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Evaluation of Noise Level in Effurun, Delta State, Nigeria

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Abstract: This research focused on evaluation and effects of noise level on health and behavioral attitude of people in Effurun metropolis, Uvwie Local Government Area of Delta State Nigeria. It targeted four strategic locations namely: PTI junction, Jakpa junction, Airport road junction and Enerhen junction using GRA as control point. The sound level meter was used to collect data during the following periods; morning (7-9am), afternoon (12-2pm) and evening (5-7pm) for two weeks at designated locations. The study used tables and bar graphs in the presentation of data while mean (average) was used in the data analysis of the noise exposure level at the respective locations. The results obtained shows and that Enerhen junction has the highest noise level of 92.04 dB (A), Jakpa junction 89.08 dB (A), PTI junction 87.08 dB (A) while Airport Road junction recorded the lowest value of 77.01 db (A). All The readings from the various locations were significantly higher than the recorded 50 dB (A) at GRA control point and the recommended level of 60 dB (A) for commercial and residential areas. The noise level was found to be higher during the busy hours of the morning and evening. Furthermore, the noise level was also found to be higher at weekends mostly on Saturdays than weekly days. Sequel to the above findings, the study recommends that vigorous campaign mode should be carried out to educate the populace on the effects of noise pollution on their environment**.**

Keywords: Noise, pollution; sound level meter, evaluation and effects,

1.1 Introduction

Noise is an unwanted sound which is loud, unpleasant resulting from urbanization and the development of transportation and industry. It is an increasing form of pollution, omnipresent that continuously disturbs human health, peace and stability, which constitutes an important environmental hazard and a threat to the quality of man‟s environment.

Noise is one of the most neglected forms of pollution that have some major impacts and effects on the environment health and other segments. The potential harmful effects depend not only on the level of the area but duration of exposure. However, this research has been restricted to traffic and transportation noise level.

The World Health Organization[1] considered noise in big cities to be the third most hazardous type of pollution after air and water. Noise is described in terms of loudness (intensity) and pitch (frequency) and noise exposure is measured using a logarithmic decibel dB‟ scale of sound level meter, to measure the exposure of traffic noise.

Noise levels can be investigated in three different ways as road traffic and transportation; industrial activities; Sport, marketing and entertainment facilities. The Occupational Safety and Health Administration (OSHA) recommends hearing protection in the workplace i.e. if there is exposure to noise greater than 85 dB for eight hours or more because of the potential of permanent hearing loss.

According to the findings of [2], industrial areas have highest noise levels, followed by busy roads/road junctions, passenger motor parks and commercial areas. Traffic noise pollution is so severe in rapidly expanding cities of Southern, Eastern and Western Nigeria where the cities are poorly planned and there is insufficient control exercise.

Sounds produced by all vibrating bodies are not audible. The frequency limits of audibility range from 20 to 25.000 Hertz (Hz). A noise problem generally consists of three interrelated elements namely: the source, the receiver and the transmission path. The source is the emission gadget, the receiver is the receptor and transmission path is usually the atmosphere through which the sound is propagated. This may include the structural platform materials of any building containing the receiver.

Noise may be continuous in a prolong manner or intermittent, defining short outburst in non-continuous manner. Noise may be of high or low frequencies is undesired for a normal hearing e.g., the typical cry of a

child produces sound, which is mostly unpleasant to normal hearing hence unwanted sound or noise. The discrimination and differentiation between sound and noise also depends upon the habit and interest of the person/species receiving it, the ambient conditions and impact of the sound generated during the particular duration of time though, there is a standard of personal perception of what constitute noise to some people is relative and is not applicable to others.

Sound frequencies less than 20 HZ are called infrasonics and those greater than 20,000 HZ are called ultrasonic. Since noise is also a sound, the terms noise and sound are sometimes synonymously used.

According to[3], noise is a normal phenomenon of life and should be derived as one of the most effective alarm systems in man"s physical environment. It may also be defined as damaging sound particularly a loud one, which could disturb people or make it difficult to hear the wanted sound [4, 3].

Also, noise is viewed as unwanted electrical or electromagnetic energy that degrades the quality of signals, data and in communication. Thus, noise could be referred to as interference (static) that destroys the integrity of signals on line[5]. Noise has some characteristics which are intensity, frequency, amplitude and loudness. The effects of noise though of various forms are determined by the level of exposure-implicitly low level exposure may not necessarily have harmful effects on man[5].

The following are some common types of noise:

i. Environmental noise: This is the summed noise pollution from outside adduce to transport, individual and recreational activities. Environmental noise is generally present in some form in all areas of human activities. Its effect may vary from environmental to physiological.
ii. Acoustic noise: This is anything from quiet but annoying to loud and harmful e.g portable audio player; [6]
iii. Physiological noise: this refers to noise that is perceived when our conscious awareness shifts its attention to that noise rather than letting it filter through our subconscious where it goes unnoticed[6].
iv. White noise: This is the noise that emanates from audio recording equipment both electrical and musical (http://www.merriamwebster.com/dictionary/white%20noise)
v. Ambient noise: This includes all sounds present in an environment. The ambient noise may be measured any moment but it will vary widely with time (http://www.cafefoundation.org/v2/pdf_tech/noise.Technologies//PAV. Environ.Noise.B&K.pdf.)

Washington State Department of Transport (WSDOT) stated that, traffic noise is not usually a serious problem for people who live more than 500 feet from heavily travelled freeways or more than 100-200 feet from lightly travelled roads. Highway traffic noise is not constant. Noise levels change with the number, type, and speed of the vehicles. For example, traffic noise levels might be lower during rush hour when traffic speeds are reduced compared to times when fewer vehicles are travelling at a higher speed. To be conservative in our estimates of traffic noise levels, WSDOT typically models traffic noise levels within rush hour and traffic travelling at the posted speed limit.

Traffic noise is a combination of the noises produced by vehicle engines, exhaust and tires. Traffic noise is increased by defective mufflers or other faulty equipment. Conditions, like a steep incline causes heavy labouring of vehicle engines also increase traffic noise levels. Other factors which complicate the loudness of traffic noise such as traffic noise levels are reduced by distance, terrain, vegetation and natural and manmade obstacles as a person moves away from a highway.

1.2 Research Problem

The road traffic has remained the predominant source of noise pollution that constitute environmental problem in many urban areas in developing countries. In Nigeria, the problem of noise pollution is wide spread and there is the need to measure and know the prevailing noise level of noise exposure to infer how it affects individual and the society at large. Moreover, related research conducted in the area some 20 kilometer away, was in 2008 on Investigation of Environmental Noise Pollution Level of Abraka in Delta State, Nigeria by [22.]

The adverse effects of noise according to[7] include: creation of annoyance due to their receptors disturbance at high sound level and fluctuation. This affects working performance of humans due to distraction, causation of health problems such as ringing in ear, feeling of tiredness thereby affecting the entire functioning of human body system. Furthermore, it affects sleep thereby inducing people to become restless to loose concentration and mindset during activities. Long exposure to high sound levels impair hearing (mostly unnoticed) with physiological features like breathing, amplitude, blood pressure, heartbeat rate, pulse rate, blood cholesterol affected. It has been observed that people in the area are shouting at high pitch voices in communicating .This is an aberration and must be corrected.

The above mentioned effects and the need to prevent such anomalies in the area have made this study imperative and timely

1.3 Aim of the Study

The aim of this study is to find out the noise level exposure in the area and examine the effect of noise pollution on environment of Effurun, Delta State Nigeria

1.4 Objectives of Study

The specific objectives of this study is to determine the noise level in some busy junctions with attendant health implication and other related effects in Effurun, Delta State Nigeria

1.5 Limitations of the Study

The following are the major limitations of this study:

There is the problem of shuttling the designated areas for data collection. This further makes observation as well as data analysis considered a serious constraint.

The procedure of procurement through various applications in the Department for obtaining sound level meter from Petroleum Training Institute (PTI) used for the measurement of noise level is strenuous. Also, the long period of time spent at the designated junctions characterized by excessive air dust, poses serious health risk during data col**lection.**

1.6 Literature Review

This research takes advantage of the following research works carried out within and outside the area.

[8]observed that numerous studies associated sleep disturbance with noise and also revealed that, populations living in noisy areas of urban populations are at risk of increased neuroticism, subjective noise sensitivity and noise annoyance. The participants of this study reported difficulty in falling asleep, frequent awakenings through the night, difficulties in falling back to sleep, increased fatigue, poorer sleep quality, and the need for increased use of sleeping agents These findings suggest an increased negative social behaviour and annoyance reactions in response to period of time, when the body is attempting to rest and restore it. Furthermore, sound levels attributable to disturbed sleep can be as low as a continuous noise greater than 30 dB or an intermittent noise that increases the amounts of awakenings per night [9, 10, 11, 12].

[13]in their work road traffic noise in down town Tehran of stated the exposure of people to noise level greater than 65dBA. This is above the limit value, and hence the population in area are at high risk of pollution.

[14]worked on road traffic noise in Baripada town, India and stated that the noise levels by a horn of Motor vehicles in Baripada were not more than the permissible limit. In related research, [15] in their work on valuation of traffic noise in Corlu opined that noise should be mentioned among the major environmental problems inCorlu.

In 1998 to 2000, it was estimated that approximately 28 million Americans suffer from hearing loss and almost 10 million Americans suffer from NIHL with the cost estimated to be in the billions of dollars [16, 17]. The National Institute of Deafness and Other Communication Disorders reported that about 22 million Americans between the age of 20 and 69 have hearing loss secondary to noise exposure[17]. Most exposures have been from occupational noise however recreational noise and noise from home have become important sources of exposure. Vulnerable populations are often thought of as workers involved in manufacturing, construction, transportation, agriculture, military, factory, and mining because of their exposure to hazardous noise levels [18, 19]. Recreational activities such as target shooting, snowmobile or speedboat riding, woodworking, play in a band, listen to loud music or attend frequent rock concerts are examples of activities that increases the risk of NIHL [18, 16, 17, 19].

Studies are also revealing that young children and young adults are showing signs of NIHL. Communication, cognition, social-emotional development, academics, and future careers may all be affected in the young secondary to hearing loss[20]. The third National Health and Nutrition Examination Survey revealed that about 15% of US children between the ages 6-19 years have low and high frequency hearing loss Although NIHL is permanent, it is a 100 percent preventable disease by using ear protection such as earmuffs or earplugs, avoiding a noisy environment, and knowing what the harmful levels of noise are [17, 20].

Latent mental illness is thought be exacerbated and intensified by noise pollution and not believed to be a cause of mental illness[9]. In one study, children who were exposed to noise levels above 55 dB had decreased attention, difficulty with social adaptation, and increased oppositional behaviour to others compared to children not exposed to these noise levels [21].

Noise has numerous health effects making noise pollution a public health concern although it has not been well addressed. To name but a few the effects of noise are; elevated blood pressure, noise-induced hearing

loss, sleep disorders, and irritability. In addition, noise pollution also creates a decrease in the performance at work and school[9].

Several in Nigeria studies reported that noise level in metropolitan cities exceeds specified standard limits. A study by [22] found that, the peak noise level at road junctions in Abraka, Nigeria to be 100 dB(A). This noise level is higher than the recommended level of 60 dB (A) for commercial and residential areas. Similarly, study conducted by [23] in Makurdi, Nigeria found that the noise pollution level in the city was about 3 dB(A) to 10 dB(A) above the recommended upper limit of 85 dB(A). Furthermore, [24] investigated the level of noise pollution in selected industrial locations in Benin City, Edo State Nigeria. The average ambient noise level in Sawmills, Electro-acoustic market and food processing industrial areas was determined to be above 90 dB (A).

This noise level is well above the healthy noise level of 60 dB (A) [22, 23, 24].

[25] reported that in Nigeria, there is no legal frame work upon which noise pollution can be abated and the Federal Environmental Protection Agency (FEPA) in Nigeria only provided daily noise exposure limits for workers in industry i.e. 90 db (A) for 8h exposure. Amazingly, the Nigerian Government and her citizenry appear not to be conscious of the present and future impacts of noise induced health hazards in their environment. Unless and until measures are taken to control the level of noise, the ongoing urbanization and industrialization may complicate the problem so much to becomes incurable according to [25].

According to [26], there are varieties of strategies for mitigating and controlling roadway noise. These include: use of noise barriers, limitation of vehicle speeds, alteration of roadway surface texture, limitation of heavy vehicles, use of traffic controls that smooth vehicle flow to reduce braking and acceleration, and tire design. An important factor in applying these strategies is a computer model for roadway noise that is capable of addressing local topography, meteorology, traffic operations and hypothetical mitigation. Costs of building in mitigation can be modest, provided these solutions are sought in the planning stage of a roadway project[26].

[27] in their work on noise pollution- sources, effects and control advised that, public education by government and NGOs are the best methods employed to control noise.

1.8 Materials and Method

(i) Equipment Used

The main instrument/equipment used in this study is the sound level meter. The standard sound level meter can be called an exponentially averaging sound level meter as the ACsignal from the microphone is converted to DC by a root-mean-square(RMS) circuit Thus, it must have a time-constant of integration; today referred to as the time-weighting. A sound level meter or sound meter is an instrument that measures soundpressure level, commonly used in noise pollutionstudies for the quantification of different kinds of noise, especially for industrial, environmental and aircraft noise. However, the reading from a sound level meter does not correlate well to human-perceived loudness, which is better measured by a loudness meter. The current international standard that specifies sound level meter functionality and performance is the IEC61672-1:2013.

The Sound level meter measures and displays sound pressure levels in dB from 40 to 130dB. User selectable features include Frequency Weighting („A‟ and „C‟), Response Time (Fast and Slow), Max Hold, and Max/Min recording. A typical digital sound level meter (Model: 407730) is shown Fig 3.1 below:

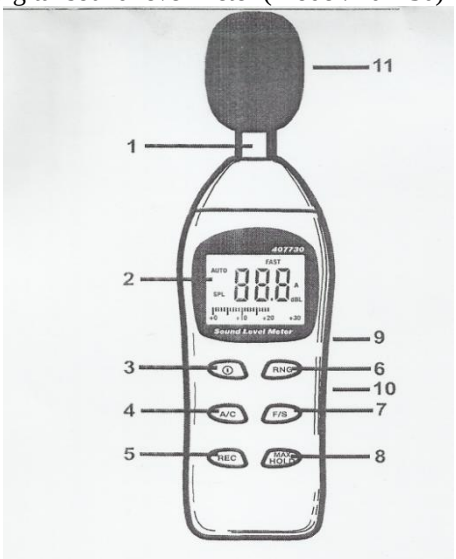


Fig. 3.1: A Digital Sound Level Meter (Model: 407730-en-EU_V1.9 7/14). Source:

Field work (2015) from http://www.extech.com

4
The parts of the above displayed digital sound level meter are labeled below:
1. Microphone
2. LCD Display
3. ON-OFF button
4. A/C weighting selection button
5. Min/Max Record button
6. Range selector button
7. F/S response selection button
8. Max Hold selector button
9. Calibration adjustment 10. ACanalog output jack 11. Windscreen.

(ii) Method of Data Collection

Direct measurement method was adopted for this research work. Four strategic points or locations in each of PTI, Jakpa, Airport and Enerhen junctions were used while the average is obtained to determine the noise exposure in the designated area. The sound level meter (SLM) is usually powered by the batteries. The batteries were first inserted and the power button was switched on using the power button. The sound level meter was allowed to stabilize for five minutes and the sponge ball was inserted into the microphone. The sound level meter was held at chest level and the „max hold" was then held for six (6) minutes so as to display the maximum noise level in decibels (db A) and the reading was recorded. This was done three times at an interval of 6 minutes in each of the points. The average reading was determined and recorded and each value was taken for that particular time of the day. The batteries were removed and the sound level meter was kept and the same procedures were repeated for each location at different period of the day for 14 days.

The measurement is done three times daily:

i. Morning 7:00- 9:00am
ii. Afternoon 12:00- 2:00pm
iii. Evening 5:00-7:00pm

1.9 Caveat/Considerations during Measurement

i. Wind blowing across the microphone increases the noise measurement. The supplied windscreen to cover the microphone when applicable.
2. The instrument is calibrated before each use especially if the meter has not been used for a long period of time.
3. We did not stored or operate the instrument in areas of high temperature or humidity.
4. We keep meter and microphone dry.
5. We avoided severe vibration.
6. The battery is removed when the meter is to be stored for long periods of time.

2.0 Research Design

The data collection time designed for this study was 7-9am, 12-2pm and 5-7pm daily for two (2) weeks. The following data collection points were selected: PTI junction, Jakpa junction, Airport junction and Enerhen junction in Effurun. GRA was chosen as the control point.

2.1 Statistical Technique and Diagrams

The study used tables and graphs plots for the presentation of collected data while mean (average) was used to determine and present noise exposure level at their respective locations.

The mean measured a level calculation is as determined below:

Average Daily Noise Level Db (A)

$$= \frac{\text{Morning+ Afternoon + Evening}}{\text{No. of times reading was taken per day}}$$

That is:

Average Noise Exposure Level Db (A) = $\frac{\text{MNEL+ANEL+ENEL}}{3}$

Where:

MNEL= Sum mean of Morning Noise Exposure Level 5
ANEL = Sum mean of Afternoon Noise Exposure Level
ENEL = Sum mean of Evening Noise Exposure Level

2.2 Presentation of Data

The data collected using sound level meter at the four designated points (Enerhen junction, Jakpa junction, Airport junction and PTI junctions during the hours of 7-9am, 12-2pm and 5-7pm using GRA as a control point were analyzed, interpretation and presented in the following tables and bar graphs.

Table 2.1: Morning average weekly readings for all locations in dB (A)

Sample Point	**Number of days**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**AMNEL**	**WHO Standard (dB)**
PTI	87.8	86.2	86.6	85.6	87.0	93.7	80.6	86.8	60
Jakpa	87.7	89.8	92.9	91.6	88.4	96.0	82.3	89.8	60
Airport	78.1	78.5	77	78.6	77.4	79.8	73.1	77.5	60
Enerhen	91.0	90.2	89.8	91.3	96.8	101.8	90.3	93.0	60
Control	52.2	51.6	53.7	51.3	50.5	51.1	46.3	50.9	60

Source: Field Work (2017).

Table 2.2: Afternoon average weekly readings for all locations in dB (A)

Sample Point	**Number of days**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**AANEL**	**WHO Standard (dB)**
PTI	86.5	83.9	81.9	83.5	85.8	92.6	87.8	86	60
Jakpa	88.4	86.3	87.5	82.9	86.4	89.8	83.4	86.3	60
Airport	77.1	75.5	73.3	81.0	75.5	78.8	73.0	76.3	60
Enerhen	88.4	89.0	88.3	89.9	91.2	100.3	88.1	90.7	60

Source: Field Work (2017).

Table 2.3: Evening average weekly readings for all locations in dB (A)

Sample Point	**Number of days**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**AENEL**	**WHO Standard (dB)**
PTI	81.9	87.4	87.1	84.3	92.4	96.8	89.8	88.6	60
Jakpa	91.3	89.3	89.5	91.5	93.2	99.8	97.8	93.3	60
Airport	77.7	77.3	75.9	79.1	77.1	79.3	76.2	77.6	60
Enerhen	89.3	90.7	90.9	88.9	95.6	101.8	98.1	93.7	60
Control	50.4	48.3	51.3	54.1	52.2	47.1	45.0	49.8	60

Source: Field Work (2017).

Table 2.4: Average Noise Exposure level for all locations in dB (A)

	Morning	**Afternoon**	**Evening**	**Ave Daily Exposure**	**WHO Standard (dB)**
PTI	86.8	86.0	88.6	82.8	60
Jakpa	89.8	86.3	93.3	89.8	60
Airport	77.5	76.3	77.6	77.1	60
Enerhen	93.0	90.7	93.7	92.4	60
Control	50.9	50.2	49.8	50.3	60

Source: Field Work (2017).

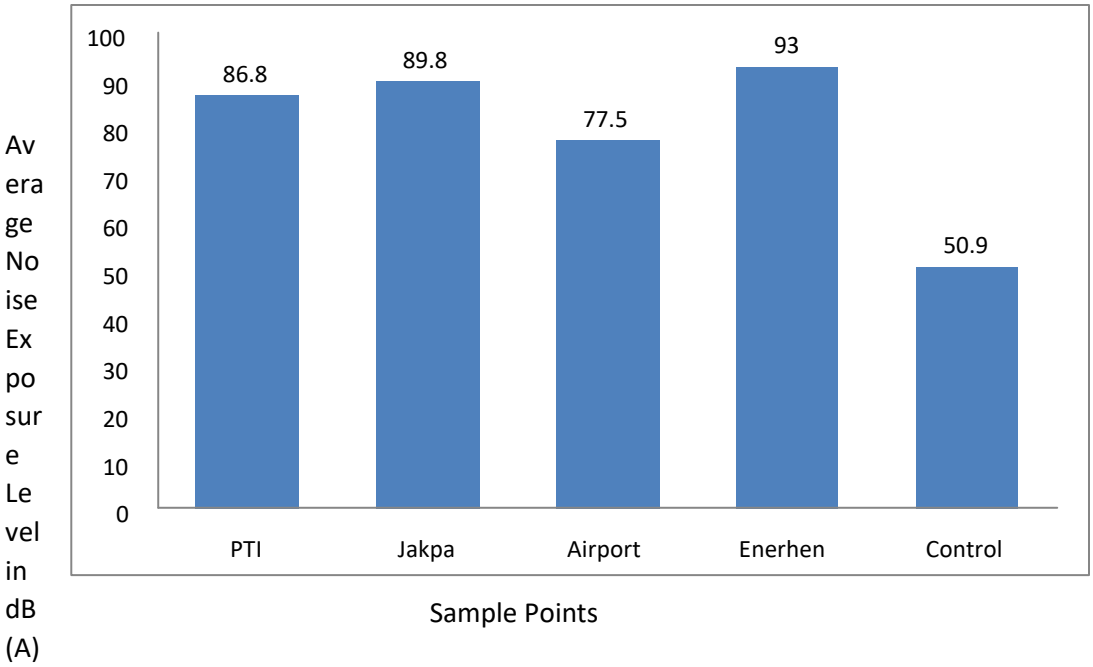


Fig 2.1: Average Morning Noise Exposure Level for all Location

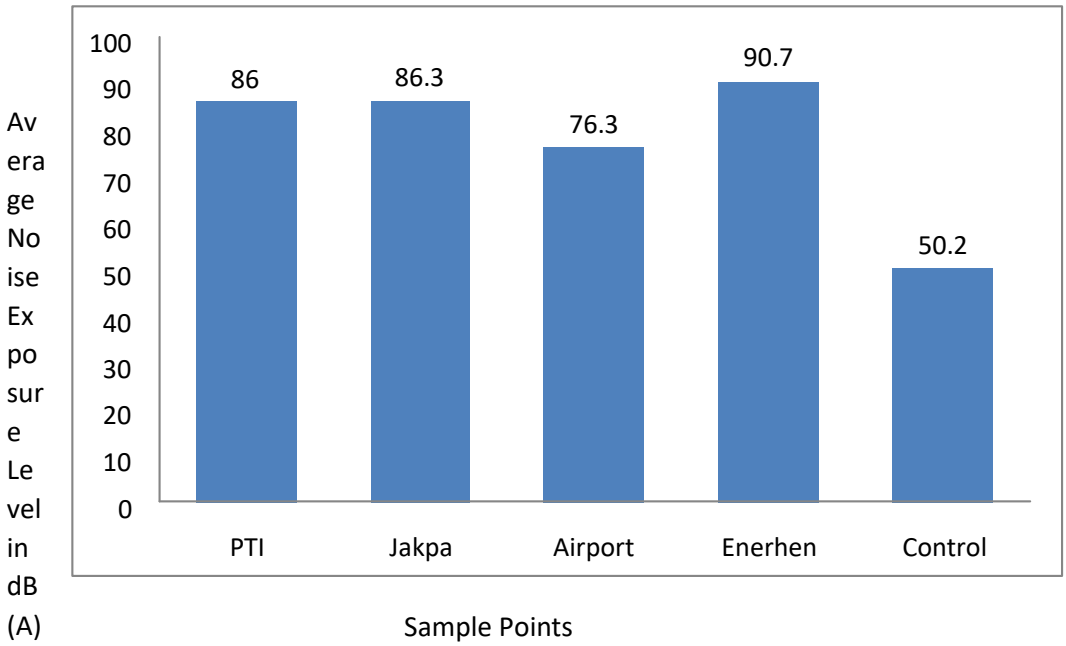
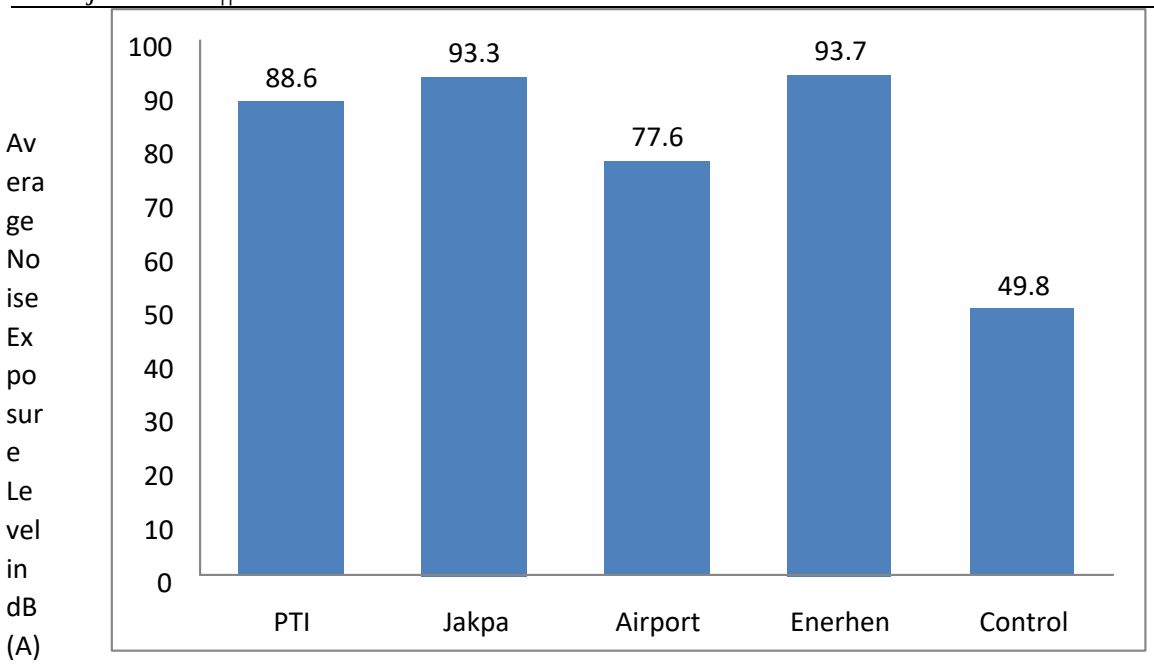


Fig 2.2: Average Afternoon Noise Exposure Level for all locations



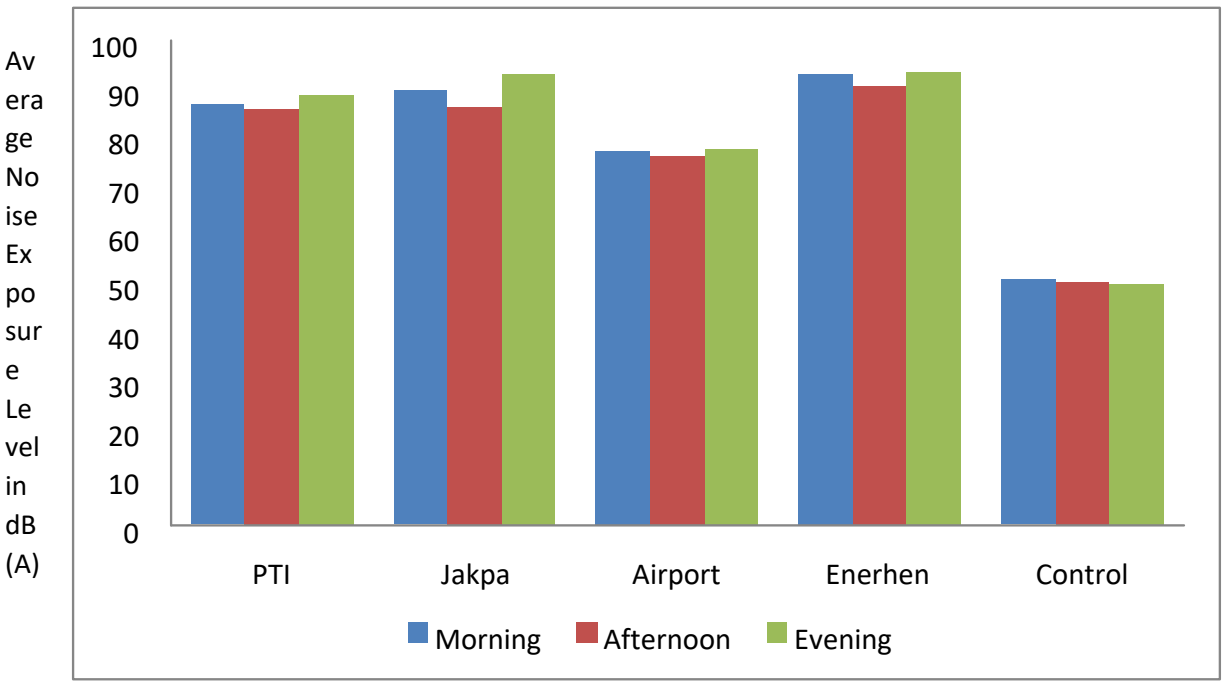


Fig 2.4: Average Daily Noise Exposure level for all Locations

2.2 Presentation of Results

The above analysis shows that the mean/average values obtained in the morning (7-9am), afternoon (122pm) and evening (5-7pm) from the four designated locations (PTI junction, Jakpa junction, Airport junction

and Enerhen junction were significantly higher than the mean value obtained from GRA (control point) location.

The point reading values show that Enerhen junction and Jakpa junction had the highest point reading (dB) while Airport road junction had the lowest point mean value compared to the other locations. The noise level was found to be higher at weekends compared to weekly days. All the recordings at the respective locations were significantly higher than the recordings at GRA (control point) and the recommended level of 60dB. Thus, the noise level at the various location sampled are considered harmful to the settlers and occupants of the locality.

2.3 Discussion of Results

The results emanating from this current study are discussed below. The study found that the noise level in the four sampled locations (PTI junction, Jakpa junction, Airport junction and Enerhen junction were above the recommended level of 60dB for commercial and residential areas. This finding is in agreement with the findings of [22] that observed the peak noise level at road junction in Abraka, Nigeria to be 100 dB. Furthermore, the study conducted by [23] in Makurdi, Nigeria found that the noise pollution level in the city was about 3 dB (A) to 10 dB (A) above the recommended upper limit of 85 dB (A). [24] also investigated the level of noise pollution in selected industrial locations in Benin City, Edo State Nigeria. The average ambient noise level in Sawmills, Electro-acoustic market and food processing industrial areas was determined to be above 90 dB (A). This noise level is well above the healthy noise level of 60 dB (A). These findings are in agreement with the current finding.

2.4 Summary of Findings

The following were the findings of this study:

i. Enerhen junction and Jakpa junction had the highest noise level reading dB (A) while Airport Road junction had the lowest noise level reading.
ii. The noise level was found to be higher at weekends than at week days in the four designated locations.
iii. All the recordings at the respective locations (PTI junction, Jakpa junction, Airport junction and Enerhen junction were significantly higher than the recordings at GRA (control point) and the recommended level of 60dB (A). for commercial and residential areas.
iv. The noise level was found to be higher at the busy hours of morning and evening.

2.5 Conclusion

The noise level at the various location sampled were harmful to the occupants of the locality. Undoubtedly, residents and workers working around PTI junction, Jakpa junction, Airport junction and Enerhen junction were exposed to health hazards from the results available as they are more prone to noise hazards. The adverse health effects of noise pollution are numerous, pervasive, persistent, and medically and socially significant. These adverse effects represent a significant public health problem that can lead to social handicaps, reduced productivity, impaired learning, absenteeism, increased drug use, and accidents. Noise is no doubt a normal phenomenon of life and is derived to be one of the most effective alarm systems in man‟s physical environment. Noise is also defined as damaging sound particularly loud one which can disturb people or make it difficult to hear wanted sound.

2.6 Recommendations

Sequel to the findings emanating from this study, the following recommendations were advanced among others:

i. The government agencies such as Vehicle Inspection Officers (V.I.O) should be well equipped to deal with vehicles that have out-lived their usefulness and causing serious noise pollution. This is to protect the population from these adverse effects of noise.
ii. People should spend limited time in such busy/heavy traffic areas so as to reduce the effect of noise on them.
iii. Vigorous enlightenment campaign should be carried out to educate the populace on the effect of noise pollution.
iv. People working and resident in these locations should imbibe the habit of wearing nose mask and ear muff.
v. Vehicle owners should cultivate the habit of repairing/maintaining their vehicles especially those whose engine produces excessive noise and without mufflers.

2.7 Suggestions for further Studies

The study has evaluated the noise level in Effurun metropolis. The following areas are hereby suggested for further studies:

i. It is suggested that studies should be carried out to evaluate the noise level in other major cities of Delta State and by extension other busy/heavy traffic areas in Nigeria.

ii. Closely related to noise pollution is air pollution which also put people at serious health risk. It is therefore suggested that studies should be carried out on the causes and effect of air pollution in these localities.

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