ASSESSMENT OF ENVIRONMENTAL NOISE LEVELS IN AKWA IBOM NORTH WEST, NIGERIA

ISSN: 2141 – 3290
www.wojast.com

AKPAN, U. E., EKOTT, E. E.,
UMOH, A. A. AND NYONG, A. B.
Department of Physics,
University of Uyo, Nigeria
etinamabasiyakaekott@gmail.com

ABSTRACT

Elevated noise levels of adequate exposure time cause many adverse effects on the environment. Therefore, this paper presents the assessment of environmental noise levels in Akwa Ibom North West, Nigeria. Physical measurements of noise levels were made around different homes and offices using the Sound Level Meter (SLM), model WensnWS1361. The selected locations were road junctions/parks (RD JNC/PKS), churches (CH), schools (SCH), workshops/factories (WKS/FAC) and markets (MKT) and roads/streets (RD/STR). The data obtained were compared with WHO standard levels. The results of the findings indicate that all the selected locations had environmental noise levels above the WHO safe standards.

INTRODUCTION

Noise was identified as a form of disturbance by the Environmental Protection Agency (EPA) of the United States of America since in the 1970s (Menkiti and Ekott, 2014). Noise demeans the value of our environment and is known to produce various negative effects both on structures and on humans. Noise has escalated to the point where it is currently the most important peril to the superiority of our existence. This increase in noise can be attributed to the ever increasing number of people in the globe and the growing levels of economic affluence (Menkiti, 2001).

In this context, noise is defined as unpleasant sound (Schmidt, 2005). However, noise can be described as the unwanted sound in the unwanted location at the unwanted occasion. The degree of "unwantedness" is usually a psychological issue since the effects of noise can range from temperate irritation to everlasting hearing loss, and may be rated in a different way by special observers (Ekott, *et al*., 2018). Noise does affect the inhabitants, humans, fauna, etc, in the natural environment. Some definite places influence noise contacts; so it is invasive that it became difficult to run away from it. The social surveys almost always rank noise in the list of the most bothersome residential irritations. General noise sources are industry, neighbourhoods and traffic. The industrial noise is one of the most annoying sources of noise complaints (Ekott, 2011).

The protection of workers from the risks related to exposure to noise at work is contained in the European Union (EU) Directive (86/188/EEC). The objective of the directive is to reduce the level of noise experienced at work by taking action at the noise source. Two exposure levels are used (Kiely, 1998):

Daily personal noise exposure of a worker is presented in equation (1).

$$L_{EP,d} = L_{Aeq,}T_c + 10\log_{10}\frac{T_c}{T_0} \quad (1)$$

where,

$$L_{Aeq,}T_c = 10\log_{10}\{\frac{1}{T_c}\int_0^{T_c}[\frac{P(t)_A}{P(0)}]^2 dt\} \quad (2)$$

T_c = daily duration of a worker's exposure to noise.
T_0 = 8h
P_A = A – weighted instantaneous sound pressure in Pascal (Pa)

Weekly average of the daily values, $L_{EP,w}$ is presented in equation (3).

$$L_{EP,w} = 10\log_{10}\{\frac{1}{5}\sum_{k=1}^{m} 10^{0.1(L_{EP,d})K}\} \quad 3$$

where, $(L_{Ep,d})_k$ = the values of $L_{EP,d}$for each of the m working days in the week being considered. The EU directive specifies that when the daily exposure level exceeds 85 dBA, the worker is 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.

Elevated noise levels of adequate exposure time can result in short-term or permanent hearing damage. This is generally related to those working in industrial plants or operating machinery but can also take place at discotheques or near to aircraft on the ground if the duration is long enough. However, measurable hearing loss from many industrial sounds involves daily exposure for a number of years. On the other hand, community noise intrusions like traffic noise can obstruct speech communication, interfere with sleep and relaxation and disturb the capacity to perform difficult tasks (Kiely, 1998).

The British Columbia Work's Compensation Board has set 85 dB as its highest tolerant level in the work place. Above this limit hearing protection should be used. It states that the threshold of pain is attained at 120 dB and it classifies 140 dB as excessive hazard level. WHO safety noise levels are similar while EPA of Nigeria tends to have even a stricter standard of 70 dB as a maximum safe level of noise in work place. They gave the safe level around home to be 50 – 55 dB (Ekott and Menkiti, 2015). Researchers have shown that constant noise above 55 dBA causes serious annoyance and above 50 dBA moderate annoyance at home (WHO, 2007). In a non-work place and for health and safety purposes, 55 dBA is set as a safety noise level for outside and 45 dBA inside. Hospital and school permissible levels of noise are 35 dBA (WHO, 1999) Noise beyond harmless levels leads to numerous health impacts which include high blood pressure, annoyance, sleep loss, stress, hearing impairment, loss of productivity and the ability to concentrate, among others (Ekott, 2018).

A study indicated that children exposed to noise during classes experienced problem with various cognitive developmental delays in addition to words discrimination. Specifically, the writing learning mutilation called dysgraphic is usually related to stress on environment during classes (Clark, Head and Stansfeld, 2013 and Stansfeld *et al*., 2005). Studies have shown 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 (E.E.C, 1978). In addition, the consequence of elevated levels of noise on small children has been found to be related to physical health damage (Goran, 2008). A study by Obisung *et al.* (2016) shows that sleep interference by noise causes great annoyance to many people. A study by Halperin (2014) shows that sleep is an important modulator of cardiovascular function. Intermittent or impulsive noises are particularly disturbing. Because of differences between locations and people, it is not easy to establish the level of noise which will not cause sleep interference (WHO, 2009 and Kiely, 1998). When work does not involve spoken communication it is taxing to determine the impacts of levels of noise on performance. 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).

Researches on the noise impacts on children in the classroom show strong association between speech intelligibility and problems with absence of self-confidence, fatigue, irritation, uncertainty and concentration, among others (Clark *et al*., 2013, Shield and Dockrell, 2003 and Stansfeld *et al*., 2005). Noise has been connected to vital cardiovascular health risks. In 1999, the WHO drew a conclusion that the existing evidence shown predicted a weak relationship between

hypertension and long term exposure to noise beyond 67 – 70 dBA (Ising, *et al.*, 1999). More current studies have recommended that noise levels of 50 dB(A) at night may also increase the risks of myocardial infarction by constantly enhancing production of cortisol (Essiett *et al*., 2010).

Studies proposed that when pregnant women are exposed to 76.5 dBA noise of airplane, a little decline in birth weight takes place (Essiett *et al.*, 2010). Also, noise has adverse effects on children's cognition and health (Klatte, *et al*, 2013; Seabi, 2013; Clark *et al*., 2013). Children in boisterous vicinities find noise annoying and report a reduced value of life (Stansfeld *et al*., 2005). An analysis was carried out in six cities in Nigeria, Lagos, Ibadan, Port Harcourt, Enugu, Kaduna and Calabar. It was concluded that the major source of noise that bothers people most is the traffic. Exposure to high noise levels for a short period of time can result in temporary threshold shift which may last for several hours depending on the duration and noise level, (Menkiti, 2001). A ringing in the ears may also occur. Repeated exposure to high sound pressure levels may result in permanent hearing loss. Hence, the study of noise is essential in order to create more awareness on the impacts of noise on the environment for the betterment of our society. In this research, the assessment of environmental noise levels in Akwa Ibom North West, Nigeria shall be carried out.

MATERIALS AND METHODS

In this research work, various locations around homes and offices in Ikot Ekpene and Abak Local Government Areas of Akwa Ibom North West were considered for the noise level measurements. These were sites that occupied sources that generated or appeared likely to generate noise. The Local Government Areas were selected based on economic activities.

The locations included road junctions/parks (RD JNC/PKS), churches (CH), schools (SCH), workshops/factories (WKS/FAC), markets (MKT) and roads/streets (RD/STR). All the noise measurements were made using the sound level meter (SLM), model WensnWS1361 with ½ inch electret condenser microphone. This model has both A and C weightings and 0.1dB resolution with fast/slow response. It has a measuring range 30 to 130 dBA or 35 to 130 dBC. Also it is equipped with a built in calibration check (94.0 dB) and tripod moving. It has an accuracy of ± 1.5 dB. It has AC and DC outputs for frequency analyser level recorder, Fast Fourier Transform (FFT) analyser, graphic recorder and others. It also has electronic circuit and readout display and a weight of 308 g. The microphone senses the small air pressure variations related to sound and converts them into electrical forms. These signals are then passed to the electronic circuitry of the instrument for processing. The readout displays the processed sound levels in dB. The sound level meter picks the sound pressure level at one instance in a certain location. Measurements were taken by adjusting the sound level meter to A-weighting network in all the sampling locations. The sound level meter was calibrated by using the manufacturer's calibration procedure given in the manual. During the noise level measurements, the microphone of the sound level meter was positioned at a distance of above 1 m from the main source at a height of 1.2 m above the ground and windshield was always used for accuracy. 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. The data obtained were compared with WHO standard levels.

RESULTS AND DISCUSSION

Tables 1 to 3 and Figures 1 to 3 show the results of noise level measurements at selected locations in Ikot Ekpene and Abak Local Government Areas of Akwa Ibom North West.

Table 1: Average noise levels of selected locations in Ikot Ekpene LGA (2017)

Location	Average noise level (dBA)
CH	87.80
MKT	73.53
RD/STR	86.55
RD JNC/PKS	88.50
SCH	63.33
WKS/FAC	87.92

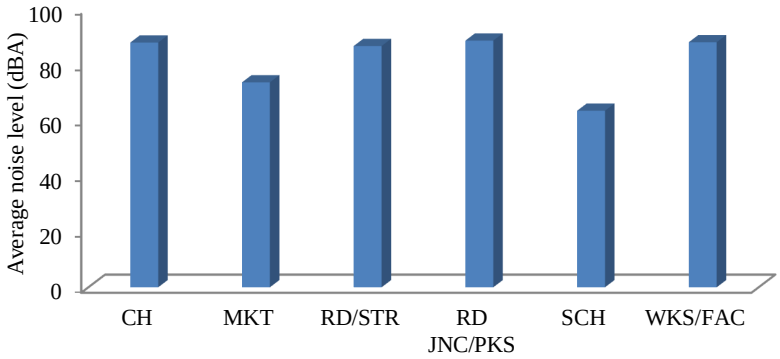

Figure 1: Average noise levels of selected locations in Ikot Ekpene LGA (2017)

Table 2: Average noise levels of selected locations in Abak Local Government Area (2017)

Location	Average noise level (dBA)
CH	87.50
MKT	73.30
RD/STR	78.80
RD JNC/PKS	80.42
SCH	61.30
WKS/FAC	93.75

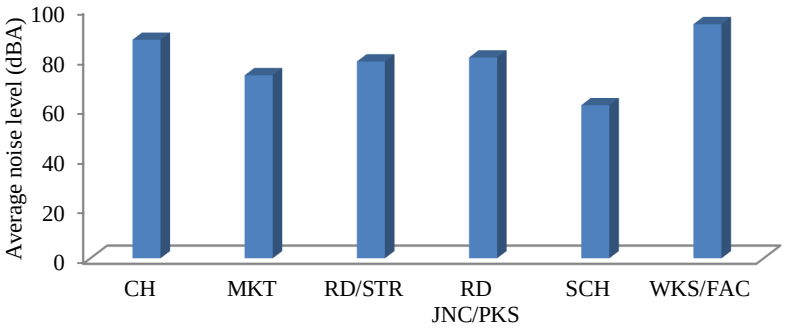

Figure 2: Average noise levels of selected locations in Abak Local Government Area (2017)

Table 3: Variation of average noise levels in Akwa Ibom North West (2017)

Local Government Area	Location/ Average noise level (dBA)					
	CH	MKT	RD/STR	RD JNC/PKS	SCH	WKS/FAC
Ikot Ekpene	87.80	73.53	86.55	88.50	63.33	87.92
Abak	87.50	73.30	78.80	80.42	61.30	93.75

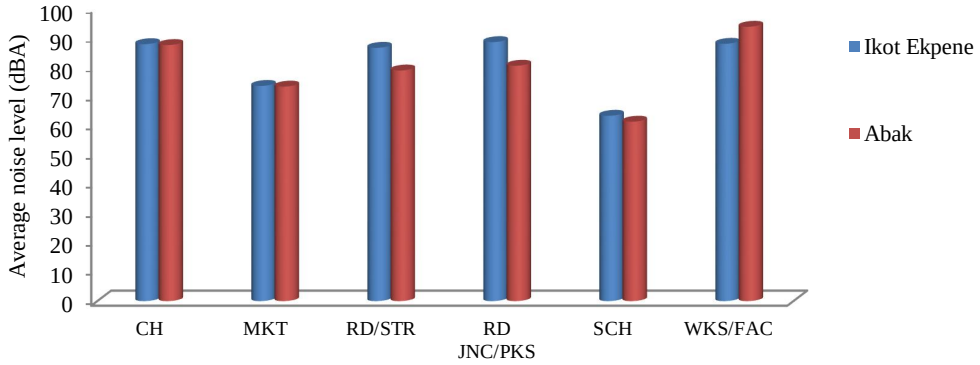

Figure 3: Variation of average noise levels in Akwa Ibom North West (2017)

In Akwa Ibom North West, the results of the survey show that churches had average environmental noise levels of 87.50 - 87.80 dBA higher than the WHO tolerant noise level of 55 dBA for a non-work environment. These levels can cause a lot of adverse effects on the people exposed to them. This therefore means that churches in the area must be professionally sited. The average annoying sound levels of markets were 73.30 – 73.53 dBA. Here, if the duration of exposure is long enough these levels can cause annoyance and other related health effects. Roads/streets had 78.80 – 86.55 dBA. Road junctions/parks generated 80.42 – 88.50 dBA. Workshops/factories values were 87.92 – 93.75 dBA. These values are above the WHO tolerant level of 55 dBA for outdoor living areas. Hence, these values with exposure time base of 16 and 24 hours can cause annoyance and hearing impairment respectively. For workshops/factories, the EU directive (86/188/EEC) specifies that when the daily exposure level exceeds 85 dBA, the worker be advised of the risks and trained to use ear protectors. Schools had the average environmental noise levels of 61.30 – 63.33 dBA higher than the WHO tolerant level of 35 dBA during classes. This can have adverse effects on speech intelligibility, information extraction and message communication during classes (WHO, 1999; Clark *et al.*, 2013; Shield and Dockrell, 2003 and Stansfeld *et al*., 2005).

CONCLUSION

From the assessment, it is concluded that all the selected locations had noise levels above the WHO tolerant noise levels. Therefore, residence of these areas are advised to use ear protectors or do their bid to reduce the noise level as it adversely affects human health.

REFERENCES

Clark, C., Crombie, R., Head, J., van Kamp, I., van Kempen, E., and Stansfeld, S. A. (2012). Does traffic-related air pollution explain associations of aircraft and road traffic noise exposure on children's health and cognition? A secondary analysis of the United Kingdom sample from the RANCH project. American Journal of Epidemiology, 176(4), 327-337.

Clark, C., Head, J. and Stansfeld, S. A. (2013). Longitudinal effects of aircraft noise exposure on children's health and cognition: A six-year follow-up of the UK RANCH cohort. Journal of Environmental Psychology, 35(3), 1-9.

Davis, M. L. and Cornwell, D. A. (1991). Introduction to environmental engineering. New York: McGraw-Hill, 1183pp.

Environmental European Commission (E.E.C). (1978). Damage &annoyance caused by noise. Luxemburg: CEC EUR, 119pp.

Ekott, E. E. (2018). Evaluation and Modelling of Environmental Noise Pollution in some Local Government Areas of Akwa Ibom State, Nigeria. (Ph. D Thesis) submitted to the Department of Physics, University of Calabar, Calabar, Nigeria.

Ekott, E. E., Bassey, D. E. and Obisung, E. O. (2018). Modeling the Relation between Noise Levels and Distance from a 500 kVA Power Generator. World Journal of Applied Science and Technology, 10 (1B), 124 – 130.

Ekott, E. E. (2011). Impact of noise on the environment: Using Itu Local Government Area of Akwa Ibom State, Nigeria as case study. Unpublished Master of Science Dissertation, Faculty of Science, University of Uyo, Nigeria.

Ekott, E. E. and Menkiti, A. I. (2015). Assessment of noise levels in parts of Akwa Ibom State, Nigeria. World Journal of Applied Science & Technology. 7(2), 170-175.

Essiett, A. A, Akpan, R. E. and Uwak, S. O. (2010). Assessment of noise level in Ikot Ekpene Town, Nigeria. International Journal of Biotechnology and Allied Sciences, 5(1), 620 – 624.

Goran, B. (2008). Urban road traffic noise and blood pressure and heart rate in preschool children. Environmental International, 34(2), 226– 231.

Halperin, D. (2014). Environmental noise and sleep disturbances: A threat to health? Journal of Sleep Science, 7(4), 209-212.

Ising, H., Babisch, W. and Kruppa, B. (1999). Noise-induced endocrine effects and cardiovascular risk. Noise Health, 1(4), 37-48.

Kiely, G. (1998).Environmental engineering. Singapore: Irwin/McGraw-Hill, 231pp.

Klatte, M., Bergström, K., and Lachmann, T, (2013). Does noise affect learning? A short review on noise effects on cognitive performance in children. Frontiers in Psychology,4: 578. Retrieved March 2, 2016 from http://dol.org/10.3389/fpsyg.2013.00578.

Menkiti, A. I. (2001). Analysis of noise bother by survey method. Global Journal of Pure and Applied Sciences, 7(3), 545-550.

Menkiti, A. I. and Ekott, E. E. (2014). Determination of noise levels with respect to distance at selected workshops/factories in Itu Local Government Area of Akwa Ibom State, Nigeria. IOSR Journal of Applied Physics (IOSR-JAP), 6(3), 43-53.

Obisung, E. O., Onuu, M. U., Menkiti, A. I. and Akpan, A. O. (2016). Road traffic noise-induced sleep disturbances in some cities in Eastern Nigeria. British Journal of Applied Science and Technology. 12(4), 1-15.

Seabi, J. (2013). An epidemiological perspective study of children's health and annoyance reactions to aircraft noise exposure in South Africa. International. Journal of Environmental Research and Public Health, 10(7), 2760-2777.

Schmidt, C. W. (2005). Noise that annoys regulating unwanted sound. Environmental Health Perspectives, 113(1), 1–3.

Shield, B. M. and Dockrell, J. E. (2003). The effects of noise on children at school: A review, Building Acoustics, 10(2), 97-116.

Stansfeld, B. M., Dockrell, J. E., Asker, R. and Trachmatzidis, I. (2005). The effects of noise on the attainments and cognitive development of Primary School children-final report for department of health and the department ETR. Retrieved January 14, 2014 from www.noisesolutions.com.

United States Environmental Protection Agency (1978). Noise a health problem: Abatement and control, Washington DC: United States Environmental Protection Agency, 113pp.

World Health Organisation (WHO) (1999). Guidelines for community noise. Retrieved June 25, 2017 from http://www.who.int/docstore/peh/noise/index.html.

World Health Organisation (WHO) (2007). Night Noise Guidelines for Europe. Bonn: WHO, Regional Office for Europe, Retrieved June 30, 2017 from http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf.

World Health Organisation (WHO) (2009). Night Noise Guidelines for Europe. WHO, Regional Office for Europe. Retrieved June 29, 2017 from http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf.