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Investigation of Environmental Noise Pollution Level of Abraka in Delta State, Nigeria

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Abstract: An investigation of environmental noise pollution level of Abraka in Delta State, Nigeria was embarked upon using a Pioneer 65 noise dosimeter. Data were collected from ten different locations and the records analysed by using the pollution modelling technique known as Pollution Standard Index (PSI). The analysis revealed that the day time noise level in Abraka falls below the WHO maximum permissible limit of 90 dB. However, the peak measurements show that only 10% of the town experiences some very loud noise above the permissible limit. The night time noise data show that 50% of the locations have their equivalent noise level less than the National Environmental Boards standard of 65 dB for night time. The peak night data also show that 10% of the locations fall below the limit for night while 90% were above the permissible noise level for night time. This study has shown that the day time noise level is relative friendly and safe except for Abraka Junction that has a peak of 100 dB. The night time is to a large extent noisy and unconducive for relaxation and academic activities. The high peak noise value at Abraka junction is attributed to automobile noise why the reason for the high noise values at night is due to the use of diesel type of electricity generating sets used almost everywhere in the town. It is recommended that the Power Holden Company of Nigeria in charge of electricity should be made to work effectively in Abraka to reduce the use of generators. It is further recommended that road network be opened up in Abraka. This will decongest the one way traffic movement in and out of Abraka and in turn reduce the noise level.

Key words: Environmental noise, sound

INTRODUCTION

Environmental noise has been defined as an unwanted or harmful out door sound created by human activities. This includes noise emitted by means of transport and from sites of industrial activities (Defra, 2003; Anomohanran *et al*., 2004). Ebeniro and Abumere (1999) view environmental noise as an unwanted signal which in most cases is sound. Leventhall (2003) in his review of published research work on low frequency noise and its effect asserted that noise is an undesired sound and that both noise and sound are similar acoustic waves carried on oscillating particles in the air. In a nut shell, noise is sound that is too loud or that is unpleasant or disturbs the listeners.

Sound is essential for us to communicate with one another, to enjoy drama and musical performances as well as recorded music and to appreciate countless other sounds we hear daily. Some loud sounds are necessary to warn us of oncoming potential danger, such as at a train crossing or at a construction site where a backing vehicle may be about to cross our path.

It is a common experience that some sounds around us may interfere with our ability to communicate. They may mask our enjoyment of desirable sounds and they may interfere with our ability to concentrate on a task. Other sounds may startle us, interrupt our sleep, cause us

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psychological stress, contribute to physiological distress and when sustained and loud enough, contribute to temporary or permanent loss of hearing (Anomohanran and Osemeikhian, 2005).

Very few reports of noise pollution studies are available in Nigeria. Menkiti (1976) highlighted the fact that there were many deaf people in Nigeria caused by exposure to loud noise. Onuu and Menkiti (1996) have analysed the spectra of road traffic noise for parts of south-eastern Nigeria and concluded that this type of noise dominates the low frequency range (500-800 Hz). The survey carried out by Menkiti (1989) on the factors that constitute road traffic noise in the Nigerian environment concluded that people were bothered more outside their home and that the awareness to pedestrian danger as a factor is very low.

Anomohanran *et al*. (2004) while studying noise level in Agbor observed that the noise situation in Agbor is caused by big trucks, luxurious buses and by commercial activities and they called on the government to restrict the citing of schools and hospitals along the major express way because of the high noise values observed from this location. Onuu (1999) observed that road traffic noise constitutes the largest proportion of environmental noise in Urban areas. He therefore observed that any meaningful noise abatement programme must first and foremost be directed towards road traffic noise which is a major subject of environmental acoustics.

According to Ochsner (2003), both the amount of noise and the length of time one is exposed to noise determine its ability to damage hearing. She said sounds that are louder than 85 dB are potentially hazardous. Hearing loss often occurs gradually, becoming worse over time. For this reason, many people do not become aware of their hearing loss until it is too late to avoid permanent damage.

Most people in Nigeria with the inclusion of Abraka, the study area would not recognize noise as an insidious pollutant or attribute it to any physiological impacts, though they may consider it as nuisance during sleeping hours. Abraka, being a small fast growing university town with a lot of social economic activities concentrated on a small area, it is expected that the noise level of the town will increase noticeably. It is therefore important to determine the noise level with the view to ascertain if the noise levels in the town conform to international permissible standards or not. The study will further ascertain the causes of high noise level in this area if it's applicable and offer solutions that will lead to the control of noise in the area.

MATERIALS AND METHODS

Location of the Study Area

The study area Abraka is in Ethiope East Local Government Area of Delta State, Nigeria. It is located in the southwestern end of Nigeria called the Niger-Delta Area. It lies within latitude 5°51^{1}N and 5°54^{1}N and longitudes 6°08^{1}E and 6°12^{1}E. It is bounded in the north by Ethiope River, the east by Obiaruku town-the administrative headquarter of Ukwuani Local Government Area, south by Orogun town in Ughelli North Local Government Area and west by Eku in Ethiope East Local Government Area. The town has a poor road network with the only tarred road being the Old Abraka/Agbor Road which has a link to the Sapele Agbor Express way through the Abraka Junction. All the other roads in Abraka are earth roads. Abraka is a community that houses the only University in the State known as the Delta State University. It has in recent time experienced a lot of developmental activities which includes construction of roads within the campus, building projects by government and individuals as well as both commercial and social activities. The spade of development have been so high and the human activities has increased tremendously giving rise to the need to ascertain the noise level of the area and to compare with acceptable standards.

Assessment of the Noise Level

The assessment of the noise level of Abraka town was carried out using a Pioneer 65 Noise Dosimeter. In the course of this study, ten locations were carefully mapped out for the measurements

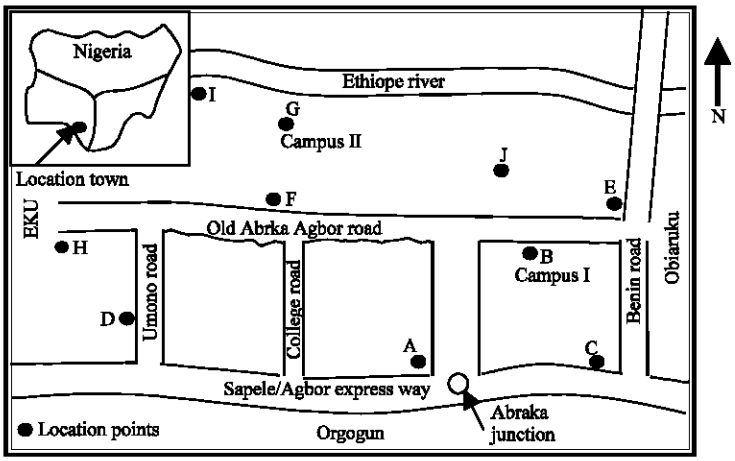

Fig. 1: Map of Abraka showing the study location

to give a good coverage of the town. Areas which are known to accommodate high concentration of activities were also preferred in the choice of the locations. The locations where measurements were carried out are as shown in Fig. 1 and are labeled from A to J. The noise dosimeter was set to A weighting network which is the most common frequency weighting in current use in environmental and industrial studies. This A-weighting network conforms approximately to the response of the human ear. The instrument was set on automatic mode to run continuously for thirty minutes at every instance after which the instrument calculates the average noise of that location and report it as average noise level or equivalent noise level. For the purpose of this study, this recording was done ten times in each of the locations and the mean of the equivalent noise level noted and recorded for the 10 different locations. This was done for day time as well as for night time measurements. The day time measurements were made between the hours of 9.00 am and 6.00 pm while the night measurements were carried out between the hours of 8.00 pm and 11.30 pm.

Pollution Standard Index

The use of the Pollution Standard Index is applied to better appreciate the environmental noise position of the area. The modelling is typically based on a function α, where α is ascribed a number indicating very good quality, good quality, satisfactory quality, unhealthy quality and hazardous. This modelling method takes the weighted values of individual pollutant parameters measured at spatial points and then compares this to the single number in the quality standards. This have been done and presented as Table 3. The attraction of this model is that the number α is a non-dimensional number.

According to Kiely (1998), the non-dimensional equation can be obtained as:

$$\alpha = \alpha_i + \frac{\alpha_{i+1} - \alpha_i}{C_{i+1} - C_i}(C - C_I) \quad (1)$$

Where:

α = Pollutant Standard Index
C = Corresponding pollutant concentration
α_1 = Breakpoint PSI from one quality to another

RESULTS AND DISCUSSION

The results obtained in this study include the equivalent noise level and the peak noise level for day time as well as night time. This result is as shown in Table 1 for day time measurement while night time measurement is presented as Table 2. These were compared with the World Health Organisation (WHO) standard of 90 dB (WHO, 1996).

Equation 1 has been applied to the results of Table 1 and 2 and the obtained PSI values are presented as Table 3 and 4.

It is clear that the equivalent noise level for all the locations measured fell below the WHO maximum standard of 90 dB. However, Abraka junction, campus I and Umono street rank highest among the 10 locations and their values were close to the WHO permissible limit in the measurement of the Leq and hence the residence in these areas need to exercise precaution in order to prevent the noise level from increasing beyond the observed levels. The peak measurement for the locations obtained have values close to the WHO permissible limit except Abraka Junction that recorded 100 dB. The day time noise level in Abraka falls within the safe noise zone as the values falls below 300 PSI except for Abraka Junction that recorded a PSI of 350 and hence it is unhealthy to stay in this location for a long time. The reason for the high peak at the Abraka Junction is because it is a spot

Table 1: Day time noise measurements carried out in Abraka

Locations	Symbol	Equivalent noise level (Leq) (dB)	Leq against WHO standard (%)	Peak noise level (dB)	Peak against WHO standard (dB) (%)
Abraka junction	A	80.8	90	100.0	11
Abraka express	B	76.0	84	82.6	92
Campus 1	C	79.8	89	86.1	96
Umono street	D	79.6	88	82.0	91
Urhuoka area	E	72.2	80	78.7	87
Campus II gate	F	73.1	81	84.9	93
Campus II	G	70.0	78	86.2	96
Grammar school area	H	74.8	83	84.6	94
Beach land	I	69.8	78	81.4	90
Ekrejeta	J	75.4	84	80.8	90
Mean		75.2	84	85.7	95

Table 2: Night time noise measurements carried out in Abraka

Locations	Symbol	Equivalent noise level (Leq) (dB)	Leq against WHO standard (%)	Peak noise level (dB)	Peak against WHO standard (dB) (%)
Abraka junction	A	70.1	78	78.3	87
Abraka express	B	64.8	72	66.8	74
Campus 1	C	66.1	73	69.1	77
Umono street	D	73.0	81	76.8	85
Urhuoka area	E	61.2	68	68.1	76
Campus II gate	F	59.7	66	65.2	72
Campus II	G	57.8	64	60.7	67
Grammar school area	H	61.1	68	67.4	75
Beach land	I	60.4	67	65.1	72
Ekrejeta	J	71.6	80	74.2	82
Mean		64.6	72	69.2	77

Table 3: Standard index for day and night time noise measurement

PSI values	Description	Day time equivalent noise level (dBA)	Night time equivalent noise level (dBA)
<100	Very good quality	<30	<20
100	Good quality	50	35
200	Satisfactory	70	35
300	Unhealthy	90	65
400	Hazardous	110	80
500	Seriously hazardous	130	95

Table 4: Calculated values of psi for the different locations

	Day time PSI values		Night time PSI values	
Locations	Leq (dB)	Peak noise (dB)	Leq (dB)	Peak noise (dB)
Abraka junction	254	350	334	389
Abraka express	230	263	299	312
Campus 1	249	281	307	327
Umono street	248	260	353	380
Urhuoka area	211	244	275	321
Campus II gate	216	275	265	301
Campus II	200	281	252	271
Grammar school area	224	273	274	316
Beach land	199	257	269	301
Ekrejeta	227	254	344	361

where all those coming into the town or leaving the town will obviously pass through. Even those having no business to do in Abraka but using the expressway will still have to pass though this junction. This junction also accommodates a lot of commercial and economic activities.

The measurements carried out during the night show that four of the locations have their noise levels exceeding the 65 dB recommended for night times by the National Environmental Board (NEB, 1976). These locations are Abraka junction, Campus I, Umono Street and Ekrejeta area and are therefore unhealthy at night. Abraka express road is at the threshold between healthy and unhealthy state. The rest locations are healthy and safe to live in at night. For night time peak measurement, only campus 2 have values less than the NEB maximum recommended value. All the other locations shows a peak higher than the permissible limit. This means that as a university town, doing research and concentrating in academic activities in about half of the town at night is impossible while the other half is prone to noisy distractions. The only free area in the town is Campus 2. This could be the reason while most students in town prefer to read inside the campus. The basic reason for the relatively high value of noise greater than 65 dB is largely due to the use of diesel generating set installed almost at every compound due to the epileptic supply of electricity to the community by the Power Holden Company of Nigeria. This implies that once the public power supply is improved upon, the noise level will reduce automatically. The use of a single entrance root to the town through the Abraka Junction have contributed to the high day time peak value obtained from this location. This is as a result of automobile congestion sometimes at this junction. It is recommended that road networks be opened up in Abraka to decongest the traffic buildup at this junction.

CONCLUSION

Noise measurements have been carried out at ten major locations in Abraka in Delta State, Nigeria. The equivalent noise level and the peak noise level for both day and night time measurements were analysed and compared to the World Health Organization and the National Environmental Board standards (WHO, 1996; NEB, 1976).

On the average, the day time equivalent noise level and peak noise level for Abraka were found to be 75.2 and 85.7 dB, respectively. These are lower than the WHO maximum permissible limit hence Abraka could be said to be quiet during the day. For night time measurements, the equivalent noise level was determined as 64.6 dB while the peak is 69.2 dB. This show that the night time noise level is unconducive as the equivalent value is at the threshold of the maximum permissible limit of 65 dB for night time (NEB, 1976). The night peak is greater than 65 dB hence the night could be said to be unconducive for good sleep, for research work and other academic activities. This is a result of rapid increase in the use of electricity generating sets at night due to PHCN inefficiency and insufficient supply of electricity. Also, the increase in automobiles and commercial motorcycles users need to be controlled as they are capable of increasing the noise level in Abraka since the town is a fast growing one.

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