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EVALUATION OF NOISE LEVEL POLLUTION OF ADAMAWA STATE UNIVERSITY GENARATOR, MUBI.

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ABSTRACT

Noise pollution has been shown to be of great concern and its health effect could trigger by the use of power generators. This study aims to assess the Sound Levels from the University generator. Measurements were taken at interval of 5m, from the base of the generator up to 50m using digital sound Levels meter. Measurement was made at 7:45 to 8:00pm off load and 8:00 to 8:15pm on load for the period of one week. From the results obtained, 86.7 and 83.8 dBA was recorded as the highest value of the noise level on load and off load at a distance of 5m and consequently, 63.1 and 62.1 dBA was also recoded as the lowest noise level when the generator is running on load and off load at a distance of 50m. Thus, the average mean was calculated as 84.1 and 82.1dBA as the highest noise level on load and off load at a distance of 5m and 67.2 and 64.6 dBA as the lowest noise level on load and off load at a distance of 50m. The result was compare with WHO and NESREA standard guidelines and found to be above the recommended level.

Keywords: Pollution, Noise level, Generator, Health Effect

Introduction

Noise pollution has been on the increase side daily as the world also keeps expanding daily, particularly in most of the urban cities. Today, the impact of noise pollution as relate to health impact cannot be over emphases as it surrounds most of the human activities. As reported by world health organization, one of the main sources of environmental noise exposure in urban areas is traffic noise. Noise pollution are generally classified as industrial, commercial and

residential which are been regulated by NESREA in Nigeria and WHO [WHO 1999 and NESREA 2009]. Industrial noise are been generated from industrial machines, commercial noise from place of business and residential noise from domestics activities. In Nigeria today, the hazard caused by the noise generated from generator in school has been of great disturbance to social, academic and office administration. Noise pollution has been considered by other researchers as less contaminants in an environment (Mansouri et al. 2006).thus, In contrast to many other problems associated to environmental, noise pollution continues to generate great fear and concern by an increasing number of complaints from people exposed to the noise. Noise pollution could be direct as well as cumulative and can lead to adverse health effects in future. This also adversely affects generations and has sociocultural, aesthetic, and economic effects (Yilmaz and Ozer 2005).

According to WHO, the permissible noise level in school environments should not exceed 35 dB. Exposure for more than six hours a day to sound in excess of 85 dB is potentially hazardous to health .some researchers have research and come to conclusion that, noise pollution may have negative impact on health and damage to human starting from difficulty in sleep, annoyance, disruption to cognitive and creativity and high blood pressure. (Georgiadou et al.2004), (Ugwuanyi et al.2004), (Saadu et al.1998), (Ahmad et al.2006), (Schwela and Zali 1999). However, noise has also been reported to have Couse complete or partial loss of ability such as deaf and hard hearing (Shield B. 2006). Thus, this has generated a great concern and fear in the heart of the student on the negative impact of the pollution on their life and academics, perhaps the need for the research. The main objective of this work is to determine the noise level of the university generator and draw conclusion on the health implication based on the NESRA and WHO standard guidelines.

Table 1: noise level guidelines by WHO and NESREA

Permissible noise level (dBA)				
	WHO		NESREA	
Location	Day	Night	Day	Night
Industrial area	75	65	70	60
Commercial area	65	55	60	50
Residential area	55	45	50	35
Silent zone	45	35	45	35

Study Area

Adamawa State University Mubi is located in the North-East Geo-Political zone of Nigeria. The university is located between latitudes 10^0 16'46" N and 10^0 17'12" N of the equator and longitudes 13^0 16' 27" E and 13^0 17' 12" E of the prime meridian (Google Earth Explorer, 2020). The University has a total land mast area of about 1.04km. The study was conducted on the university 500kva generator which is located at the university main campus and about 30m away from the female student hostel and over 100m away from the university senior staff quarters.

Materials and Method

The materials used for this study includes, measuring tape, digital sound level meter, pen and book. Measurement was taken at an interval of 5m from the base of the generator up to 50m away from the generator. The sound level meter was held 6ft above the ground during the measurement. The choice of the height was made arbitrary. The measurement was taken at 7:45pm and 8:15pm when the generator is running on OFF load and ON load for the period of one week.

Theoretical Approach

Relating this experiment theoretically shows that, the intensity of the sound is inversely proportional to the distance. But to find the true mathematical relationship between the parameters, we use dimension analysis such that

I$\propto P.D$ Where I=intensity of sound, P=Power or energy per unit time and, D=distance

Assuming that I=k.$P^a.D^b$

Where K is constant of proportionality and (a and b) are numbers to be found. By definition, the dimension of the above physical equation would be

Intensity, I=MT^{-3}, Power, P=ML^2T^{-3}, Distance, D=L, Where M=Mass, T=Time and L=Length

From I=$K.P^a.D^b$

Substituting for dimension we get

$MT^{-3} = [ML^2T^{-3}]^a.L^b$

$MT^{-3} = M^a.L^{2a+b}.T^{-3a}$

Comparing the two indices,

a=1 (1)

0=2a+b (2)

-3=-3a (3)

From (2), 0=2×1+b, 0=2+b. Therefore,

b=-2

Therefore, a=1, b=-2 so that from $I = P^a . D^b$

$I = P^1 . D^{-2}$

$I = \frac{P}{D^2}$ (4)

This expression indicate an inverse square law. But it turns out that it is more convenient to measure the intensity of sound or noise in terms of area. As such let's consider a sphere of area A, which is concentric with a point source of sound. So that areas at a distance r from the centre of this sphere would have equal intensity I. by definition, intensity

I= $\frac{P}{A}$ (5)

Where P is energy per unit time or power, A = area of a sphere. From expression (5), it is obvious that as the area increases, the intensity decreases. This is analogous to equation (4) so that if A=$4\pi r^2$ then equation (5) become$I = P/4\pi r^2$ which means as the sound waves spreads or propagates out from $r_1 to\ r_2$,the energy per second also spreads over a larger area. But $P_1 = P_2$ always. Therefore,

$P_1 = I_1 4\pi r_1^2$ (6)

$P_2 = I_2 4\pi r_2^2$ (7)

So that$I_1 4\pi r_1^2 = I_2 4\pi r_2^2$, therefore, dividing equation (6) by equation (7) gives us

$I_1 = \frac{r_1^2}{r_2^2} I_2$ (8)

This expression indicates that as the sound travels out from the source, the intensity decreases in an inverse square law relationship. Hence, when the distance is doubled, the intensity decreases by one-fourth as shown below;

From $I_1 = \left(\frac{r_1}{r_2}\right)^2 I_2$, but if $r_2 = 2r_1$ then, $I_1 = \left(\frac{r_1^2}{2r_1^2}\right) I_2$

$I_1 = \frac{1}{4} I_2$. Similarly, when the distance is tripled, that is if $r_2 = 3r_1$, then $I_1 = \frac{1}{9} I_2$ more and more.

Results and Discussion

The measurement of the noise level measured for the period of one week are presented in the figure 1and 2 below when the generator is on OFF load and ON load.

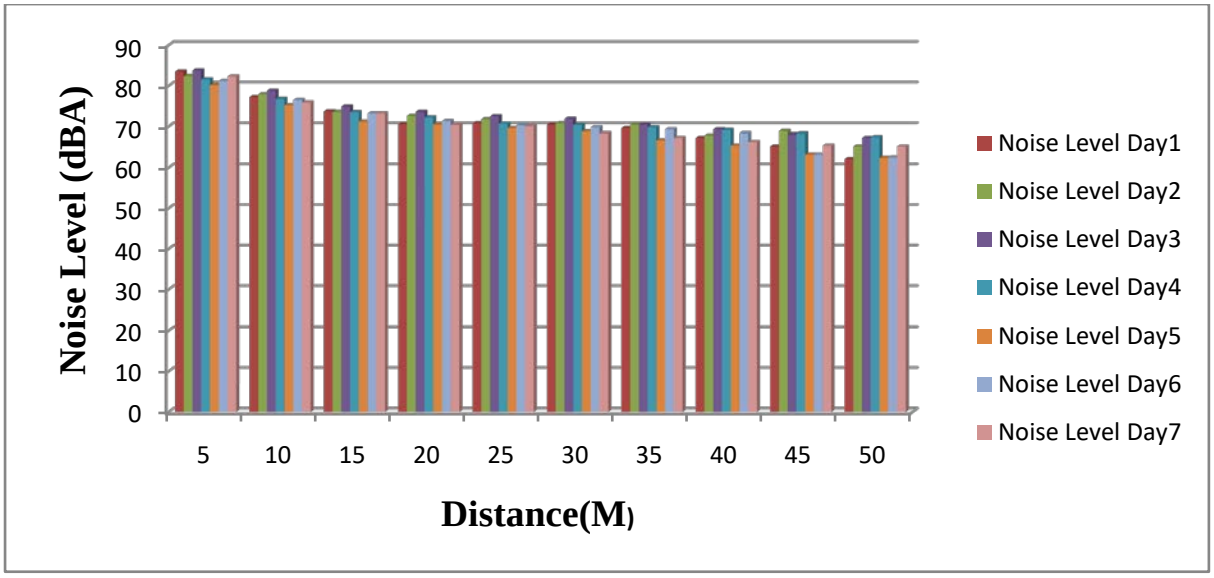

Fig.1 Noise level measured on OFF Load

Fig. 1 displays the noise level measured when the generator is running on OFF LOAD at different interval. The highest noise level was recorded at a distance of 5m and the lowest at the distance of 50m.it can be noticed that, when the distance increases, the noise level also reduces slightly.

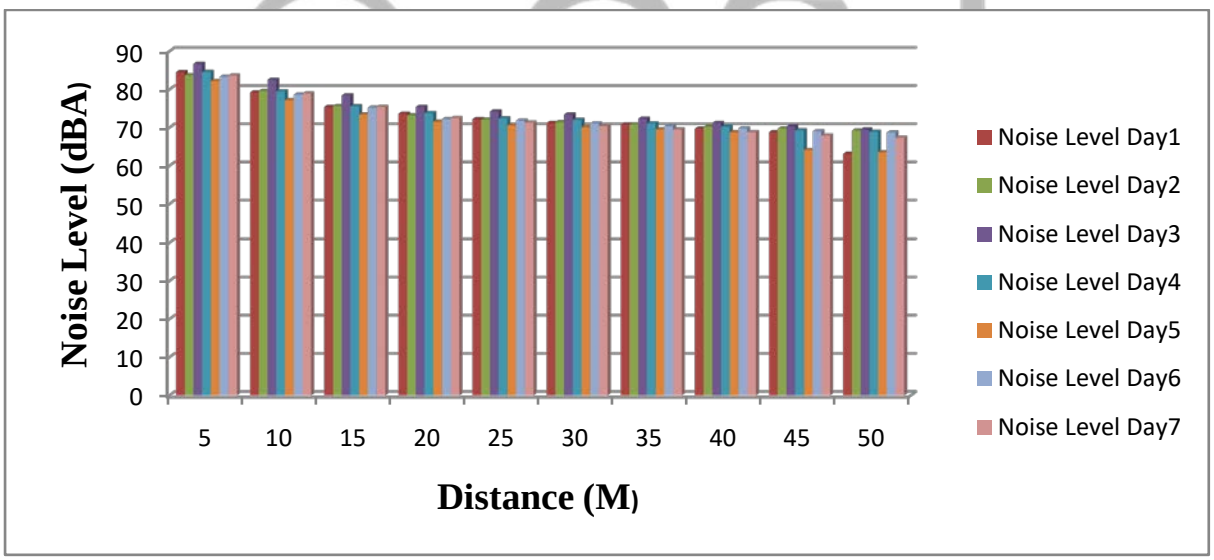

Fig.2 Noise level measured on Load

Figure 2 also displays the noise measurement when the generator is on load. The highest and lowest level was also recorded at a distance of 5m and 50m respectively.

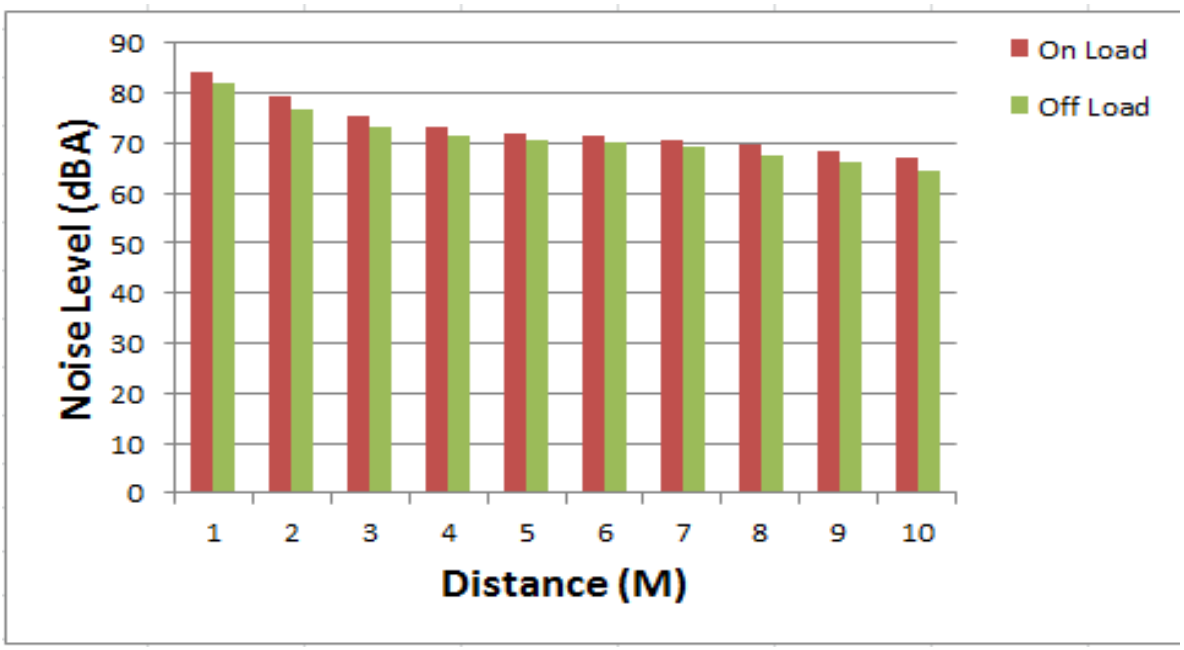

Fig.3 comparison between Noise level ON Load and OFF Load

The Figure above shows the mean average of the noise level measured in one week. The maximum level was recorded as 84.1dBA on load and 82.1 OFF load at a distance of 5m.however, 67.2 and 64.6dBA on load and OFF load were also found as the lowest noise level at the distance of 50m. The variation in the reduction of the noise level also follow the pattern in fig.1 and 2 respectively.

Conclusion

Even though noise pollution is one of the major contaminant among others, the need for power becomes a necessity in mans every day's activities. This can be address only if the power generation is increase and maintained. This study was carried out to evaluate the noise Pollution levels from the university generator due to its proximity to the student hostel and staff quarters, expanded building and increase of staff and student in the campus. The average highest noise level was recorded as 84.1 and 82.1 on load and off load respectively. The result was compare with WHO and NESREA standard and was found to be above the recommended level and well within the noise range that various studies have shown to have cognitive effects as well as non-auditory impacts. Effort should be made by the school authority to relocate or provide sound proof equipment to the generator room that may reduce the noise generated from the machine to the recommended minimum or acceptable level.

References

[1] NESREA (2009), National Environmental (Noise Standards and Control) Regulations, 2009. Federal Republic of Nigeria Official Gazette, Vol. 96, No. 67, S.I. No. 35, FGP 104/102009/1,000 (OL 60). The Federal Government Printer, Nigeria.

[2] Mansouri, N., Pourmahabadian, M., & Ghasenkhani, M. (2006). Road traffic noise in down town area of Tehran. *Iranian Journal of Environmental Health, Science and Engineering*, 3(4), 267–272.

[3] Yilmaz, H., & Ozer, S. (2005). Evaluation and analysis of environmental noise pollution in the city of Erzurum, *Turkey. International Journal of Environment and Pollution*, 23(4), 438–448.

[4] Georgiadou, E., Kourfidis, K., & Ziomas, I. (2004). Exploratory traffic noise measurements at five main streets of Thessaloniki, Greece. Global NEST. *Inter-national Journal (Toronto, Ont.),* 6(1), 53–61.

[5] Ugwuanyi, J. U., Ahemen, I., & Agbendeh, A. A.(2004). Assessment of environmental noise pollution in Markurdi Metropolis, Nigeria. *Zuma Journal of Pure and Applied Sciences*, 6(2), 134–138

[6] Saadu, A. A. (1988). Community and occupational noise survey and analysis of some selected Nigerian cities and industries . Ph.D. thesis, University of Benin, Nigeria.

[7] Ahmad, J., Abbas, A., & Reem, S. (2006), Evaluation of traffic noise pollution. *Journal of Environmental Monitoring and Assessment,* 120, 499–525

[8] Schwela, D., & Zali, O. (1999). Urban traffic pollution London: E& FN Spon.

[9] Stanley, A.M. (2010): Air Pollutants Concentration and Noise Levels from Electric Power Generators. Seminar Presented at the Seminar Series of Faculty of Environmental Design, Ahmadu Bello University, Zaria

[10] WHO. Guidelines for community noise. World Health Organization, Geneva Cluster of Sustainable Development and Healthy Environment (SDE); 1999.4.

[11] WHO., 2001. Fact sheet no. 258: occupational and community noise.

[12] WHO.,Geneva.http://collections.infocollections.org/ukedu/en/d/Js0536e/.

[13] Shield B. (2006), Evaluation of the social and economic costs of hearing impairment. Hear-it AISBL:1-202