

Investigation Of Noise Pollution In The University

Obot, O. W. and Ibanga, S. M.

**Department of Mechanical Engineering, University of Uyo, Uyo, Akwa Ibom State,
Nigeria**

ABSTRACT

This study was framed to investigate the presence of noise pollution in University of Uyo. Accordingly, an investigation was carried out employing the different field technique within the area of study. Noise measurements were taken using a sound level metre (Smart Sensor, AR824) to assess noise levels of a plethora of electricity generating sets and the concomitant pollution level in the University. The result clearly shows that the noise pollution level in University of Uyo is high and reaches a peak level of 89.5 dB(A) during the hours of 11-12pm while generating sets noise level reaches a maximum value of 95.2 dB(A). The noise emission level within the University has exceeded the maximum allowable noise level which ranges between 40 dB(A) to 50 dB(A) recommended for educational institutions and could produce noise-pollution problems leading to annoyance, lack of concentration, interfering with communication and causing general stress, low productivity and increasing work absenteeism.

KEYWORDS: *Pollution, Noise, Sound, Generating Sets, University, Uyo, Nigeria*

I. INTRODUCTION

The problem of inconsistent electricity power supply in Uyo has been accompanied with the proliferation of electricity generating sets usage of various sizes and power rating within the Town Campus of University of Uyo. One of the main requirements to accomplish certain task in offices, laboratories, workshops, lecture rooms and business centres within the university is availability of electricity.

The noise emitted from the generating sets been use within the University ranges between 81.1 dBA to 95.2 dBA depending on various factors such as the size, power rating, maintenance, age, distance of the generating sets from the recipient. High level of noise has been identified as having negative impacts within working environment especially to recipient within the sources where the noise is generated. There is need to ascertain the levels of noise pollution which persons are exposed to within the university. Meanwhile, outdoor noise within the university is attributed mainly to students, vehicles, business centres and electricity generating sets noise. According to Kajar (2008), the principal aims of measuring noise levels is to ascertain the actual level whether it conformed with an acceptable sound level which the human ears can tolerate. Noise become an unjustifiable interferences and imposition upon human health, comfort and qualitative of human life (Gorai and Pal, 2006). Noise when exceeds the recommended level becomes pollution. Noise pollution is one of the environmental hazards affecting human. According to Singh (1984), noise pollution negatively impacts most of us daily basis. Many studies addressing the problem of noise pollution in educational institutes throughout the world have been conducted. Ikenberry (1974) has analyzed some effects of noise pollution to school in regards to communication and other activities. Slater (1968) in his research work showed that students can perform better under quite condition than under noisy condition.

II. MATERIALS AND METHOD

This study is mainly based on primary sources of data which were collected through field survey. To ascertain the noise pollution level in the University of Uyo, a number of materials were used, which include: a digital sound level metre (Smart Sensor, AR824), a measuring tape and a survey map which was produced as well for the purpose of accuracy during the process of taking noise level measurements. Measurements of noise levels emanating from different electricity generating sets within the town campus of the university were carried out. It required having records of electricity generating sets operating within the campus. The generating sets were grouped based on the distance from their respective noise recipients and the power rating of the generating sets. Various locations within the Town Campus were visited for the noise level measurements. These were locations that inhabited electricity generating sets which were operating and emitting noise. The locations included administrative blocks, laboratories, libraries and business centres, among others. Measurements of sound pressure level were taken in the undisturbed sound field in the Town Campus.

The sound level meter was used to measure the level of noise emanating from generating sets in the Town Campus of the University of Uyo. The sound level meter is self-calibrated 10 seconds after the device is turn on. Measurements were taken by setting the sound level meter to A-weighting network and maximum reading in all the sampling locations. After that was done, the sound level metre displays the maximum sound pressure level emanating from the generating set on the readout LCD display of the device in decibel for recording purpose. While taking measurements, the sound level meter was held at a 45° angle. Positioned at a measured distance away from the generating sets, the sound level metre microphone was directed toward the main noise source (electricity generating sets) and at a height of 1.5 metres above the ground, in order to prevent any kind of reflection of sound. For workstations that required standing position of her personnel, the microphone was position at 1.5 metres above the floor while for workstations that required a sitting position of her personnel, the microphone was held at 1.1 metres above the floor. The measurements were taken at various points around the generating sets as indicated on the survey map and the results were recorded. Shielding by presence of persons and other objects between the noise source and microphone was avoided during measurements. The wind speed and direction relation to the microphone was considered. Hence, during sound level measurements, windshield was always used. The explanation of the experimental method is to enhance understanding of the research and verify its validity. In addition, measurements were taken within the operational temperature range of the device. A total of 127 noise level measurements were taken in Town Campus of University of Uyo. The noise level data were evaluated using Microsoft Excel spread sheet. The key findings are presented in the form of tables and graphs.

III. RESULT AND DISCUSSION

Measurement of noise were taken and the recorded data was used to generate the graphs that focus mainly on the following: the sound pressure level (L_p) emitted from noise source, the sound power level (L_w), ambient noise (AN) which is all the noise source within the University and the residual noise (RN) which is the noise remaining at a point under certain conditions when the noise from source is suppressed.

Figure 1 presents a graph of noise level versus generating sets for Town Campus. It shows that the residual noise level (R_N) reaches a maximum level of 24.7 dB(A) and increases as other noise sources but generating sets are generated. The ambient noise level (A_N) ranges between 49.6 - 62.2 dB(A) and which is above the allowable noise standard of 50 dB(A). The generating sets noise level is high within this zone and ranges between 83.4 - 91.8 dB(A) while the power level reaches a maximum level of 107.4 dB(A). Other generating sets noise power level is higher than that of their respective sound pressure level except for TG950 and IM3700 which remain at the same point as their sound pressure level (L_p). The zone is mostly dominated by staff offices and all the 13 generating sets within this zone are all of petrol engine type which is not enclosed with sound attenuated housing and located near offices of recipient between distance ranges of 0.44 – 2.74m and is the fourth generating sets noise most polluted zone within the Town Campus.

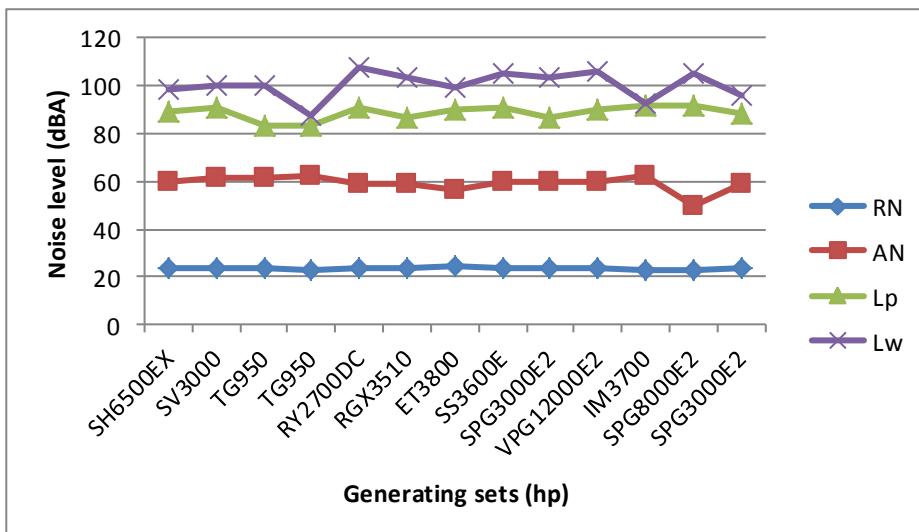


Figure 1: Noise measurement levels in Faculty of Education Zone

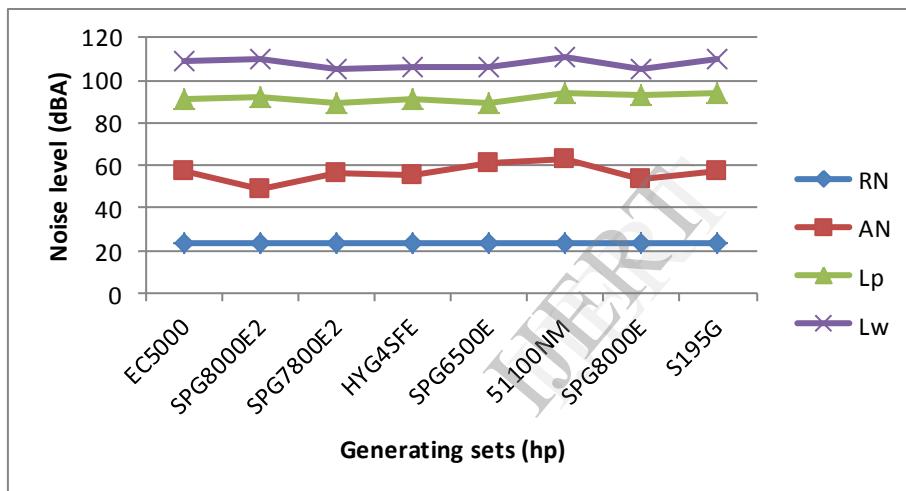


Figure 2: Noise measurement levels in Faculty of Science Zone

Figure 2 presents a graph of noise level versus generating sets for Town Campus. It shows that the residual noise level (R_N) reaches a maximum level of 23.5 dB(A) while the ambient noise level (A_N) reaches a maximum level of 63.4 dB(A). 8 generating sets are operated within this zone of which 2 of the generating sets are of diesel engine, which are not enclosed with sound attenuated housing, located by Central Bank of Nigeria (CBN) Hall and Food science and technology laboratory. The generating sets noise levels (L_p) within the zone ranges between 89.2 - 93.8 dB(A) and the generating sets are located at a distance range of 1.61 – 3.41m away from their respective recipient. The generating sets noise levels within the zone mostly affect learning and teaching process because the area is dominated by lecture halls and laboratories. The noise power of the generating sets reaches a maximum level 109.6 dB(A) and is the seventh generating sets noise most affected zone within the Town Campus.

Figure 3 presents a graph of noise level versus generating sets for Town Campus. It shows that the ambient noise level (A_N) is maintained at a maximum level of 57 dB(A) while the residual noise level reaches a maximum level of 24 dB(A). 16 generating sets are used within the zone and only two of the generating sets that of Medical Centre and Records Unit are of diesel engine and are enclosed in a sound attenuated housing. The generating sets noise level within the zone ranges between 86.8 – 95.2 dB(A) and while the noise power level emanating from the generating sets

fluctuates as it ranges between 92.5 – 110.2 dB(A). The distance of generating sets located away from their respective recipient range between 0.33 – 5.74 dB(A). This zone is dominated by administrative offices including the University Medical Centre and the noise level emitted within the zone ranks the third generating sets noise most polluted zone within the Town Campus.

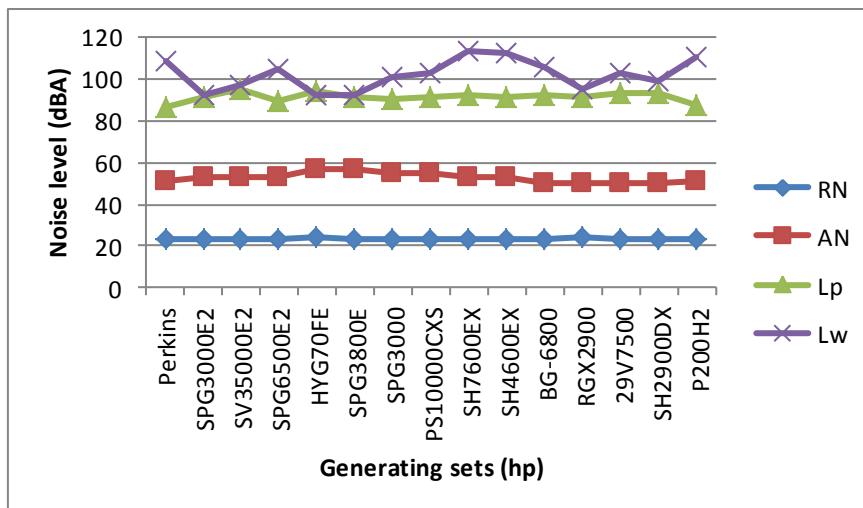


Figure 3: Noise measurement levels within Vice Chancellor's Office Zone

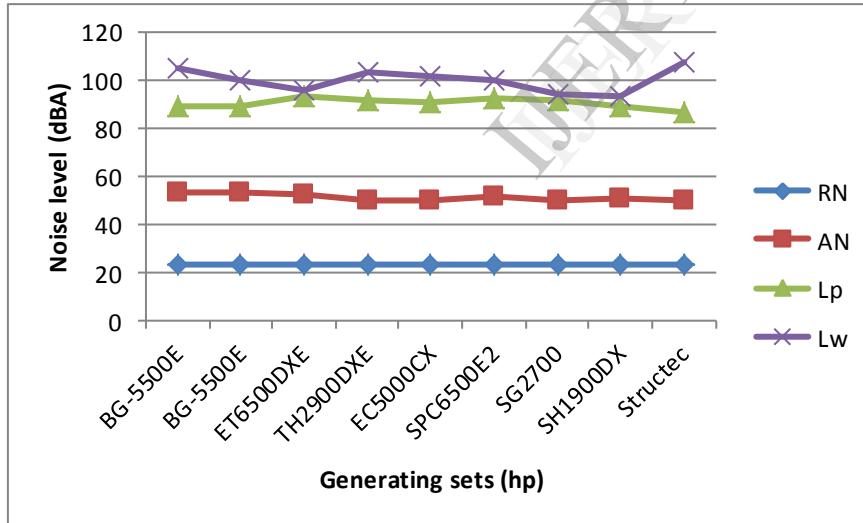


Figure 4: Noise measurement levels within PG School Zone

Figure 4 presents a graph of noise level versus generating sets for Town Campus. It shows that the generating sets noise level (L_p) reaches a maximum level of 93.2 dB(A) while the noise power level reaches a maximum level of 108.1 dB(A) as it fluctuates across the different generating sets used within the. The ambient noise level (A_N) within the zone ranges between 49.8 – 52.9 dB(A), which are slightly above the required allowable noise level standard for institutional environment. 8 of the nine generating sets within the zone are of petrol engine while the one diesel engine type is enclosed with sound attenuated housing and is located behind the Provost office at a distance 4.84m. The distance of generating sets away from their respective recipient ranges between 0.54 – 4.84m. The zone is the sixth generating sets noise most pollution zone within the Town Campus of the University.

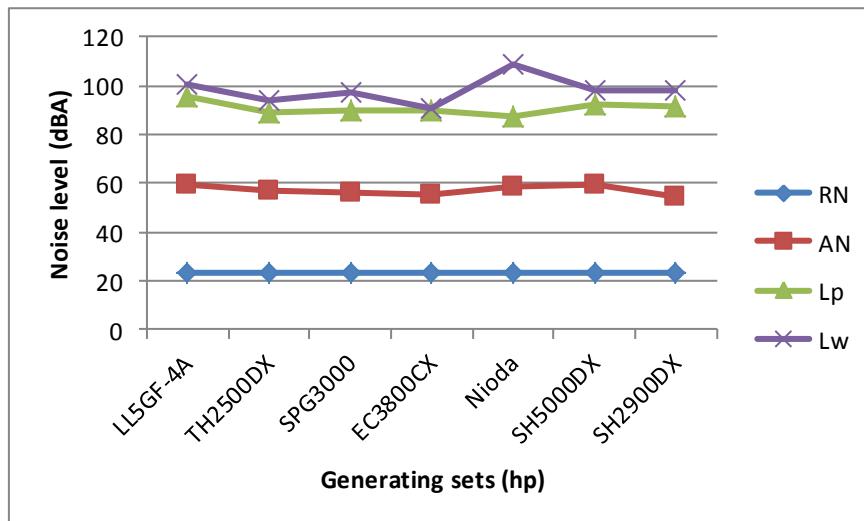


Figure 5: Noise measurement levels in Social Science Zone

Figure 5 presents a graph of noise level versus generating sets for Town Campus. It shows that the residual noise level (R_N) reaches a maximum level of 23.6 dB(A) while the ambient noise level (A_N) reaches a maximum level of 59.6 dB(A). 7 generating sets are operated within this zone of which one of the generating sets is of diesel engine which is enclosed with sound attenuated housing, located by Zenith Bank. The generating sets noise levels (L_p) within the zone ranges between 89.3 - 95.2 dB(A) and the generating sets are located at a distance range of 0.46 – 4.52m away from their respective recipient. The noise levels within the zone mostly affect learning and teaching process because of some lecture halls and offices within the zone. The noise power level is slightly above the sound pressure level and rise to a maximum level 100.8 dB(A). It is the seventh generating sets noise most affected zone within the Town Campus.

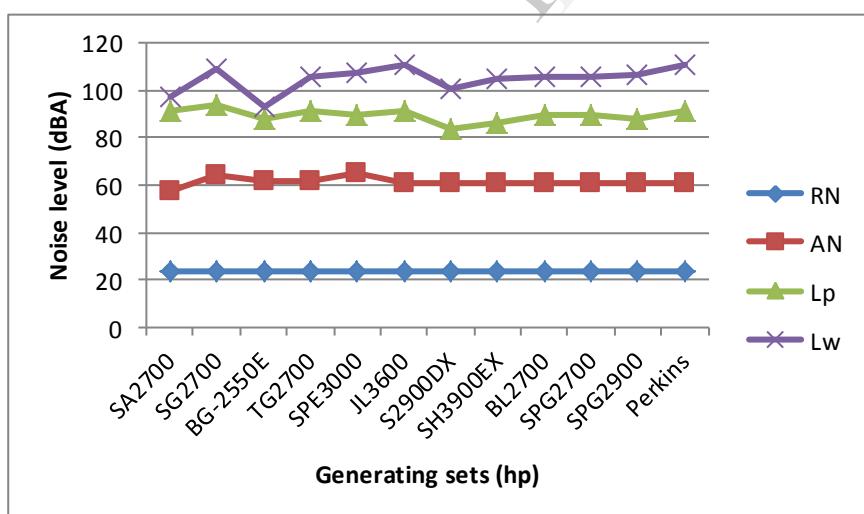


Figure 6: Noise measurement levels within Continue Education Zone

Figure 6 presents a graph of noise level versus generating sets for Town Campus. It shows that the generating sets noise level (L_p) emanating from this zone is high and ranges between 81.1 – 93.7 dB(A) while the noise power reaches a maximum level of 111.4 dB(A). The ambient noise level (A_N) reaches a maximum level of 68 dB(A) while the residual noise level (R_N) reaches a maximum level of 23.5 dB(A). 33 petrol generating sets and a sound attenuated enclosed diesel generating sets

are operated within the zone. It is observed that 33 generating sets operate within the zone mostly dominated by business centres. It records the highest noise pollution within the Town Campus and the distances at which the generating sets are located away from their respective recipient ranges between 0.69 – 5.12m.

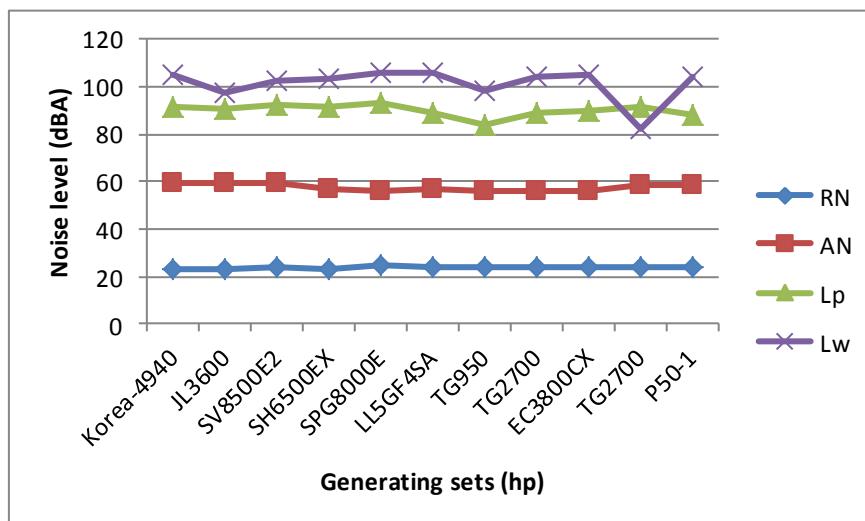


Figure 7: Noise measurement levels in Faculty of Agriculture Zone

Figure 7 presents a graph of noise level versus generating sets for Annex to Town Campus. It shows that the residual noise level (R_N) reaches a maximum level of 24.7 dB(A) while the ambient noise level (A_N) reaches a maximum level of 59.3 dB(A). The generating sets noise level is high within this zone and ranges between 84 - 93 dB(A) while the power level of the generating sets reaches a maximum level of 106.3 dB(A). The zone is mostly dominated by laboratories and few offices. 11 generating sets were found operating within this zone of which 10 are petrol engine type that are not enclosed with sound attenuated housing and they are located near laboratories and offices of recipient between distance ranges of 0.14 – 3.13m and also is the fifth generating sets noise most polluted zone within the Town Campus.

Figure 8 presents a graph of noise level versus generating sets for Annex to Town Campus. It shows that shows that the ambient noise level (A_N) is maintained at a maximum level of 59.6 dB(A) while the residual noise level reaches a maximum level of 24.7 dB(A). 6 generating sets are used within the zone and only that of Faculty of Law is of a diesel engine which is enclosed in a sound attenuated housing. The generating sets noise level within the zone ranges between 83.8 – 93.9 dB(A) and while the noise power level emanating from the generating sets fluctuates as it ranges between 81.7 – 106 dB(A). The distance where the generating sets are located away from their respective recipient range between 0.12 – 4.85 dB(A) and the noise level emitted within the zone ranks the ninth generating sets noise most polluted zone within the university.

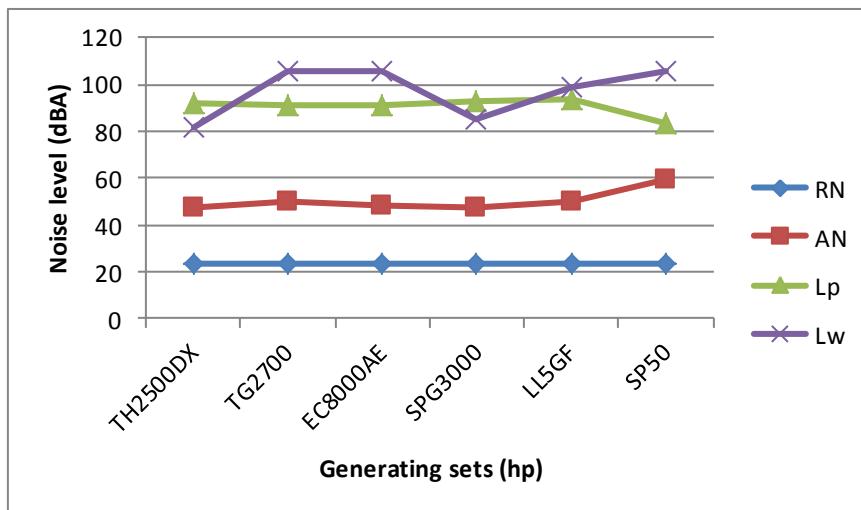


Figure 8: Noise measurement levels in Faculty of Environmental Studies Zone

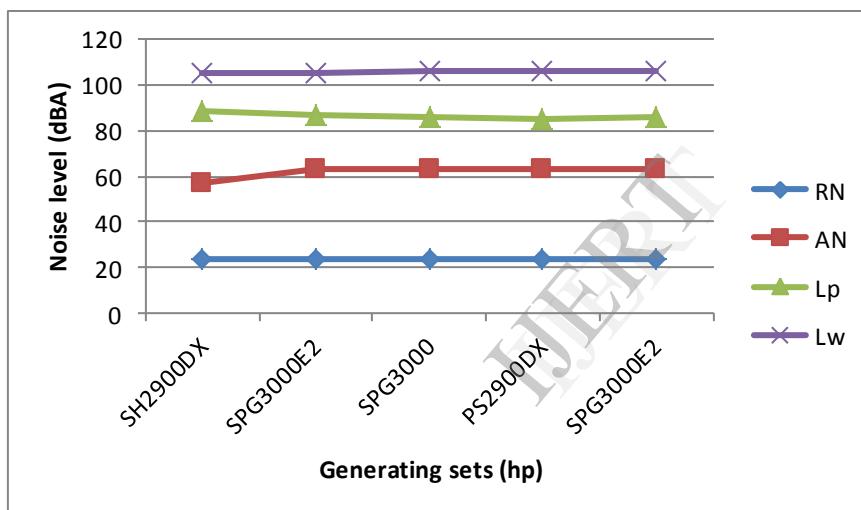


Figure 9: Noise measurement levels in Faculty of Business Administration Zone

Figure 9 presents a graph of noise level versus generating sets for Annex to Town Campus. It shows that the generating sets noise level (L_p) reaches a maximum level of 88.9 dB(A) while the noise power level reaches a maximum level of 105.4 dB(A) as it fluctuates across the different generating sets used within the zone. The ambient noise level (A_N) ranges between 57 – 62.8 dB(A). all the 5 generating sets are of petrol engine which are not enclose in a sound attenuated housing. The distance at which the generating set are located away from their respective recipient ranges between 2.61 – 4.61m and is the least noise pollution zone within the Town Campus

Figure 10 presents a graph of noise level versus generating sets for Annex to Town Campus. It shows that the generating sets noise level (L_p) emanating from this zone ranges between 86.8 – 92.2 dB(A) while the noise power reaches a maximum level of 109.2 dB(A). The ambient noise level (A_N) ranges from 62.2 – 64.1 dB(A) while the residual noise level (R_N) within the zone reaches a maximum level of 23.7 dB(A). A total of 18 petrol generating sets are operated within the zone and record the highest generating sets noise pollution within the Annex to Town Campus and is mostly dominated by business centres. The distances at which the generating sets are located away from their respective recipient ranges between 1.23 – 3.52m.

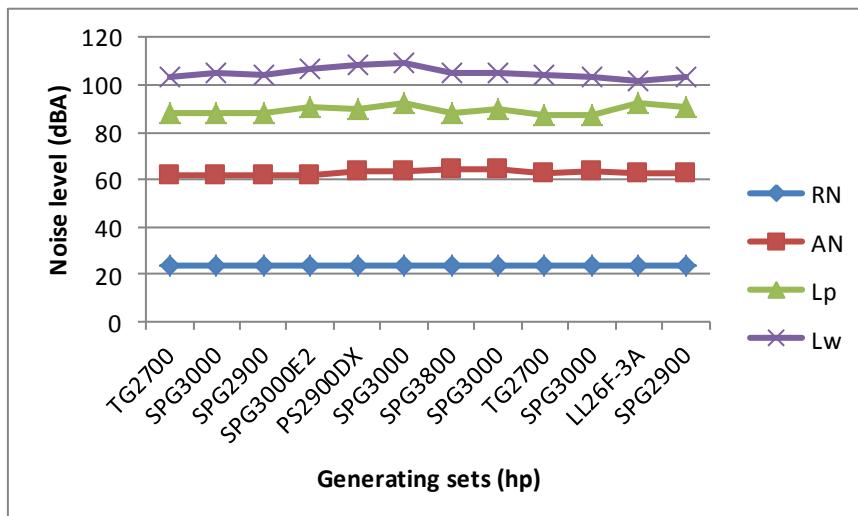


Figure 10: Noise measurement levels within Paul Harris's Park Zone

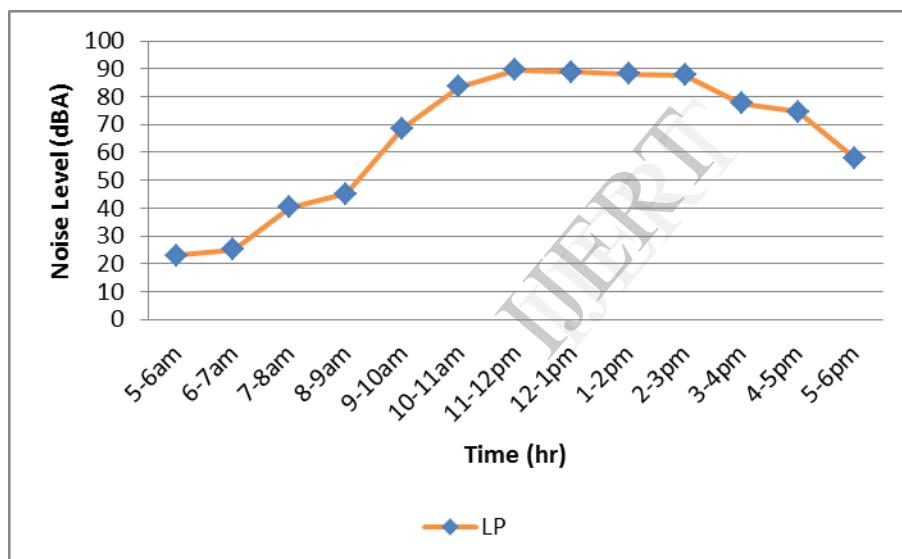


Figure 11: overall noise measurements in the University of Uyo, Nigeria

Figure 11 presents a graph of overall noise measurement in the University of Uyo. It shows that the noise pollution level exhibits a rising trend during day. At morning time between the hours of 5am – 8am the noise level rises and remains within the allowable noise standard but between 8am – 9am which rises to 45.2 dB(A) above the maximum limit of 45 dB(A). At day time, the noise level rises above the allowable noise limit to its peak of 89.5 dB(A) between the hours of 11am – 12pm and gradually begins to fall to 74.6 dB(A) at 5pm which is still higher than the acceptable noise limit for educational institutes. Most of the surveyed locations recorded noise level emitted are above the maximum acceptable limit. It is observed that the noise pollution level in University of Uyo increases day after day due to the proliferation of electricity generating sets to meet certain obligation within the University.

From the measurement of noise level of generating sets operating within the Town Campus of the University of Uyo, it shows that noise pollution does exist in the institution and it is observed that

the noise level recorded does exceed the tolerance level which clearly show that the environment is not suitable for teaching-learning process. The study showed conclusively that generating sets are the predominant source of noise within the Town Campus because of their important role as alternative power supply during Power Holding Company of Nigeria power shortage. To meet the demand of functional working environment, electricity generating sets have become a high incidence of noise population in the Town Campus of the University of Uyo.

In the present work, an attempt was made for comprehensive study of noise pollution level in the University of Uyo. The maximum noise level observed was maximum 95.2 dB (A) (Table 1). The major sources of noise pollution were electricity generating sets 42% followed by students 37%. The permissible limit of noise standard in educational institutions is 50dB (A) (*Debnath, D., Nath, S.K. and Barthakur, N.K., 2012*)

From the analysis of data from questionnaire it is clear that noise pollution does exist in the Town Campus of University of Uyo and raises above the noise level permissible limits. Noise pollution in educational institutes mainly depends on where the institute is located. The surveyed educational institution is located in the heart of town which is in the busiest roads and places of town. And thereby the Town Campus of the University of Uyo is suffering from noisy environment creating disturbance in daily work and adversely affecting productivity.

The major sources of noise pollution were electricity generating sets 42% followed by students 37% (from questionnaire)

- a) Electricity Generating Sets - 42%
- b) From Student - 37%
- c) From vehicle - 19%
- d) Business centres - 2%

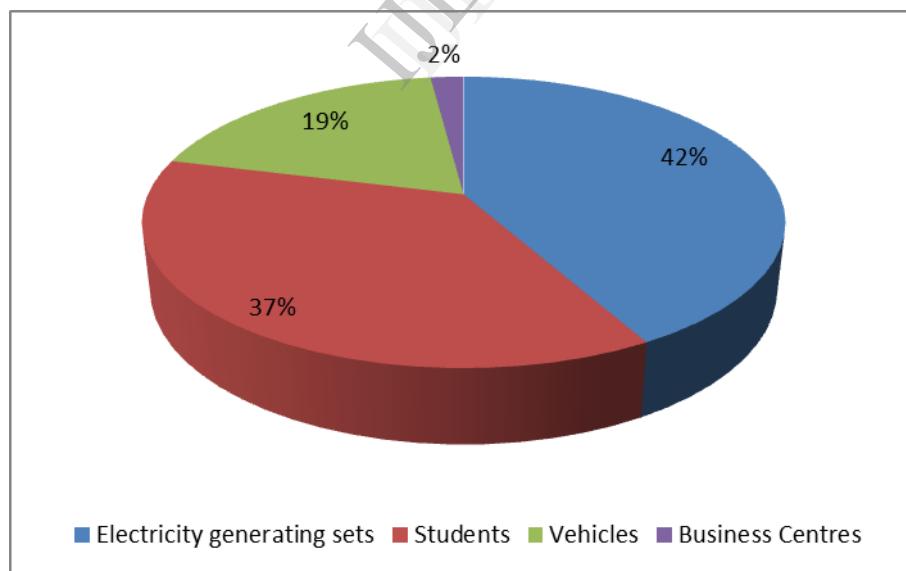


Figure 12: Sources of noise pollution in University of Uyo, Nigeria

I. CONCLUSIONS AND RECOMMENDATIONS

With the proliferation of generating sets, noise pollution has become more pervasive in the Town Campus of University of Uyo. This study reveals the current status of noise pollution level in the Town Campus, which exhibits a rising trend during the day to a peak of 89.5 dB(A) between the

hours of 11am – 12pm and gradually decreases towards evening hours. Noise emission levels of 127 generating sets were measured and it is observed that the noise level emitted from these generating sets exceeds the allowable standard limit almost at every point of measurements. Electricity generating sets account for 43% of noise pollution level within the University and are the main source of noise pollution as well as students, vehicles and business premises. Also, noise induces different types of health hazards and creating an uncomfortable environment for persons that spend much time near its source. The following range of measures may be taken to reduce electricity generating sets noise pollution in the University of Uyo.

- 1) There is the need for public enlightenment (such as seminars and workshops), education and sensitization on the hazard, danger and human health catastrophe associated with noise pollution.
- 2) There is the need to take advantage of the opportunities presented to man by technological advancement in the area of measurement and control of noise through the use of gadgets like insulator and sound proofing to doors, walls, ceilings, using ear protection, planting vegetation to absorb and screen out noise pollution and zoning of the town campus to maintain a separation between silence area and zones of excessive noise.
- 3) The realization of the importance of sustainable educational environment is necessary. This is achievable if specific laws are put in place to determine level of acceptable noise and regulate noise pollution in University of Uyo so that fewer persons will be adversely affected by noise. Putting in place a regulatory body will assist in the measurement, control and enforcement of the laws to achieve a desired goal.
- 4) The machines most creating noise should be subjected to engineering controls by treating the noise at the source or in its transmission path (e.g. be covered with sound-absorbing material, using sound dampeners or silencers, noise barriers or noise abatement panels and isolation).

REFERENCES

Air Force Medical Services (1956). Hazardous Noise Exposure, FR 160-3.

Bond, M. (1996). Plagued by noise. New Scientist, November 16pp: 14-15

Botsford, J.H. (1967). Simple Method for Identifying Acceptable Noise Exposures. *J. Acoust. Soc. Am.* 46, 418.

Crocker, M. J. and Kessler, F. M. (1975). *Noise and Noise Control*, CRC Press, 32, 33.

Debnath, D., Nath, S.K. and Barthakur, N.K. (2012) Environmental Noise Pollution in Educational Institutes of Nagaon Town, Assam, India

Gorai, A K and A K Pal (2006): Noise and its impact on human being: A Review. *J. Environ. Sci. Engg.* 48: 253-260.

IEC/60651 (1979). Sound Level Meters. <http://www.iec.ch>

Ikenberry, Larry D, School noise and its control. *Journal of Environmental Health* 36, March/April 1974:493-499.

Kajar, S. (2008). A - Z of corporate environmental management. Earthacan Publications Ltd London.

NIOSH (1998). *Criteria for a recommended standard: occupational noise exposure. Revised criteria 1998*. Cincinnati, OH, National Institute for Occupational Safety and

Health.

Parvathi, K. and Navaneetha, G. A. (2003). "Studies On Control Of Noise From Portable Power Generator" *Proceedings of the Third International Conference on Environment and Health, Chennai, India, 15-17 December*, pp. 328 – 338.

Singh, P. (1984). Noise pollution. *Every Man's Science*. 25(1&2):231-35

WHO (2007). *Experts consultation on methods of quantifying burden of disease related to environmental noise*. Geneva, Switzerland: World Health Organisation.

Table 1: Maximum allowable noise standards in educational institutions

Day time (9am-6pm)	Morning time (5am-9am)	Evening time (6pm-10pm)	Night time (10pm-5am)
50 dB(A)	45 dB(A)	45 dB(A)	40 dB(A)

Debnath, D., Nath, S.K. and Barthakur, N.K. (2012)