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ASSESSMENT OF NOISE LEVELS IN PARTS OF AKWA IBOM STATE, NIGERIA

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ABSTRACT

The noise level measurements with a sound level meter at selected locations in Akwa Ibom State namely schools, churches, markets, workshops, roads and parks were assessed. The results of the findings revealed that Schools, Churches, Markets, workshops/factories, roads/streets and road junctions/parks have the mean noise levels of 66.63 dBA, 77.93 dBA, 74.33 dBA, 82.68 dBA, 71.50 dBA and 78.45 dBA respectively. Hence, the findings revealed that these figures are greater than the recommended noise levels.

INTRODUCTION

The rate at which environmental noise pollution is increasing in parts of Akwa Ibom State, Nigeria needs a critical study. This increase in noise can be attributed to the rising levels of economic affluence in the State. Community Social surveys almost always rate noise among the most annoying environmental nuisances (Kiely, 1998). Researches indicate that noise degrades the quality of our environment and is known to produce many adverse effects both on humans and structures. The adverse effects of noise include cardiovascular effect, hearing loss, speech interference, work interference, and annoyance, among others. Environmental Protection Agency (EPA) of the United States of America recognised noise as a problem back in the 1970s. The EU Directive (86/188/EEC) is on the protection of workers from the risks related to exposure to noise at work. The objective of the directive is to reduce the level of noise experienced at work by taking action at the noise source.

Sound pressure level, L_p in decibels is defined as:

$$L_p = 20 \log_{10} (P/P_o) \quad (1)$$

where, P is the measured root mean square pressure value in Pascal, Pa; P_o is the reference pressure (20 μPa). The EU directive specifies that when the daily exposure level exceeds 85 dBA, the worker is to be advised of the risks and trained to use ear protectors. If the daily exposure level exceeds 90 dBA, a programme to reduce levels should be put in place (Kiely, 1998). The British Columbia Work's Compensation Board (WCB) has set 85 dB as its maximum exposure limit in the work place. Above this level hearing protection should be worn. It states that the threshold of pain is reached at 120 dB and it classifies 140 dB as extreme danger. World Health Organisation (WHO) values are similar while Environmental Protection Agency (EPA) tends to have even a stricter standard of 70 dB as a maximum safe noise level in work place. The safe level in homes is 50 – 55 dB. Studies have found that steady noise above 50 dB gives moderate annoyance and above 55 dB serious annoyance at home. For health and safety reasons in a non-work environment, 55 dB is set as a safety level for outside and 45 dB inside. Hospital and school safe levels are 35 dB. Findings also show that the noise exposure limits in decibels for industrial workers in Nigeria are the same in dBA as those of the US Department of Labour as shown on Table 1 (FEPA, 1991).

Table 1: Noise exposure limits for industrial worker in Nigeria

Exposure Time (h/day)	Permissible Exposure Limits in dB
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Road traffic noise is major concern of communities living in the vicinity of road networks in urban areas (Rawat *et al.,* 2009). For free-flowing traffic with at least 5 percent heavy vehicles, the traffic noise level drops to a minimum at an average speed of 30 to 40km/h irrespective of the traffic volume (DOT, 1988). Heavy vehicle such as delivery truck was observed (Bjorkman and Rylander, 1997) as an important vehicle component responsible for contributing noise to environment. The noise level at the reception point is influenced by the intervenining ground surface conditions among others (Kiely, 1998). In a study (Menkiti, 2001) it was concluded that the factors that constitute to road traffic noise are complex. They include noise and vibration, fumes from vehicles, dust raised by moving vehicles, noise resulting from opening and closing of vehicle doors, parking of vehicles, and to a minor extent the danger for pedestrians crossing roads. Measurements and surveys show that traffic noise bothers more people more when road traffic flow increased; people are bothered more outside their homes. The disturbance experienced depends on how far the house is from the road and also on the road gradient. The awareness of pedestrian danger at road traffic is very low. Investigations in different countries in the past several decades have shown that road traffic noise affects badly health of the people living in close proximity to busy road highways (Rylander *et al.,* 1976; Calixto *et al.,* 2003; and Ouis, 2002).

The effects of noise are the consequences of elevated sound levels. Elevated workplace or other noise can cause adverse effects on human and structures. Studies show that excessive noise can cause hearing impairment, that certain levels and types of noise can cause heart attack, that body tissue resonances can be adversely affected by noise and that noise generally causes discomfort and annoyance to people exposed to it (EEC, 1978). The hearing process consists of a number of separate processes. It should be noted that no simple and unique relationship exists between the physical measurement of sound and the human perception of the same sound (Kiely, 1998). The hearing damage potential of a given noise source depends not only on its level but also on its duration. It is generally accepted that a sound environment below 75 dB is not harmful (although much lower levels can cause annoyance and disturb sleep), while a single sound above 140 dB may produce permanent hearing damage. Between these two levels, the amount of hearing damage varies with the sound level, the length of exposure and the individual's susceptibility to noise. Other contributing factors are the number and length of quiet periods between exposures, the type of sound (continuous, intermittent or impulsive) and its frequency distribution. Sounds with most of their energy in the speech frequencies are more damaging.

The EC Directive (86/188/EEC) on the protection of workers from the risks related to exposure to noise at work is incorporated into the laws of EC Member States (Commission of the European Communities, 1986). It specifies that certain actions must be taken where the daily personal exposure (eight hour equivalent) of a worker to noise is likely to exceed 85 dBA or where the maximum value of the unweighted instantaneous sound pressure is likely to be greater than 200 P_a, equivalent to 140 dB. Noise has been connected to important cardiovascular health problems. In 1999, the World Health Organization concluded that the available evidence shown suggested a weak associated between long term noise exposure above 67 – 70 dB(A) and hypertension (Ising, *et al*., 1999). More recent studies have suggested that noise levels of 50 dB(A) at night may also increase the risks of myocardial infarction by chronically elevating cortisol production (Essiett *et al*., 2010). According to Lesser W. Sontag of the Fels Research Institute (as presented in the pamphlet authored by the U.S Environmental Protection Agency in 1978); "there is ample evidence that environment has a role in shaping the physique, behaviour and function of animals including man from conception and not merely from birth. The foetus is capable of perceiving sounds and responding to them by motor activity and cardiac rate change". Noise exposure is deemed to be particularly pernicious when it occurs between 15 and 60 days after conception, when major internal organs and the central nervous system are formed. Later developmental effects occur as vasoconstriction in the mother reduces blood flow and hence oxygen and nutrition to the foetus. Low birth weights and noise were also associated with lower levels of certain hormone in the mother, these hormones being thought to affect foetal growth and to be a good indicator of protein production. The difference between the hormone levels of the pregnant mothers in noisy versus quiet areas increased as birth approaches. Children who live in noisy environments have been shown to have elevated blood pressures and elevated levels of stress induced hormones. Studies also suggest that when women are exposed to 76.5 dB aircraft noise, a small decrease in birth weight occurs (Essiett *et al.,* 2010).

Shouted conversations at the same distance are possible up to about 85 dBA. To permit normal conversations at distances of about five metres would require a background noise level below 50 dBA. Satisfactory telephone conversations need background levels less than about 80 dBA (Kiely, 1998). High noise levels may reduce the accuracy of the work being undertaken rather than the quantity. Steady noises appear to have little effect on work performance unless the A-weighted noise level exceeds about 90 dB (Davis and Cornwell, 1991). According to a WHO task group, daytime noise levels of less than 50 dBA outdoors cause little or no serious annoyance in the community (OECD, 1986). Because of differences between people and locations, it is difficult to determine the noise level below which sleep interference will not occur (Kiely, 1998). Noise levels above 80 dB are associated with both an increase in aggressive behaviour and a decrease in behaviour helpful to others. The news media regularly report violent behaviour arising out of disputes over noise; in many cases these disputes end in injury or death (WHO Guidelines for Community Noise, 2000).

MATERIALS AND METHOD

Locations visited inhabited sources that generated or appeared to generate noise. The locations included road junctions, churches, schools, workshops and markets, among others. All the noise measurements were made using the Sound Level Meter (SLM), model TES 1350A with ½ inch electret condenser microphone. This model has both A and C weightings and 0.1dB resolution with fast/slow response. It has high and low measuring ranges 35 to 100 dB and 65 to 160 dB respectively. Measurements were taken by setting the sound level meter to A-weighting network in all the sampling locations. The sound level meter was calibrated before and after each use. The manufacturer's manual gave the calibration procedure. During the noise level measurements, the sound level meter (microphone) was positioned at a distance of at least 1m from the main source at a height of 1.2 m above the ground. Traffic noise measurements were normally taken when the road surface was dry. This is because wet road surfaces would give increased noise levels. For the purposes of the noise Insulation Regulations for housing in the United Kingdom, traffic noise is assessed at a reception point located 1m in front of the most exposed part of an external window or door (EU Directive 86/188/EEC). This method was adopted during the traffic noise measurements. The wind speed and direction relation to the microphone was considered. This is because at higher wind speed (i.e above 5 m/s) turbulent noise caused by the wind may mask the noise source being measured. This implies that valid measurements can be taken in wind speed up to 5 m/s. Measurement may be acceptable with wind speeds up to 10 m/s. In general the peaks of wind noise should be at least 10 dB below the noise source being measured (Kiely, 1998). Hence, during sound level measurements, windshield was always used (i.e for outdoor measurements). Slow response was used for comparatively stable noise measurement. For instance, work place noise level measurements were taken on slow response. Here, the response rate is the time period over which the instrument averages the sound level before displaying it on the readout. Fast response was used for fast varying noise. Measurement of workplace sound pressure was made in the undisturbed sound field in the workplace, with the microphone located at the position normally occupied by the ear exposed to the highest value of exposure (EC, 1986). Similarly, environmental noise measurements were taken at locations where the maximum noise nuisances occurred.

RESULTS AND DISCUSSIONS

Table 2: Mean noise levels of individual locations (2010)

LOCATION	MEAN NOISE LEVEL (dBA)
Four Schools	66.63
Three Markets	74.33
Five Workshops/Factories	82.68
Five Roads/Streets	71.50
Six Road Junctions/Parks	78.45
Four Churches	77.93

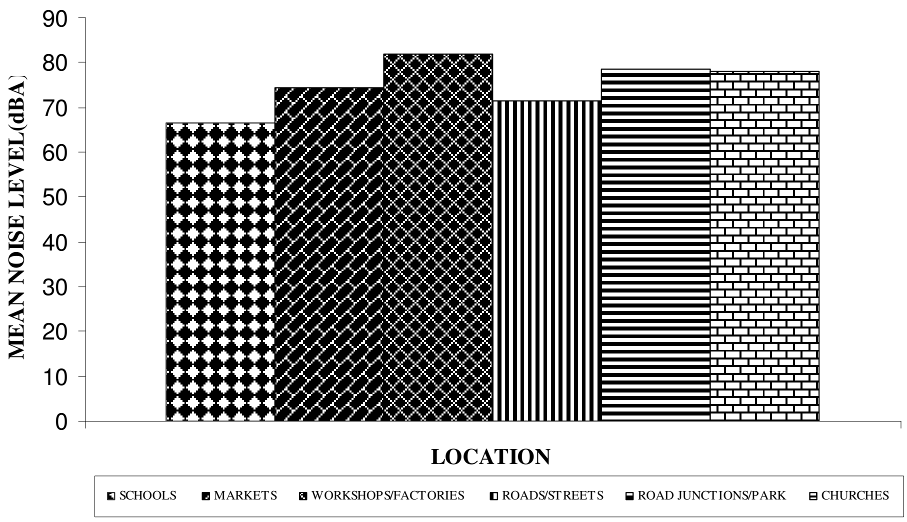

Figure 1: Mean Noise Level Measurements

Tables 3.1and Figure 3.1 represents the results of the study. The results show that schools have a mean noise level of 66.63 dBA instead of the World Health Organisation (WHO) standard value of 35 dB. This noise level (66.63 dBA) can contribute to low academic performance of a child by promoting lack of concentration. It is also hazardous to health of the teachers. Markets produced a mean noise level of 74.33 dBA which may cause high blood pressure, sleep loss, annoyance and stress, among others. Workshops/factories introduced a mean noise level of 82.68 dBA which is also hazardous to both residents and environments. In residential areas, roads/streets produced a mean noise level of 71.5 dBA. This is far above the World Health

Organization (WHO) safety level of 55 dB for outside a non-work environment. Road junctions and parks produce a mean noise level of 78.45 dBA, while churches generate 77.93 dBA which are hazardous to both human and structures.

Generally, it is observed that these figures are greater than the recommended noise levels. This increase in noise can be attributed to the rising levels of economic affluence in the State.

RECOMMENDATIONS

It can be recommended from the findings as follows:-

- The Federal Environmental Protection Agency (FEPA) should organized seminars and workshops to enlighten members of the public in both private and public sectors on the hazards of noise pollution.
- Environmental consultants should visit residential areas, schools and workshops/factories (where this pandemic attains its climax) to investigate the effect of noise pollution on the populace.
- FEPA should create, collect and distribute information and resources regarding noise pollution and strengthen laws and governmental efforts to control noise pollution.
- FEPA should also establish network among environmental, professional, medical, governmental and activist groups working on noise pollution issues for the betterment of our environment.

CONCLUSION

It can be concluded from the findings that all the parts visited have noise levels above the recommended levels. From the results of the findings, it can also be concluded that workshops/factories with the highest mean noise level of 82.68 dBA are the major sources of noise.

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