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Impact of Noise on the Environment: Using Itu Local Government Area of Akwa Ibom State, Nigeria as Case Study

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Abstract: *This paper presents impact of noise on the environment and the analysis of noise bother by survey method in Itu Local Government Area. Noise level measurements with a sound level meter at selected locations were conducted. The selected locations which included schools, churches, markets, workshops/factories, roads/streets and road junctions/parks were taken as interview areas, hence, copies of questionnaires were distributed and the results were analysed using the Percentage Analysis Method (PAM). The results of the findings reveal that noise creates negative impact in Itu Local Government Area. The results of the findings reveal that there are numerous sources of noise in Itu Local Government Area. They include traffic, workshops/factories and compact disk sellers, among others. Workshop/factory noise bothers them most. Also, the results of the findings reveal that there is no well-defined relationship between levels of noise and degree of bother, instead the degree of bother increases as energy content of the noise increases.*
Keywords: *Analysis, environment, impact, Itu Local Government Area, noise,*

I. Introduction

The rate at which environmental noise pollution is increasing in Itu Local Government Area 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 [1]. Researches indicate that noise degrades the quality of our environment and is known to produce many adverse effects both on humans and structures. 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) and 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 [1]. 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. They gave the safe level around home to be 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 that of the US Department of Labour [2]. Road traffic noise is major concern of communities living in the vicinity of road networks in urban areas [3]. 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 [4]. Heavy vehicle such as delivery truck was observed [5] 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 [1]. In a study [6] 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, (awkward) parking of vehicles, and to a minor extent the danger for pedestrians crossing (busy) 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. It was also concluded that there appears to be an

empirical relationship between road traffic noise components and bother. 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 ([7]; [8]; and [9]). Calabar- Itu highway is one of the busiest roads in Itu Local Government Area of Akwa Ibom State. 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 [10]. 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 [1]. 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 [11]. 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 Organisation concluded that the available evidence shown suggested a weak associated between long term noise exposure above 67 – 70 dB(A) and hypertension [12]. 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 [13].

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 [13]. 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 [1]. 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 [14]. According to a WHO task group, daytime noise levels of less than 50 dBA outdoors cause little or no serious annoyance in the community [15]. Sleep interference by noise causes great annoyance to many people. Intermittent or impulsive noises are particularly disturbing. Because of differences between people and locations, it is difficult to determine the noise level below which sleep interference will not occur [1]. 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 [16].

II. Materials And Methods

This research work was undertaken in three parts. In the first part, physical measurements of noise levels in specially selected locations of Itu Local Government Area were carried out. These locations were around people's homes and offices. The aim was to enable checks to be made between people's responses of bother (as indicated by the bothered population) and the level of noise. All the noise measurements were made using the sound level meter (SLM), model TES 1350A with ½ inch electret condenser microphone. 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. The second part involved survey as a series of interviews of different sectors of the population of Itu Local Government Area. In this survey, 450 copies of questionnaires were distributed but 395 copies of it were collected. Forty four (44) out of the 395 were wrongly filled while 351 copies of it were used. The idea was to have an insight into what types

of sources people identify as noise and how they are bothered by these. The third part involved recording noise on tapes, replayable at predetermined levels and presenting these to a selected section of the interviewed population. In this survey, 100 copies of questionnaires were distributed and 94 copies of it were collected and used. Their response was matched against levels of noise as an attempt to correlate degree of bother with levels of noise.

Formulae used were:-

$$\% \text{ Heard} = \frac{\text{Number heard X 100}}{\text{Total number of respondents}} \quad \ldots \quad 2$$

$$\% \text{ Bothered} = \frac{\text{Number bothered X 100}}{\text{Total number of respondents}} \quad \ldots \quad 3$$

III. Results And Discussions

3.1 Survey I (Using Copies of Questionnaires)

Table 3.1: Data on noise bother survey (2010)

NOISE	% HEARD	% BOTHERED
Motor Cycles	90	**71**
Cars	86	**48**
Lorries	88	**50**
Churches	86	**39**
Children	90	**14**
Animals	71	**25**
Workshops/Factories	94	**88**
Night Clubs	40	**35**
Compact Disk Sellers	83	**80**
Ships/Engine Boats	30	**15**
Other People	80	**70**
Other Sources	**75**	**43**

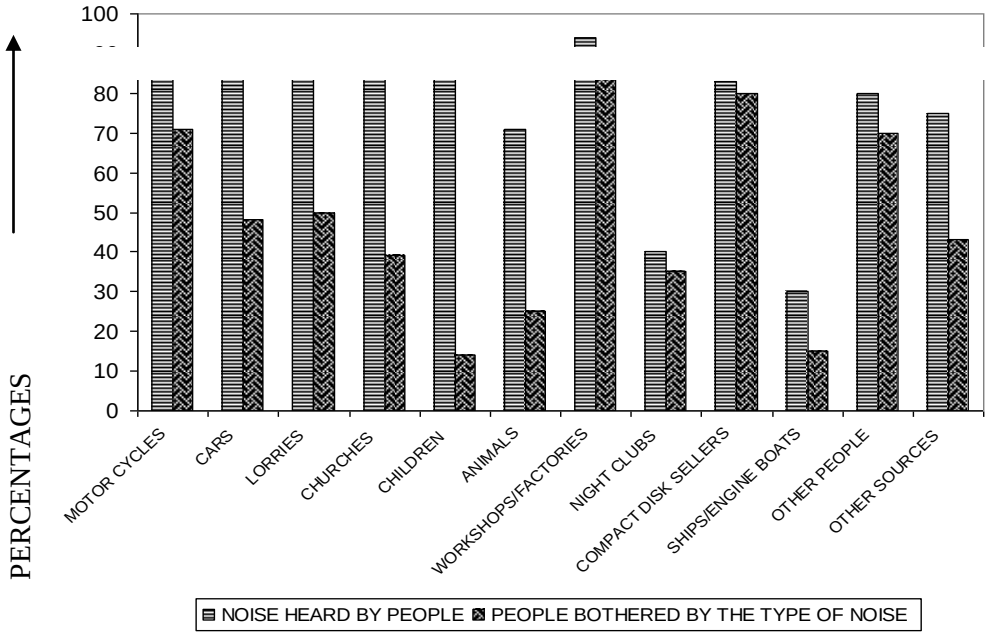

Figure 3.1: Survey I (Using copies of questionnaires)

3.2 Survey II (Response To Tape Recorder)

Table 3.2: Average noise level (dBA) (2010)

NOISE LEVEL (dBA)	% HEARD	% BOTHERED	% SERIOUSLY BOTHERED
50	-	-	-
55	51	35	**3**
60	77	40	**5**
65	80	55	**40**
70	91	80	**56**
75	90	60	**25**

80	96	90	**59**
85	89	82	**15**
90	87	83	**16**
95	95	79	**10**
100	93	77	**14**
110	**95**	**75**	**20**

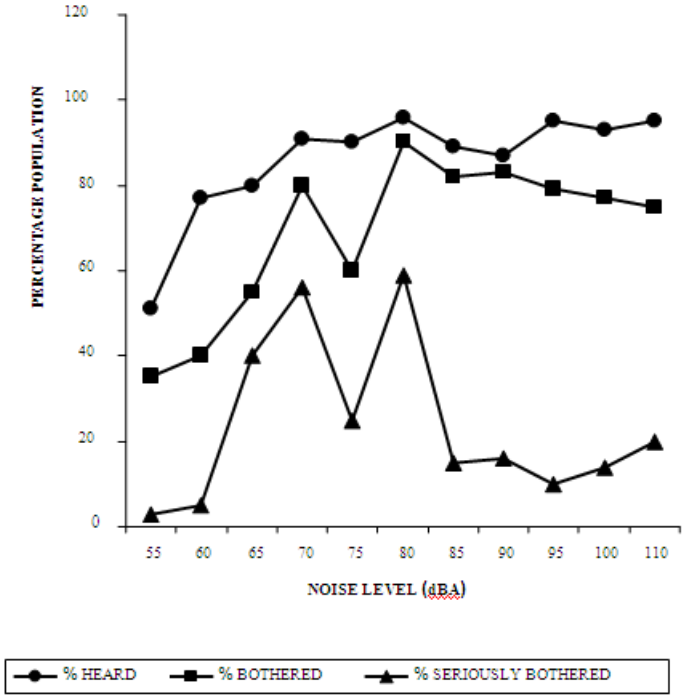

Figure 3.2: Average response to noise

IV. Discussions

Table 3.1 and Figure 3.1 show that 90% of respondents were exposed to motor cycle noise while 71% were bothered by it. Motor cycle noise is the third in the list of bother and among the second ones in the list of noise heard. Car noise had 86% of the respondents exposed to it, while 48% were bothered by it. The corresponding percentages for lorries were 88% and 50%. It is shown that 86% of the respondents were exposed to church noise and 39% were bothered by it. As much as 90% of the respondents were exposed to noise of children (mainly in schools) but only 14% were bothered. Animal noise had 71% of respondents exposed to it and 25% bothered by it. Obviously, workshops/factories top the list of the sources of noise that people are exposed to and bothered by in Itu Local Government Area, averaging 94% with 88% bothered by it. Night Club noise had 40% exposed to it and 35% bothered by it. Noise of compact disk sellers bothered 80% of the 83% exposed to it. Here, almost all the percentages exposed to the noise sources are bothered by it. The result is not unexpected. Compact disk sellers always play music at very high levels in order to attract customers. Some are using cars to advertise their goods (that is mobile music vendors). Ships/engine boats noise bothered 15% while 30% of the respondents were exposed to it. Noise of other people bothered 70% of the 80% exposed to it. Whereas 75% of the population responding was exposed to noise of other sources, only 43% was bothered by it. Power generator noise tops the list of other sources of noise heard and bothered by the people of Itu Local Government Area. Others in the list included market women, earth moving machine (especially during the on-going construction of Calabar-Itu highway), gunshots, quarrels, mobile hawkers, construction site machines, ambulance, siren, insects, markets and sporting activities.

Table 3.2 and Figure 3.2 show the average response to noise of the total population exposed to noise. [17] hypothesized that the response of a population to noise is dependent on the behaviour of the three sub-populations: the noise-sensitive; the noise-insensitive and the remainder. Here, some indications of such groups are evident in Figure 3.2. At the low level of 55 dBA, the percentage of population seriously bothered was 3%. This group may represent the ultra-sensitive (to noise) section of the population who do not want any form of noise. At an average noise level of 60 dBA, 77% of the respondents heard the noise, 40% were bothered and 5% were seriously bothered by it. At 65 dBA, 80% of the noise-exposed population heard, 55% were bothered while 40% were seriously bothered. At 70 dBA, 91% of the respondents heard the noise, 80% were bothered while 56% were seriously bothered. At an average noise level of 75 dBA, 90% of the respondents were exposed to the noise, 60% were bothered by it and 25% were seriously bothered by it. At 80 dBA, 96% of the respondents

heard the noise, 90% were bothered by it, while 59% were seriously bothered. An average noise level of 85 dBA had about 89% of the population exposed to it, 82% bothered by it, but only 15% were seriously bothered by it. The corresponding percentages at 90 dBA were 87%, 83% and 16%. At the level of 95 dBA, 95% of the respondents were exposed to it, 79% were bothered by it while only 10% were seriously bothered. An average noise level of 100 dBA had 93% of the population exposed to it, 77% bothered by it and 14% seriously bothered by it. At the high level of 110 dBA, there are indications that about 80% of the populations exposed to noise are not seriously bothered! Here, 95% hear, 75% are bothered and 20% are seriously bothered. This must be the noise-insensitive group.

In general, Figures 3.1 and 3.2 show that the major source of noise that bothers people most in Itu Local Government Area is the workshop/factory. Figure 3.2 shows that the bother due to compact disk sellers ranks second, while that of motor cycles ranks third. The graph of Figure 3.2 shows that response to noise of the population exposed to it is not linear. Hence, this graph provides criterion for examining the possible relationships that exist between levels of noise and the degree of bother. A number of questions need to be answered to establish a relationship between bother (or annoyance) and level of noise. What is the relationship between the content of bother and exposure of noise? Does the content of bother increase with exposure to noise? For instance does an increase of 5 dBA from 80 dBA to 85 dBA yield the same response as the same increase from 90 dBA to 95 dBA? If 20% of the respondents are bothered by a noise level of 70 dBA, are (20 + y)% bothered by 75 dBA? Are (10 + 2y)% bothered by 80 dBA? This survey has thus revealed that there is no linear relationship between noise level and degree of bother (or annoyance).

V. Conclusion

It is concluded from the findings that:

(i) the significant sources of noise that people in Itu Local Government Area are exposed to are numerous, they include traffic, workshop/factory and compact disk sellers among others;
(ii) the ones that bother them are also numerous, but workshop/factory noise bothers them most;
(iii) there is no linear relationship between noise level and degree of bother (or annoyance) hence there is no correlation between levels of noise and degree of bother;
(iv) noise creates negative impact in Itu Local Government Area.

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References

[1]. G. Kiely, (1998). Environmental Engineering (Singapore,Irwin/McGraw-Hill Publishing Company Limited, 1998)
[2]. FEPA (1991), Guidelines to Standards for Environmental Pollution Control in Nigeria. Federal Environmental Protection Agency (FEPA), Lagos, 1991.
[3]. K. Rawat, V. K. Katiya and Pratibha. Mathematical Modeling of Environmental Noise Impact, Indian Journal of Biomechanics, Special Issue (NCBM 7-8 March) 2009, 75-81.
[4]. Department of Transport (DOT) Calculation of Road Traffic Noise, Technical Memorandum, HMSO, London, 1988
[5]. M. Bjorkman and R. Rylander, Maximum Noise Level in City Traffic. Journal of Sound and Vibration, 205 (4), 1997, 513-516.
[6]. Menkiti, Factors that Constitute Road Traffic Noise in Nigerian Environment. Global Journal of Pure and Applied Sciences. 7(3), 2001b, 589.
[7]. R. Rylander, S. Sorensen and A. Kajland. Traffic Noise Exposure and Annoyance Reactions. Journal of Sound and Vibration, 47(2), 1976, 237-242.
[8]. Calixto,F. B. Diniz, and P. Zannin, Effects of Traffic Composition on Road Traffic Noise in an Urban Setting. Cities, 20(1), 2003 23-29.
[9]. D. Ouis, Annoyance from Road Traffic Noise: A Review. Journal of Environmental Psychology, (1), 2002, 101-120.
[10]. E. E. C., Damage and Annoyance Caused by Noise EUR 5398e CEC Luxemburg, 1978.
[11]. Commission of the European Communities, Council Directive on the protection of workers from the risks related to exposure to noise at work', 86/18/EEC, 1986 .
[12]. H. Ising, W. Babisch, B. Kruppa, Noise-induced Edocrine Effects and Cardiovascular Risk. Noise Health, 1(4), 1999, 37- 48.
[13]. A. A. Essiett, R. E. Akpan and S. O. Uwak, Assessment of Noise Level in Ikot Ekpene Town, Nigeria. International Journal of Biotechnology and Allied Sciences, 5(1), 2010, 620 – 624.
[14]. M. L. Davis and D. A. Cornwell, Introduction to Environmental Engineering, McGraw-Hill, New York, 1991.
[15]. OECD, Environmental Effects of Automotive Transport. The OECD Compass Project, OECD, Paris, 1986.
[16]. WHO Guidelines for Community Noise, Transport Noise and Health: Transport and Environment, 2010, www.transportenvironment.org/module... Accessed Dec. 3, 2010.
[17]. J. F. Langdon, and I. D. Griffiths, Subjective Effects of Traffic Noise Exposure, II: "Comparisons of Noise Indices, Response scales and effects of changes in Noise Levels". Journal of Sound and Vibration, 83, 1982,171-180.
[18]. Menkiti, Analysis of Noise Bother by Survey Method. Global Journal of Pure and Applied Sciences, 7(3), 2001a, 545, 547, 549-550.