous nature the properties of being invisible without any residual effect and people becoming accustomed to it, environmental noise is the most underrated pollutant. (Basner 2015).

Noise can pose a serious threat to a child's physical and psychological health, including learning and behaviour. For example, noise can interfere with speech and learning language and can also impair learning and hearing loss (EPA, 2021).

Definition and Types of Noise Pollution

Noise pollution is unwanted or excessive sound that can have deleterious effects on human health, wildlife, and environmental quality (Nathanson and Berg, 2023).

Noise pollution is defined as any unwanted or disturbing sound that hurts the health and well-being of humans and other living organisms (United Nations, 2018).

Another definition Murali, (2010), also defined noise pollution as the propagation of noise with ranging impacts on the activity of human or animal life.

National Geographic Society, (2019) classified noise pollution as follows:

1. **Man-made noise:** this refers to the noise created due to manmade activities. It can be anything from construction work, noise from the air vehicular traffic noise, and noise from pubs and bars, to name a few ranging from 30 to a whopping 140db, this form of noise is extremely harmful to humans.
2. **Environmental noise:** environmental noise refers to the kind of noise occurring from a range, of environmental activities. This can be anything from the mating call of animals to the sound that often go up to 140.

Various causes of noise pollution

Sordello, *et. al*, (2019) explained some of the most popular causes of noise pollution:

- i. **Industrialization:** most industries use big machines which are capable of producing a large amount of noise. Apart from that, various equipment like compressors generators, exhaust fans, and grinding mills also participate in producing big noise.
- ii. **Poor urban planning:** in most of the developing countries, poor urban planning also plays a vital role. Congested houses large families sharing small spaces, and frequent fights over basic amenities lead to noise pollution, which may disrupt the environment. Noise pollution in urban settings may also be caused when residential properties and industrial buildings are in proximity. In institutions like these, the noise from the nearby industrial property might hinder the basic well-being of the individuals living in residential properties.
- iii. **Social events:** noise is at its peak in most of the social events. Whether it is marriage, parties, pubs, disc or places of worship, people normally flout rules set by the local administrations and create a nuisance in the area. People play songs at full volume and dance till midnight, which makes the condition of people living nearby pretty worse. In markets, people are using loud noise to attract the attention of buyers, which with time, affects the hearing abilities of the individuals who are constantly exposed to these sounds.
- iv. **Transportation:** a large number of vehicles on roads, aero planes flying over houses, and underground trains produce heavy noise and people find it difficult to get accustomed to that. The high noise leads to a situation where in a normal person loses the ability to hear properly.
- v. **Construction activities:** under construction activities like mining, and construction of bridges, dams, buildings, stations, roads, and Flyovers take place in almost every part of the world. These construction activities take every day as we need more buildings and bridges to accommodate more people however, while this does help us to some degree, in the long run, the noise from construction activities hinders the hearing abilities of individuals exposed to this sound.
- vi. **Chores:** people are surrounded by gadgets and uses them extensively in their daily life gadgets like TV, mobiles, mixer, grinder, pressure cooker, Vacuums cleaners, washing machine and dryer, and cooler air conditioners are minor contributors to the amount of noise that is produced. Still, it affects the quality of life in your neighborhood in a bad way. While this form of pollution may seem harmless, it has

- vii. far-reaching consequences. The adverse effects on the health of the environment are quite severe.
- viii. **Noise from air traffic:** while many find it difficult to believe, air traffic also contributes significant levels of noise pollution. Noise from a single aircraft may produce sounds of up to 130db. Now imagine the amount of noise produced by the numerous aircraft travelling our space.
- ix. **Catering and nightlife:** when the weather is good, restaurants, bars and terraces spill outside late-night parties continue with loud music and unnecessary noise made by the party managers. These can produce more than 100db. Noise from pubs and clubs is also included.
- x. **Animals sound:** the noise made by animals cannot be unnoticed, particularly a howling or barking dog. These can produce noise around 60-80db.

Acceptable Noise Levels in Different Locations

Table: Acceptable Noise level for different areas

	Description of areas	Noise level DB	
		Day time	Night time
1	A sensitive area where quietness is of primary importance such as schools, hospitals, Mosque etc	35	45
2	Residential areas	50	40
3	Mixed areas as well as commercial and industrial purpose	50	60
4	Commercial areas	70	60
5	Industrial areas	75	70

Source: Farooqi, *et al.* (2019).

Method of Noise Assessment

Nathanson and Berg, (2023) explained that noise is measured in terms of pressure, intensity, and frequency. Sound pressure level (SPL) represents the amount of pressure relative to atmospheric pressure during sound wave propagation that can vary with time, this is also known as the sum of the amplitudes of a wave. Sound intensity measured in watt per meters-squared, represents the flow of sound over a particular area. Although sound pressure and intensity differ, both can describe the level of loudness by comparing the current state to the threshold of hearing, these results in decibel units on the logarithmic scale. The logarithmic scale accommodates the vast range of sound heard by the human ear.

Frequency or pitch is measured in hertz (HZ) and reflects the number of sound waves propagated through the air per second. The range of from 20HZ to 20,000HZ, however, sensitivity to hearing higher frequencies between 0 and 20 HZ (infrasound), and others, such as bats, can recognize frequencies above 20,000 HZ (ultrasound) to echo late.

Researchers use different weights to account for noise frequency with intensity, as humans do not perceive sound at the same loudness level. The most commonly, use weighted levels are A-weighting, C-weighting, and Z-weighting. A-weighting mirrors the range of hearing with frequencies of 20 HZ to 20,000 HZ. This gives more weighting and has been used to measure peak sound pressure or impulse noise, similar to loud short-lived noises from machinery in occupational settings. Z-weighting, also known as zero-weighting, represents noise levels without any frequency weights.

Some metrics describing noise exposure include:

Energy average equivalent level of the A-weighted sound LA eq: this measures the average sound energy over a given period for constant or continuous noise such as road traffic. LA eq can be further broken up into different types of noise based on the time of day; however, cutoffs for evening and nighttime hours may differ between countries. Maximum level, LA max: this measurement represents the maximal noise level when examining point sources or single events of noise, however, this value does not factor in the duration of the event.

Sound Exposure Level (SEL) is a measure of energy, it takes into consideration both the received sound level and the extent of the exposure. It permits the comparison of sound exposures of different stages in terms of total acoustic energy. This simply means it is a cumulative measure of the acoustic energy of a given sound throughout the noise event. From a numerical point of view, SEL is the equivalent of the total sound energy over the stated period. The unit of sound exposure (SI) is the Pa²·s (pascal-squared second). The higher the noise, the higher the decibels, and the longer the exposure, the higher the SEL (Basner, 2015).

Percentile-derive measurements (L10, L50, L90, ETC) noise may be described in terms of its statistical distribution over a set time, in which investigators may obtain values, or cut-points, at any percentile level. The L90 is the sound level that exceeds 90% of the period; this is commonly referred to as background noise.

Effects of Noise Pollution on Human Being

The potential health effects of noise pollution are numerous, pervasive, persistent, medically and socially significant. Noise produces direct and cumulative adverse effects that impair health and degrade residential, social and working environments with corresponding real (economic) and intangible (well-being) losses, diseases, social handicaps, reduced productivity, negative social behaviour, annoyance reactions, absenteeism and accidents. (Hiral, *et al*, 2017).

A noise problem generally consists of three interrelated elements the sources, the receiver and the transmission path. This transmission path is usually the atmosphere through which the sound is propagated but can include the structural materials of any building containing the receiver.

The discrimination and differentiation between sounded noise also depend upon the habit and interest of the person/species receiving it, the ambient conditions and the impact of the sound generated during that particular duration of time. There could be instances that, excellently rendered musical concerts, for example, may be felt as noises and exceptional music as well during the concert. Sound of frequencies less than 20 HZ are called infrasonic and greater than 20,000 HZ is called ultrasonic, since noise is also a sound, the terms noise and sound are synonymously used and are followed in this module (EEA, 2020)

U S Environmental Protection Agency (EPA, 2009) estimated that nearly 100 million people in the United States (about 50%) of the population had annual exposure to traffic noise that was high enough to be harmful to health. The impacts of noise pollution as described by Nathanson and Berg, (2023) are as follows:

- A. **Hearing problems:** Any unwanted sounds that our ears have not been built to filter can cause problems within the body. Our ears can take in a certain range of sounds without getting damaged. Man-made noises such as jackhammers, horns, machinery, aeroplanes and even vehicles can be too loud levels of noise that can easily result in the damage of our eardrums and loss of hearing, causing tinnitus or deafness. It also reduces our sensitivity to sound that our ears pick up unconsciously to regulate our body rhythm. It is estimated that worldwide 1.3 billion people suffer from hearing impairment as a result of noise exposure. World Health Organization (WHO) estimated that 10% of the global population is currently exposed to noise levels that could lead to hearing impairment.
- B. **Psychological issues:** Excessive noise pollution in working areas such as offices, construction sites, bars and even in our homes can influence psychological health. Studies show that the occurrence of aggressive behavior, disturbance of sleep, constant stress, fatigue, depression, anxiety, hysteria and hypertension in humans as well as animals can be linked to excessive noise levels. The level of irritation increases with noise, and people tend to become less patient. These in turn can cause more severe and chronic health issues later in life.
- C. **Physical problems:** Noise pollution can cause headaches, high blood pressure, respiratory agitation, racing pulse, and exposure to extremely loud, constant noise, gastritis, colitis and even heart attacks may occur.
- D. **Sleeping Disorder:** While it may not seem like much at this point, excessively high levels of noise are likely to hamper your sleeping pattern thereby leading to irritation and uncomfortable situations.
- E. **Cardiovascular issues:** Blood pressure levels, cardiovascular diseases and stress-related heart problems are on the rise. Studies suggest that high-intensity noise causes high blood pressure and increases heartbeat rate as it disrupts normal blood flow. Since bringing these rates to a manageable level depends on our understanding of noise pollution, we need to be wary of the ill effects and tackle this situation mindfully. Estimates hold that chronic noise exposure contributes to about 48,000 new cases of heart disease in Europe each year and disrupts the sleep of 6.5 million people (Stephanie, 2022).
- F. **Public health:** Noise has been recognized as one of the major environmental threats resulting from the robust industrial development and transport system over the years. (WHO, 2018) it is significantly different from soil, water, and air pollution due to its widespread and unique source, which adversely affects public health, especially in urban and suburban areas. (Farooqi, *et al*, 2019). Estimates from available data suggest that 65% of Europeans living in major urban areas are exposed to high noise levels exceeding 60db which could be due to attendance at social activities, such as bars and concerts. Exposure to environmental noise levels above recommended levels results in 1169 cases of dementia, 788 strokes and 542 heart attacks every year in the UK alone (EEA, 2013).
- G. **Stress:** research commissioned by Rock Wool, a multi-national insulation manufacturer with headquarters in Denmark, reveals that in the UK third (33%) of victims of domestic disturbances claim loud parties have left them unable to sleep or

- H. made them stressed in the last two years. Around one in eleven (9%) of those affected by domestic disturbances claim it has left them continually disturbed and stressed. More than 1.8 million people claim noisy neighbors have made their life a misery and they cannot enjoy their homes (WHO, 2021).
- I. **Reduced Cognitive Functioning:** The ear is connected to the brain, which coordinates the body's stimulus responses. For this reason, all sound waves that hit the ear are sent to the brain for interpretation. This means too much noise also gets to the brain, and according to scientific reports, such kind of noise dulls the brain and contributes to a lower response rate by the brain. Due to this, cognitive functioning reduces and so does the ability to solve problems normally. Individuals who live in areas with too much noise, for instance, adjacent to busy highways, railway lines, airports or near loud nightclubs tend to have lower cognitive power compared to those who live in quieter environments. (Hiral, *et al*,2017).

Emotional and behavioral change: This is different from cognitive thinking. Too much noise means disturbances of peace, which may lead to annoyance or anger. People in this state tend to have constant headaches, which may even intensify if the noise is continuous. This may lead to amplified stress levels, and thus emotion takes over, and violence may ensue. This type of behavior is reported to be due to anxiety. With such behavior, it becomes hard to concentrate on work and achieve set goals owing to reduced work efficiency (Farooqi, *et al*. 2019).

Reproduction problems: varying studies have been conducted to estimate the effect of noise pollution on reproduction in human beings, and surprisingly, most of these studies have posited that pregnant women exposed to noise pollution during the course of their expectancy tend to give birth to children with less body weight. The stress levels experienced by the expectant mother equally disturbs the unborn child.

Trouble community: high decibel noise can create inconvenience and may not allow two people to communicate clearly. This may lead to misunderstanding, and one may have difficulty understanding the other person. Constant sharp noise can cause severe headaches and disturb the emotional balance.

Effects of Noise Pollution on the Environment

Noise pollution can have a major impact on the environment. According to the National Park Service (NPS) in the United States noise pollution has an enormous environmental impact and does serious damage to wildlife. (Michel, 2018) opined that noise pollution can interfere with cycles and rearing even hastening the extinction of some species. One ecosystem that exemplifies the harsh effects of noise pollution is marine life. Life underwater can naturally be pretty loud. Water particles are more densely packed than air particles so sound travels faster. Over time marine creatures have adapted to use sound as a way to communicate with one another. Some fish like smooth-claw snapping fish even sound those 200 decibels (louder than a gunshot). One of the most devastating man-made sounds in the ocean is from "seismic surveying".

Noise pollution affects the health and well-being of wildlife. Studies have shown that loud noise can cause caterpillars' dorsal vessels (the insect equivalent of the heart) to beat faster,

and cause bluebirds to have fewer chicks. Animals use sound for a variety of reasons, including to navigate, find food attract mates and avoid predators. Noise pollution makes it difficult for them to accomplish these tasks, which affects their ability to survive. Increasing noise is not only affecting animals on land, it is also a growing problem for those that live in the ocean. Ships, oil drills, sonar devices, and seismic tests have made the marine environment loud, and chaotic (Sordello, *et. al*, 2019).

Effects of Noise Pollution on Wildlife

Wildlife faces far more problems than humans because of noise pollution since they are more dependent on sound. Animals develop a better sense of hearing than us since their survival depends on it. Mammals rely on echolocation to communicate, and excess noise interferes with their ability to effectively echolocate. A recent study published in *Biology Letters* found that human-created noise affects a wide, range of animals. The ill effect of excessive noise begins at home. Pets react more aggressively in a household where there is constant noise, they become disoriented more easily and face many behavioural problems. In nature, animals may suffer from hearing loss, which makes them easy prey and leads to dwindling populations. Others became in efficient at hunting disturbing the balance of the ecosystem (Clark and Dunn, 2022).

Clark and Dunn (2022), proposed the following as effects of noise pollution on animals:

- **Effect on mating:** In many species (particularly birds and frogs), males rely on particular calls to attract mates. The most enticing calls are typically low-pitched, but some animals have been observed making their voices higher to compete with low-frequency noise like car engines. These less attractive vocalizations can lower the male's ability to find and keep mates. Additionally, the calls resonate through a smaller range in noisy environments, creating smaller breeding pools. Scientists have realized concern about how noise pollution could therefore lower population sizes and genetic diversity.
- **Effect on Navigation:** Nocturnal and aquatic species have adapted to their low light environments in different ways bats and dolphins can echo late, emitting cells at a certain frequency and using the echoes to identify obstacles in the area. Human-generated noise (like traffic or sonar) can disorient these animals by either damaging their hearing or causing them to adjust the pitch of their calls in ways that don't provide as useful of echoes.
- **Foraging:** Animals like owls and cats have evolved complex ears to help them hear prey. But it is harder for them to do so in a loud environment. Humans can barely perceive a one-decibel difference, but a study found that for every IDB increase in noise owls in the areas were 8% less successful at catching prey. The psychological impacts of noise can also impact herbivory. One study found that noise drew in nectar-eating hummingbirds (increasing pollination) but deterred several seed-eating birds (decreasing the spread of seeds). Indicating that noise may have the potential to alter a habitat's plant community.

Effects of Noise Pollution on Plants

Clinton, (2019), also opined that noise pollution has lasting effects on plants and trees. Human noise pollution affects the diversity of plant life in an ecosystem even after the noise has been removed. Noise pollution is altering the landscape of plants and trees, which depend on noise-affected animals to pollinate them and spread their seeds. Some plants do worse in noisy areas, a study found, while others seem to do better, depending on how the community of creatures around them change. Either way, the ripple effect can be far-reaching and long-lasting, especially for trees which often take decades to grow from seedlings to adults.

Recent studies show that plant organisms perceive sound as a mechanical stimulus and translate it into cellular and metabolic changes. Sound stimuli can influence germination rates and increase plants growth and development, improving the yield in some crops. Plant emit sound from xylem and faint ultra sound in case of stress. Plants can hear caterpillars chewing and set up the appropriate defenses, but they can also hear the moving close of pollinator using flowers as ears and responding within minutes by sweating the nectar. In plants, depending on the frequency or intensity of the sound waves to which these organisms are exposed, it could happen that they will go against both a promotion in growth and a greater resistance to diseases and predators (Taylor and Francis, 2020).

The effect of audible sound has been studied on the germination and growth of the green beans by exposing them for 72 hours to a frequency ranging from 1 to 2.5 kHz and with variable intensity (80/90/100/dB). The study found a decrease in germination time and a significant increase in the growth of buds exposed to frequencies of 2 KHZ and an intensity of (Taylor and Francis, 2020).

Effects of Noise Pollution on Birds

With the growth of air traffic, construction and other machine-based activity; the globe has been growing louder over the last century. Only recently have scientists started to the ways that individual species respond to the racket, in loud places studies have found in the last few places, some birds sing at higher frequencies. Bats can have trouble finding prey, frogs can struggle to find mates. And whales seem to be vocalizing with more volume to communicate with each other. (Francis, 2019).

Researchers suggest that noise pollution affects their behavior, fitness, breeding and growth, and often leads to chronic stress. Scientists say that constant noise may form an acoustic blanket muffling the audio cues birds rely on to detect predators, competitors and their species. According to a result of research conducted by California Polytechnic State University, the result showed that birds living in forested environments tend to be more sensitive to noise than birds in open environments. Noise pollution delays nesting for birds whose songs are at a lower frequency and thus more difficult to hear through low-frequency human noise. (Hammerson and Niemann, 2016).

Ways to Reduce Noise Pollution

In some cases, noise pollution is unavoidable. However, there are ways to reduce noise levels inside the home and the environment. Helen, (2020) proposed the following ways to reduce noise pollution, these include:

1: Reducing noise from appliances: items, such as air conditioning units, heaters, fans, and other appliances, contribute to overall noise levels in the home. Try turning them off more often or setting a timer, so they only switch on at certain times.

2: Reducing noise from media devices: consider the volume and duration of noise from music, televisions, radios and video games. Avoid having unnecessary noise playing in the background for long periods, or listening to sounds at too high volume. It may be useful to set aside dedicated time for watching TV or listening to music.

3: Repair or replace old machinery: Old appliances vehicles and other items can be louder than newer models. Consider upgrading or replacing noisy household items.

4: Soundproofing: Adding insulation strategically around the home can help muffle sounds from other rooms, neighbors, or outside. Rugs, carpets and curtains may also help.

5: Create more quiet time: Try regularly setting aside time for quiet activities, such as reading, puzzles, or creative hobbies. Avoid playing music or having background noise during the time.

6: Ear protection: If loud noise is unavoidable, use ear plugs or ear muffs, to reduce its impact. Planting shrubs and stress to buffer noise.

Noise Control Methods

Several methods can be utilized to control the level of noise as suggested by Helen, (2020).

- First of all, the design and technology of machines and equipment could be altered resulting in low noise emission.
- Secondly, noise barriers may help us control noise.
- Thirdly, is to protect receptors of sound by a shield e. g building may be insulated against noise. Similarly, body and window planes may be made soundproof.
- Fourth, a legal framework could be enforced to regulate users of vehicles/equipment, but it requires huge resources and good governance.

To reduce the general reverberant noise level in machine shops, a caustic material may be placed on the ceiling and sidewalls. With this treatment 3 to 8db reduction of middle and high-frequency noise may be achieved. This would bring down the general reverberation noise level and as a consequence, the noise condition may become less confusing.

For efficient noise reduction, functional sound absorbers may be clustered as near the machine as possible. These units may be suspended and distributed in any pattern to obtain lower noise levels within the machine shop. Compared based on equal total exposed surface areas, functional sound absorbers have slightly higher noise reduction coefficients.

Some methods that can be used to control noise pollution include the following:

- i. **Ear protection acids:** for noisy industries, the workers should be provided with ear protection acids like earplugs, headphones or noise helmets. A unique form of operational modification is employing a deaf person to handle noisy equipment, wherever possible subject to suitable safeguards. The noise levels must be reduced to a point where the noise hazard will be reduced to a condition of acceptability.
- ii. **Design of doors and windows:** To reduce noise, it is necessary to design carefully the doors and windows of the room. The sound travels through fragile cracks

- iii. between the doors and walls. Excellent sound insulation is obtained by constructing glazed windows with double or triple panes of glass. The air space at the edges of such panes is filled with sound-absorbing materials.
- iv. **Treatment of floors, ceiling and floorings:** it is known that floating floors and suspended ceilings help considerably in reducing noise. Suitable sound-absorbing materials like hair, caustic tiles perforated plywood and specifically made porous materials are available and can be fixed on walls, floors and ceilings to have a noise reduction. It is suggested to use a few suspended absorbers from the ceiling for reducing deflections from the ceiling and for absorbing machine noise. These absorbers may be suspended on the top of the machine and as close as possible to it.
- v. **Planting of trees:** a new concept gaining acceptance is the planting of trees like Neem, tamarind, coconut and so on near schools, hospitals, public offices and such sites. The presence of trees is likely to reduce the noise to the extent of about 8. Belts of trees or shrubs may also be used as a barrier of sound. It has been found that in dense evergreen woods, the attenuation of sound is about 18 per 300m at 500c/s. this is due to absorption by the foliage on one hand and multiple scattering on the other. The denser the barrier, the greater the attenuation.
- vi. **Vibration dumping:** this arrangement is attempted to reduce vibration. A layer of damping material in the form of resilient pads made of rubber, neoprene, cork and plastic may be adopted for high-frequency vibrations. It is desirable to make a massive base for a vibrating machine.
- vii. **Noise control by location:** another practical method of reducing noise is by increasing the distance between the source and the work vicinity. Machine processes and work areas which are approximately equally noisy should be located together. Particularly noisy areas should be segregated from quiet areas. The office space in a factory should be as far as possible segregated from the production area and preferably be located in a separate building. If a common wall is unavailable, it should be heavy with minimum connecting doors and no permanent openings.

Noise control by absorption of reflected sound:

This process includes:

- i. **Ceiling:** the absorptive of the ceiling can be increased by introducing a large absorbing area without interference with other operations. Two methods are commonly employed.
- ii. **By suspended grid system,** using lay-in or concealed grid type panels or tiles and
- iii. **By vertically suspending panels of absorbent material.** If ceiling – treatment does not give the required attenuation, reflections from the walls should be reduced by applying absorptive treatment to them.
- iv. **Screens:** if the noise is to be reduced further, it is possible to use screens around the noisy machines. Sound reduction by 10 (A) to 15 (A) may be achieved by using screens in an already treated area. The various other absorbing materials are caustic plaster (plaster of granulated insulating materials and cement), compressed cane or wooden boards, perforated asbestos, teak plywood packed by wire, etc.

Noise control in urban planning

Morillas, *et. al*, (2018) recommended some tools for noise control in urban planning, these include the following:

1. Noise mapping and monitoring: noise mapping is the process of creating a visual representation of the noise levels and patterns in a given area, using data from measurements, models, or surveys. Noise monitoring is the process of collecting and analyzing data over time, using sensors, meters or apps. Noise mapping and monitoring can help urban planners identify noise hotspots, assess noise exposure and annoyance, evaluate noise mitigation measures, and enforce noise policies and standards. For instance, states can produce strategic noise maps and action plans.
2. Noise reduction and mitigation: noise reduction is the process of lowering the noise levels at the source or along the propagation path, using techniques such as traffic management, vehicles, sound barriers, insulation and landscaping. Noise mitigation is the process of minimizing the adverse effects of noise on the receivers, using techniques such as noise zoning, building design, soundproofing and masking. These processes can help urban planners create quieter and healthier environments for living, working and recreation.
3. Noise awareness and education: these are the processes of informing and engaging the public and stakeholders about the causes, effects of noise pollution. They can involve such activities as campaigns, events, publications, websites, apps and participatory projects. Noise awareness and education can help urban planners raise awareness and understanding of noise issues, promote positive attitudes, foster collaboration and participation, and empower citizens and communities to take action.
4. Vibrations from external sources such as railways cars, traffic, and factories create sound. The most effective method of reducing such noise is to have rational town planning, the city is divided into suitable zones and residential zones are placed away from railways, workshops, factories and main streets. A vigorous pursuit of the existing legislative measures, especially during the festivals and marriage functions should be made to control noise pollution. Traffic noise can be reduced through the installation of speed humps, signs and markings on the streets.

Conclusion: Good mental and physical health requires that exposure to loud noise should be minimized on the roads inside factories, at construction sites and inside residential buildings. Noise produced inside the factories is very harmful to workers as they are continuously exposed to it for years. It is detrimental to the interests of the owners as well as it lessens the efficiency of the worker. Inside the house, one can lessen noise by using carpet or rubber on the floor. Heavy curtains also lessen the propagation of noise. Fans and other electrical equipment need care so that they make the least noise, the most important thing is to make people aware that noise is bad for their physical and mental health.

References

- M. Basner 2015. *Auditory and non-auditory effects of noise on health: An ICBEN Perspective*. The Journal of the Acoustical Society of America 137(4):2246-2246 DOI:10.1121/1.4920192
- P. Cohen, O. Dotcher and I. Schnell 2014. *The impact of an urban park on air pollution and noise level in the Mediterranean city of Tel Aviv, Israel*. Environmental pollution 195,78-83.
- F. Clark and J. Dunn 2022. *This is how noise pollution can harm animals*. Anglia Ruskin University. August 2022. <https://www.aru.ac.uk>.
- F. Clinton 2019. *Effect of traffic noise on biodiversity*. Macmillan Publishers, Chicago.
- European Environmental Agency EEA,2020. *Noise pollution is a major problem for human health and the environment*. Environmental Protection Agency EPA,2009, *Noise pollution and its effects on children*.
- L. Goines and L. Hader 2007. *Noise pollution. A modern plague*. Southern medical Journal Lippincott Williams and Wilkins. 100(3): 287-294
- F. Hammersen,, H. Niemen and J. Hoebal 2016. *Environmental noise annoyance and mental health in adults*. International Journal of Environmental Research and Public Health 13 (10) pp 954-957
- M. Helen 2020. *Health Effect of Noise Pollution*. Medical News [https:// www. Medical news today .com/](https://www.Medicalnews.com/) noise pollution and its effects on human health.
- J. Hiral, S. S. Huma, J. P.Minarva and M.G.Yogesh 2017. *Noise pollution and human Health, 'A Review'*. <https://www.org>. Australian Academy of Science// noise and its effect on human health 2019. [https://: doi.org//](https://doi.org/) environmental science and pollution research/causes and effects of noise
- N. C. Kogutu 2013. *Level of environmental noise and perceived health in bus terminus in Nairobi central business district*. M.Sc. thesis, school of public health Kenyatta University Kenya.
- K. W. Lawrence and Norman C.Y. Tzekung 2018. *Advanced air and noise pollution control*. Humana Press, Totowa New Jersey.
- Juan M.B. Morillas, Guillermo R. Gozalo, David M. Goonzalez and Pedro A. Moraga 2018. *Noise Pollution and Urban Planning*. ResearchGate 4(8):12 DOI:10.1007/s40726-018-0095-7
- K. Murali 2010. *The book of environmental studies*. 3rd edition Savera publishing house New Delhi.
- N. Menkiti and J. Agunwamba 2015. *Assessment of noise pollution from electricity generators in a high- density residential areas*. African Journal of science technology, innovation and development, 7 (4): 3pp 306-312.
- A. Micheal 2018. *Noise pollution and control strategies*. Journal 2(3): pp 101-105

- S. Narendra and C. Davaras 2004. *Noise pollution sources, effect control*. Journal of Human Ecology vol. 16(3)181-187
- J.A. Nathanson and R. E. Berg 2023. *Noise pollution*. Encyclopedia Britannica. www.britannica.com
- National Geographic 2019; Noise Pollution. National Geographic Society, July 2019 <https://www.nationalgeographic.org/encyclopedia/noise-pollution>.
- D. Stephanie 2022. *The effect of noise on health medicine*, viral world spring 2022 Harvard medicine.
- R. Sordello, F. Flamerie, V. Sylvie and B. Livorell 2019. *Evidence of the environmental Impact of noise pollution on biodiversity: A systematic map*. February 2019, Environmental Evidence 8 (8) DOI:10.1186/s13750-019-0146-6
- M. Taylor and K. Francis 2020. *Plant behavior*, Journal of Marine Biology 2 (5) pp 234-235.
- United Nations 2018. <https://www.un.org/development/desa/en/news/population/2018>. World Health Organization (WHO) 2018, Noise guideline for Europe [www/http://doi/conservesenergyfuture.com/effectofnoise](http://www.who.int/news-room/fact-sheets/detail/noise-and-health) pollution.
- Z. U. Rahman Farooqi, Muhammad Sabir and Predrag Ilic 2019. *Assessment of noise pollution and its effects on Human health in the industrial hub of Pakistan*. [www. ResearchGate.net](http://www.researchgate.net). DOI:10.1314/RG2.2.11576.3968