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Assessment of Noise Pollution Level of Selected Construction Sites with in the Residential Area in Obio/Akpo Local Government Area, Rivers States, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors NAA and NTI did formal analysis. Author BLL did data curation. All authors read and approved the final manuscript.

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ABSTRACT

The measurement of industrial noise pollution level of selected construction sites within residential area in Obio/Akpo Local Government Area of Rivers State has been carried out. The noise level meter with range of 30.0 - 80.0 dBA. (BK Precision 732, IEC 651 TYPE II) was use in measuring the

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sound level of the selected construction sites. Four (4) selected construction sites was considered for the measurement of industrial noise pollution of the construction sites. The obtained results of the selected construction sites vary from 77.40 - 81.25 dBA, 77.0 - 80.90 dBA, 75.4 - 81.15 dBA, 67.30 – 81.90 dBA with mean of 79.77 dBA, 77.41 dBA,79.53 dBA, 70.21 dBA for Plus Steel, Zortex, Darlington and Gift Construction Site respectively. Higher noise pollution level was obtained from Pius Steel Construction site with mean of 79.77 dBA and the least noise level was recorded at Gift Construction Site with mean value of 70.21 dBA. The obtained results of the selected construction sites were higher than the stipulated value of 65.0 dBA and 55.0 dBA decibels for industrial and residential area recommended by NESREA (2009). The noise percentage of the construction sites is of the increasing order of Gift, Pius < Zortex < Darlington < Pius Steel Construction Sites and the least percentage was obtained in Gift construction site while the higher noise percentage was recorded in Pius Steel Construction site with 27% increment. The obtained noise pollution level of the selected construction sites within the study area shows that the workers and the residential area are exposed to high noise level. The obtained result may not pose any immediate health risk but an individual who may spent his/her life time within the area, may develop hearing impairment in the nearer time due to over exposure to noise pollution level within the immediate environment and construction sites should be located outside the residential area.

Keywords: Noise level; construction; site; health risk and human ear.

1. INTRODUCTION

Noise is originated the Latin word called “Nausea” and implied ‘unwanted sound’ or dislike sound. Basically Noise originates from different human activities here on earth and through urbanization and the modern development of transportation system and more so through industrial and technological development. The unwanted health effects of noise pollution are usually manifested either through direct or indirect pathways, involving cognitive perceptions Babisch (2002). Noise pollution has some dangerous health effects on human and many individual or group of individuals are not yet aware of its related health effects in our recent time and its some time reffer to as a dangerous silent killer within the environment Clark et al, (2007). Majority of the environmental noise pollution effects, may lead to hearing impairment, annoyance, and tinnitus, hypertension, high level of stress, cardiovascular effects. Umunnakwe et al, (2018).

Acording to Nwabuogo and Stephen (2017), environmental noise pollution originates from growing global population, advancement in ressearch and advancement in technological or orther human related activities which is capable of generating enverinment noise pollution.

Noise pollution in Nigeria has contributed greatly environmental nuisance due to the advancement in technological activities such as industrial activities, increases in population size and increase in transportation. Abel (2015).

Human ear are more sensitive to noise with frequencies between 20.0Hz - 20.0kHz, these sensitivity of the noise level depends on the closeness of the ear to the noise sources within the immediate environment. The noise level of 45.0 dBA and 60.0 dBA have been considered for normal conversation of an individual within a distance of three to six feet. The noise limit of 80.0 dBA will be unfavorably and will affect the ear, while > 130.0 dBA will be dangerous to human and cause more pain Baloye et al, (2015). According to different documented literature, the noise emanating from road traffic also linked to increased risk of hypertension, cardiovascular diseases and central obesity Zollinger et al, (2020).

Environmental noise Pollution is classified into three major interesting groups such as industrial Noise, commercial noise and residential noise level. The general noise effects on human at work or not at work has been a great concern to many scientists over the years. Olorutoba et al. (2012). Industrial noise are excessive noise sources emanating from industrials activities which has effects on workers or residents within the immediate environment over time.

According to Ene (2020), Environment noise pollution has greater health effects on human and its environment and some of these health effects are: annoyance, sleep disturbance, cardiovascular disease and cognitive impairment. Noise emanating from road traffic have some health effects associated with auditory and wider

health such as hypertension, stroke, hearing loss and cardiovascular-related events such as myocardial infarction and heart failure.

Industrial tools also contributed to the noise level during work due to the nature of the tool. Some of the tools are made of steel and metals, metal has an important characteristic of being sonorous in nature and it's also contributed the noise pollution level. (EEA 2009). The excessive noise from the industrial tool always lead to great health risks to workers and the environment, despite the consistent use of personal protective equipment.

The Poor urban development planning also give rise to environmental noise pollution within the immediate environment. The noise sources from the industrial area located within the residential area has related health effects on the populace. Barbara (2006).

The major interest of this research is to ascertain the noise pollution level within the industrial working area of the study area and identified the harmful noise effects within the immediate environment.

1.1 Study Area

The study area is located in Obio/Akpor Local Government Area and four construction site was selected for the purpose of the study and its head quarter is Rumuodumaya. The study area is situated between latitudes 4º30'0''N and 5º30'0''N and longitude 6º30'0''E and 7º30'0''E with inhabitants of 464,789 (NPC, 2006). Obio/Akpor appreciate tropical hot monsoon climate as a result of her latitudinal position. The daily tropical monsoon climate is characterized by heavy rainfall and high temperature all year round. The study area experiences lengthy and heavy rainfall season and very short dry season. Rainfall is at its peak in July and September with a little dry season occurring in August, although the period of the break has been fluctuating in recent times.

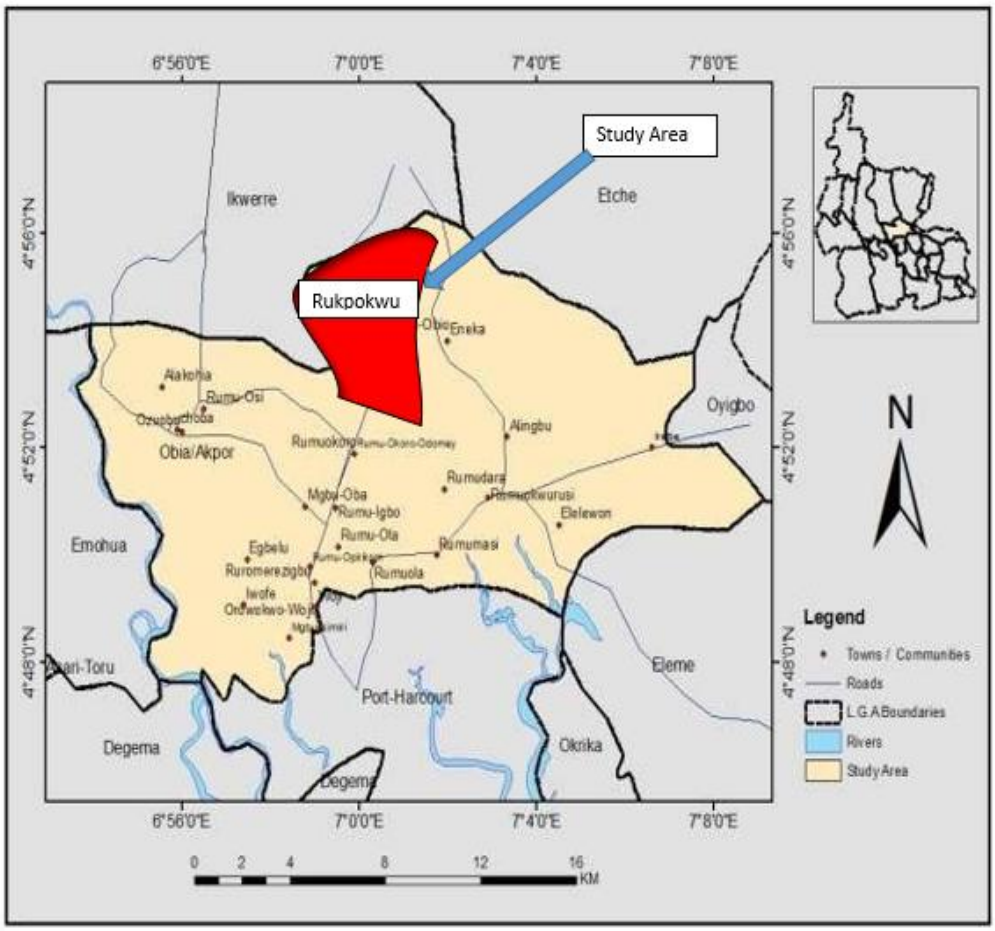

Fig. 1. Shows the map of the Study Area

2. MATERIALS AND METHODS

Obio Akpor is a Local Government Area in Rivers State is the study area. The industrial noise levels measurement was taken at different construction sites within the study area. Four construction site was considered for the research. The study was carried out within the selected construction sites of Obio/Akpo using the sound level meter (BK Precision 732, IEC 651 TYPE II) with measurement range of 30.0 dBA – 80.0 dBA power supply (9.0 V battery) and Audio Frequency Counter (Keuwisoft). The noise meter was place at one meter (1m) above the ground level for effective measurement of noise level within the study area and the noise meter was switched off after taking each reading for measurement accuracy. The screen (LCD) panel displayed the sound level of the current environmental noise pollution level, then minimum button was pressed in order to record the minimum value and a value appeared, replacing the current environmental noise when this value was stabilized, it was read as the minimum sound level of the noise source. The geographical Positioning system (GPS) was applied in measuring the precise location of each of the construction within the Local Governments Area.

3. RESULTS AND DISCUSSION

3.1 Results

The results of the industrial noise obtained from the selected industrials areas within the study area and their respective geographical coordinate are presented in Table 1 to Table 4 and Table 5 Show the mean of the selected construction site. Fig. 2 shows Noise level of Plus Steel Nigeria compared with standard, Fig. 3 show the Noise level of Zortex Nig Enterprises compared with standard, Fig. 4 shows Noise level of Darlington Multi-Servive compared with standard, Fig. 5 shows Noise level of Gift Construction compared with standard.

Table 1. Plus, Steel Nigeria Plc

S/n	Tools	GPS Reading	Noise level (dBA)		Average Noise level (dBA)	Frequencies (Hz)
			Min	Max		
1	Hammer	N04°51.481 E006°59.591	78.8	82.7	80.75	1862.45
2	Filing Machine	N04°51.480 E006°59.594	80.1	82.4	81.25	3106.19
3	Generator	N04°51.480 E006°59.593	76.5	80.4	78.45	2046.42
4	Saw	N04°51.479 E006°59.591	80.1	82.2	81.15	3741.81
5	Rod bender	N04°49548 E006°59.596	80.1	82.2	77.40	2303.43
6	Welding Machine	N04°49582 E006°59.592	78.4	80.8	79.60	2064.96
	Mean		79.0	81.78	79.77	2520.88

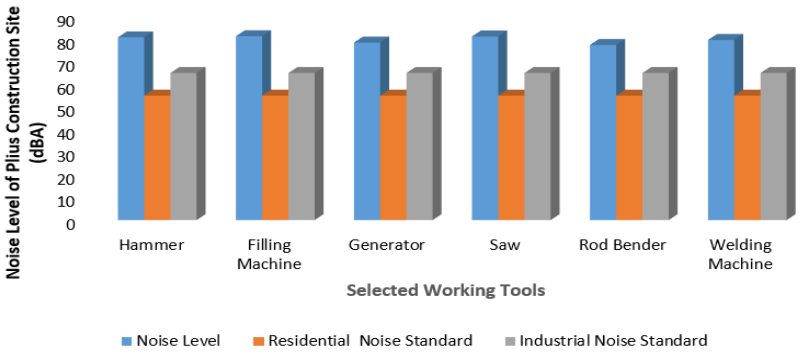

Fig. 2. Noise level of plus steel site compared with standard NESREA (2009)

Table 2. Zortex Nig. enterprises

S/n	Tools	GPS Reading	Noise levels (dBA)		Average Noise levels (dBA)	Frequencies (Hz)
			Mini	Max		
1	Hammer	N04°51.510 E006°59.597	71.9	82.1	77.0	1770.93
2	Filing Machine	N04°51.509 E006°59.597	79.5	82.3	80.90	4100.8
3	Generator	N04°51.510 E006°59.597	70.8	82.3	76.55	2460.75
4	Saw	N04°51.501 E006°59.609	72.3	80.1	76.20	3106.19
5	Welding Machine	N04°51.509 E006°59.597	72.6	80.2	76.40	1824.13
	Mean		73.42	81.4	77.41	2652.56

Table 3. Darlington multi service

s/n	Tools	GPS Reading	Noise levels (dBA)		Average Noise level (dBA)	Frequencies (Hz)
			Min	Max		
1	Hammer	N04°53.386 E006°55.222	80.1	82.2	81.15	1873.73
2	Filing Machine	N04°53.387 E006°50.218	79.4	82.3	80.85	6400
3	Generator	N04°53.387 E006°50.218	79.3	82.3	80.7	2381.7
4	Welding Machine	N04°53.389 E006°55.218	80.3	70.5	75.4	2034.96
	Mean		79.78	79.33	79.53	3172.59

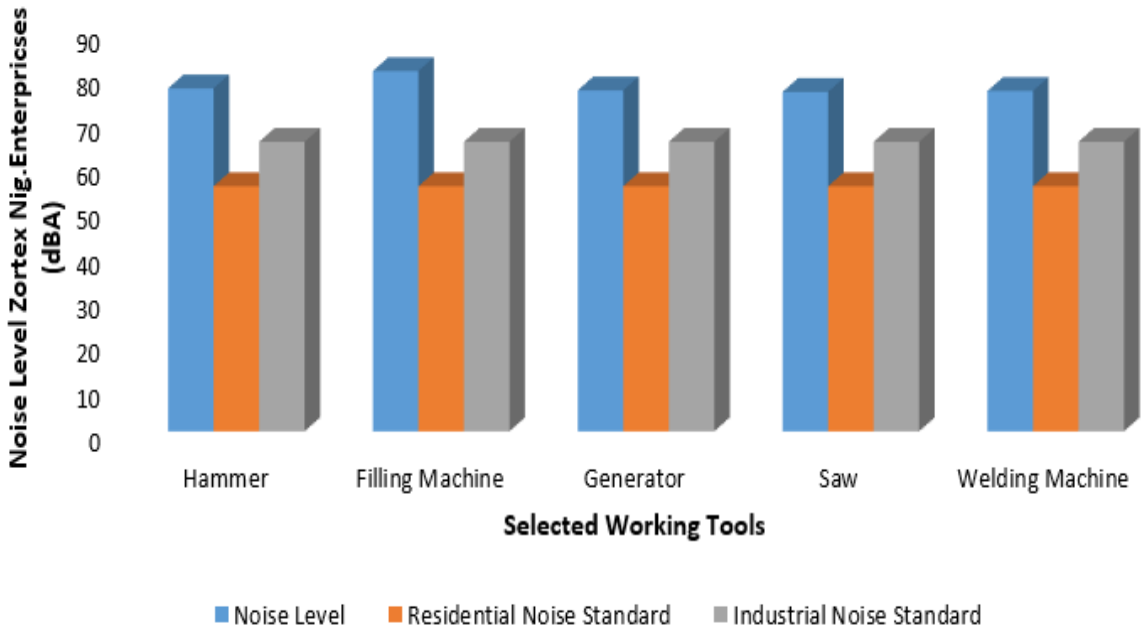

Fig. 3. Noise level of Zortex Nig. enterprises compared with standard NESREA (2009)

Table 4. Gift construction company

S/n	Tools	GPS Reading	Noise levels (dBA)		Average Noise levels (dBA)	Frequencies (Hz)
			Min	Max		
1	Hammer	N04°52.255 E006°57.982	52.4	82.2	67.3	950.78
2	Filing Machine	N04°52.254 E006°57.989	81.7	82.2	81.9	3502.84
3	Welding Machine	N04°52.240 E006°57.970	70.6	80.3	75.45	1021.38
4	Rod bender	N04°52.304 E006°57.980	56.4	70.6	63.50	950.78
5	Filing Machine off	N04°52.255 E006°57.982	56.1	69.7	62.90	562.71
	Mean		63.44	77.00	70.21	1509.43

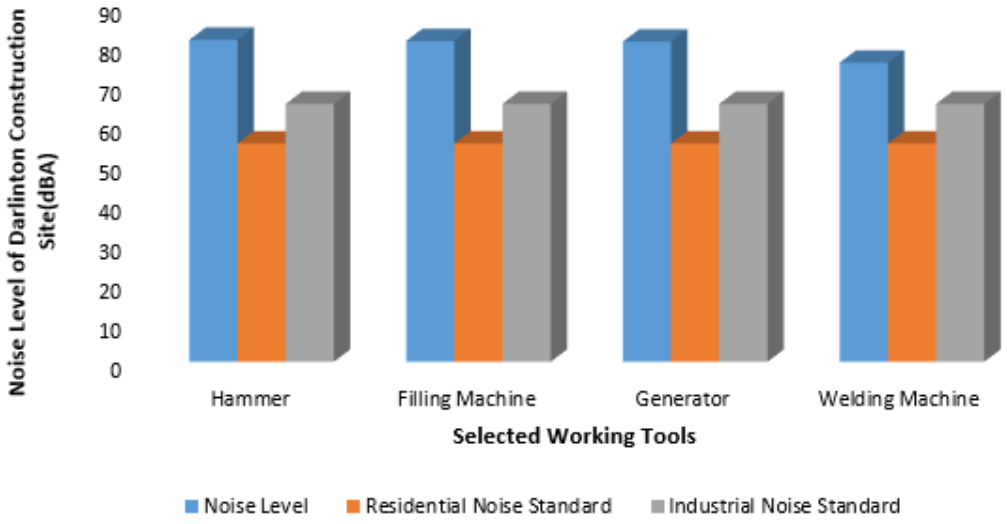

Fig. 4. Noise level of darlinton multi-servive compared with standard NESREA (2009)

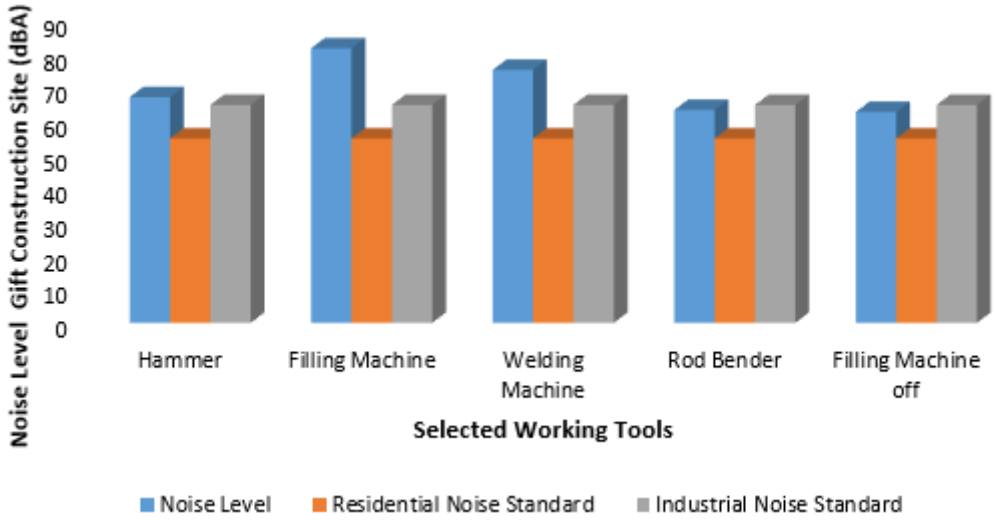

Fig. 5. Noise level of gift construction compared with standard NESREA (2009)

Table 5. Mean of the selected construction sites

S/n	Selected Construction Sites	Noise Level (dBA)	Frequencies (Hz)
1	Pius Steel Nigeria Plc	79.77	2520.88
2	Zortex Nigeria Enterprises	77.41	2652.56
3	Darlington Multiservice	79.53	3172.59
4	Gift Construction Company	70.21	1509.43

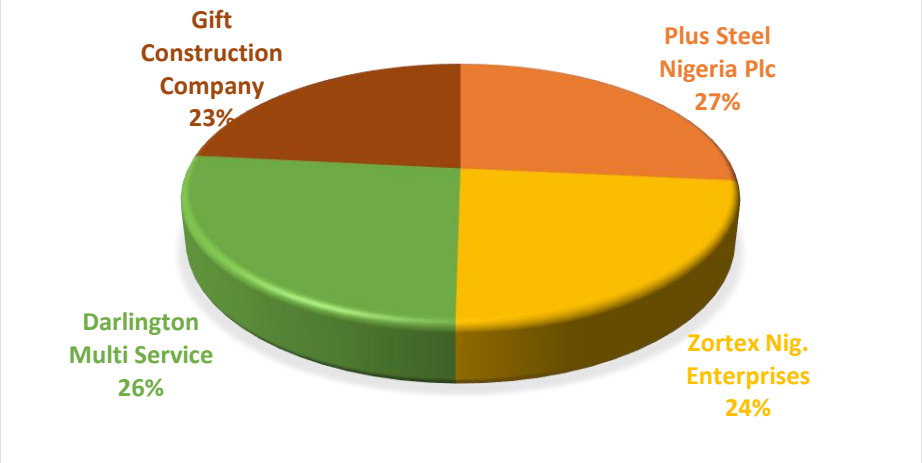

Fig. 6. The percentage of noise level of the selected construction sites

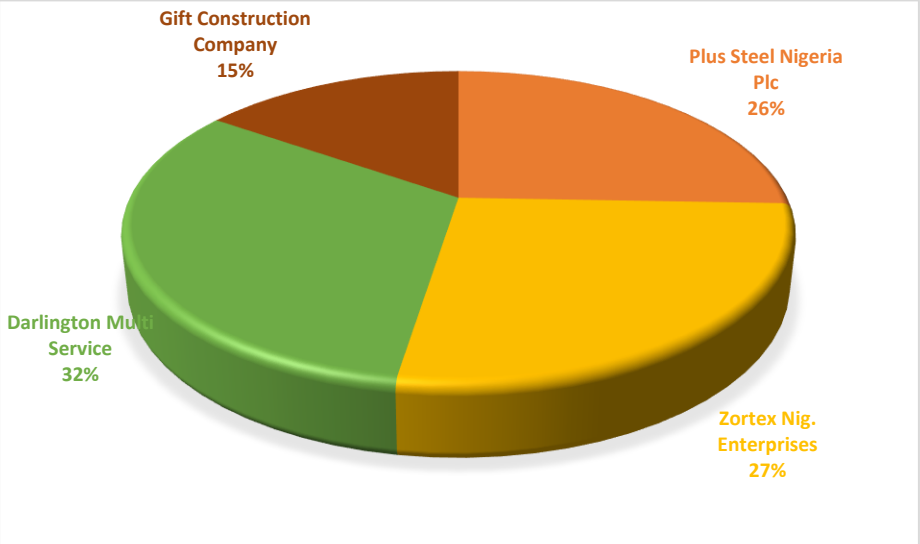

Fig. 7. The percentage of frequency of the selected construction sites

The Percentage of Noise level of the Selected Construction Site (Fig. 6). The Percentage of Frequency of the Selected Construction Site The comparison of the different mean Value of frequences and Fig. 7 show the Contour Map of the Study Area.

3.2 Discussion

The results of industrial noise pollution measurement of the selected construction sites are presented in Tables 1 to Table 4 with its coordinates, Fig. 2 to Fig. 5 shows the comparison of noise level with standard value. The results of the industrial noise level of the study area varies from 77.40 - 81.25, 76.20 - 80.90, 75.4 - 81.15 and 62.90 - 81.9 (dBA) with mean value of 79.77, 77.41, 79.53 and 70.21 (dBA) for Plus steel Nigeria, Zortex Nigeria enterprise, Darlington Multi service and Gift Construction sites respectively. High noise pollution level was obtained within the filling

machine and hammer of the selected construction site of the study area and this high noise level may be due to the high energy required by the machine in filling the metals and the obtained noise level was within the range reported by Shehu et al, (2019) and higher than the stipulated value of WHO (2005).

The lower noise level was obtained in Gift Construction site as shown in Fig. 5 and the obtained result is below the stipulated value of 65 decibels for commercial and 55 decibels for Residential area by NESREA (2009) and this might be due to lesser work within the construction site.

The frequencies vary from 1862.45 - 3741.81, 1770.93 - 4100.8 Hz, 6400.0 - 2034.96 and 950.78 – 3502.84 Hz with mean of 2520.88, 2652.56, 3172.59 and 1509.43Hz for Plus steel Nigeria plc, Zortex Nigeria enterprise, Darlington multiservice and Gift Construction sites respectively as shown in Fig. 6. The highest frequency was recorded in Darlington multiservice and lower frequency was obtained from Gift Construction company. The frequency obtained from the study area is below the hearing threshold revealed notch of 400.0 KHz for human ear, justified as noise induced hearing impairment or hearing loss Biasson, et al, (2014).

4. CONCLUSION

The Industrial noise pollution level of the selected construction site of within Obio-Akpor Local Government Area, has been carryout. The obtained results of the selected construction site within the study were higher than the stipulated value of 65.0 dBA and 55.0 dBA for industrial and residential area as recommended by NESREA (2009). This high value of the noise is an indication that the workers within the construction sites and residents within the area, develop hearing impairment in future due to the exposure to high noise pollution level.

Therefore, the needs of redesigning the Local Government and its environs to re-classify the areas that should be designated as residential /schools, commercial and industrial area to avoid noise pollution and its related health effects, that may be detrimental to residence, within the environment. The workers within the industrial area should put on hearing protecting instrument in order to reduce the effects of noise on their health.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI Technologies such as Large Language Models (ChalGPT, COPILOT, etc) and text-to-image generator have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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