Background Noise and Radiation Levels' Perturbation within Rumuodara Residential Area, Port Harcourt, Nigeria.

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The environmental assessment of the levels of background radiation and noise perturbation within the Rumuodara residential area of Port Harcourt, Nigeria has been carried out using a nuclear radiation monitor (Radalert-100) and a digital noise level meter (CEL 524 model) set on the A weighting scale respectively. The results obtained showed that the average exposure rate during the active period ranged between 11.4 to 16.0 µR/hr with an area mean exposure rate of 13.8 µR/hr whereas, the area mean background exposure rate recorded was 11.6 µR/hr. This result indicates an area mean deviation of 18.9% from normal background radiation exposure. Also, the average noise level measured during the active period ranged between 61.0 to 82.0 dB(A) with an area mean noise level of 73.2 dB(A) whereas, the area mean background noise level recorded was 48.5 dB(A). This result indicates an area mean deviation of 50.9% from normal background noise level. These results indicate radiation exposure rate above normal background radiation. Also, the noise levels recorded during the active period were greater than the background noise level and the World Health Organization limits set for speech interference, sleep disturbance and serious annoyance. Though the results obtained did not show that the use of power generating sets within the surveyed area can bring about deleterious health effect such as hearing impairment, their usage constitutes environmental pollution since this has brought about instability in the normal environmental status of the area.

Keywords: environmental, noise, radiation, perturbation, residential

1. INTRODUCTION

The quest for stable power in Nigeria has been on the increase since there cannot be any meaningful economic growth in a nation without constant electricity. However, this dream has been a mirage and has resulted to individuals and families providing their energy needs through the use of power generating sets. These power generating sets are owned by virtually all individuals within their various homes and are put on at will whenever they have need for electricity consumption. The frequent use of generators most times, especially without proper servicing has reduced them to major sources of noise and fumes. The only way to monitor precisely an individual's exposure to noise from such a source is by the use of either a sound-level meter or a dosimeter.

Noise is detrimental to health in several respects, such as, hearing impairment, sleep disturbance, cardiovascular effects, psychophysiologic effects, psychiatric symptoms, and

fetal development [1]. The major cause of hearing loss is occupational exposure, although other sources of noise, particularly recreational noise, may produce significant deficits. Studies suggest that children seem to be more vulnerable than adults to noise induced hearing impairment [2]. Even ear-safe sound levels can cause non auditory health effects if they chronically interfere with recreational activities such as sleep and relaxation, if they disturb communication and speech intelligibility, or if they interfere with mental tasks that require a high degree of attention and concentration [3]. The signal--noise ratio (in terms of signal processing) should be at least 10 dB(A) to ensure undisturbed communication. High levels of classroom noise have been shown to affect cognitive performance [4]. Reading and memory have been reported to be impaired in school children who were exposed to high levels of aircraft noise [5]. Furthermore, studies have shown that neighborhood noise (consisting of noise from neighboring apartments, as well as noise within one's own apartment or home) can cause significant irritation and noise stress within people, due to the great deal of time people spend within their residences. This can result in an increased risk of depression and psychological disorders [6], migraines, and even emotional stress [7].

Outside the noise generated from the use of power generating sets, fumes from generators constitute some form of environmental hazard. The International Agency for Research on Cancer [8], an affiliate of the World Health Organization (WHO) has classified diesel engine exhaust as carcinogenic to humans based on sufficient evidence that exposure is associated with an increased risk for lung cancer. The World Health Organization has declared that diesel fumes cause lung cancer and experts said they were more carcinogenic than second- hand cigarette smoke [9]. Carbon monoxide (CO) is formed as a result of incomplete combustion of the fuel in generators and this produces carbon-14 which is a radioactive isotope of carbon that decays into nitrogen-14 through beta decay. Fossil fuels such as petroleum or coal deposits often contain trace amounts of carbon-14 and can release ionizing particles to the environment through the exhaust compartment of gasoline fired generators during combustion [10].

The surveyed area in this research work serves as residential quarters for so many individuals who either do white collar jobs or are business people. It has been observed that most of the residential compounds house so many buildings with so many occupants. These inhabitants most often provide their energy needs through the use of electric generators between the hours of 6.00 pm and 12.00am, and a visit to any of these residential quarters within this period constitutes a worrisome mood as the place is usually found to be very noisy, very disturbing and sometimes smoky. This research work is therefore an attempt to evaluate the ambient noise and radiation levels of the surveyed area to see the extent of environmental perturbation in terms of noise and radiation.

2. METHODOLOGY

This study was conducted between January and February, 2012 around Rumuodara residential area, Port Harcourt. The study area is located within the heart beat of Port

Harcourt urban in Obio Akpor Local Government Area of Rivers state, Nigeria. Twenty two residential compounds (fenced round with brick walls) were selected for the survey.

Two methods of measurements were adopted for this survey. Firstly, an *in situ* approach of background radiation measurement using a nuclear radiation monitor (Radalert-100) and secondly, noise level measurement using precision digital noise level meter (CEL 524 model) set on the A weighting scale. For the background radiation measurement, the Radalert- 100 was set to the total-count-mode and the counting taken for a timed period of 10 minutes with the end window facing the environment under inspection. This was to enable the detector detect the alpha and low energy beta and gamma radiations. Also, a timed total count was preferable in determining the average counts per minute over a period of time since the number of counts detected by the Radalert-100 varies from minute to minute due to the spontaneous nature of radioactivity [11]. This measurement was done between the hours of 6.00 pm to 12 am, when the generators are usually on- referred to as Active Radiation Exposure and then between the hours of 3.00 am to 5.00 am, when the generators are usually off- referred to as Background Radiation Exposure. The percentage (%) deviation from background radiation (PR) was computed using the equation;

$$PR = [(AR - BR)/BR] \times 100 \quad (1),$$

where AR = Active Radiation Exposure and BR = Background Radiation Exposure.

To take the noise level measurements, the digital noise level meter was held at arm's length at the ear height estimated to be about 1.2 and 1.5 metres above the ground [12]. The readings were taken on SLOW response rate since noise level measurements should preferably be taken on SLOW response. The response rate is the time period over which the instrument averages the sound level before displaying it on the readout [12]. This measurement was done between the hours of 6.00 pm to 12 am, when the generators are usually on- referred to as Active Noise Level and then between the hours of 3.00 am to 5.00 am, when the generators are usually off- referred to as Background Noise Level. The percentage (%) deviation from background noise (PB) was computed using the equation;

$$PB = [(ANL - BNL)/BNL] \times 100 \quad (2),$$

where ANL = Active noise level and BNL = Background Noise Level.

3. RESULTS AND DISCUSSIONS

The results of radiation exposure rate measured within the surveyed area have been presented in Table 1. The results show that the average exposure rate during the active period ranged between 11.4 to 16.0 µR/hr with an area mean exposure rate of 13.8 µR/hr whereas, the area mean background exposure rate recorded was 11.6 µR/hr. This result indicates an area mean deviation of 18.9% from normal background radiation exposure within the surveyed area. Also, most of the recorded exposure rates were above the

normal background ionization radiation of between 11μR/hr to 13μR/hr as have been recorded by previous researchers [13, 14] within the Niger Delta Area of Nigeria where this study area falls. This deviation in radiation exposure could be majorly attributed to the formation of carbon monoxide (CO) as a result of incomplete combustion of the fuel in generators. Carbon-14 which is a radioactive isotope of carbon decays into Nitrogen-14 through beta decay and fossil fuels, such as petroleum or coal deposits often contain trace amounts of carbon-14 and can release ionizing particles to the environment through the exhaust compartment of gasoline fired generators during combustion [10]

Area ID	Estimated No. of Generators		Average Radiation Exposure Rate (μR/hr)		Deviation from Background Radiation (%)
	0.65 KVA	2.5 KVA	Active	Background	
A	4	1	14.0	12.0	16.7
B	2	2	14.0	12.0	16.7
C	2	2	15.8	11.6	36.2
D	-	2	13.4	11.6	15.5
E	1	1	13.2	11.2	17.9
F	1	3	13.2	10.2	29.4
G	-	2	13.8	12.0	15.0
H	4	1	11.4	11.0	3.6
I	2	-	11.4	10.0	14.0
J	2	-	13.2	13.2	0.0
K	-	3	14.6	12.0	21.7
L	3	-	13.4	12.2	9.8
M	-	2	14.4	10.6	35.8
N	-	4	14.0	12.0	16.7
O	1	3	13.6	10.6	28.3
P	-	2	14.6	10.2	43.1
Q	2	2	14.4	13.0	10.8
R	2	2	14.6	13.2	10.6
S	1	1	13.2	10.4	26.9
T	-	2	14.0	11.4	22.8
U	-	2	13.6	13.2	3.0
V	4	-	16.0	10.6	50.9
Area Mean			13.8	11.6	18.9

Table 1 Average active radiation level measurements compared with background radiation within the surveyed area

The results of the average noise level measured within the surveyed area have been presented in Table 2. Also, the bar chart comparing the active and background noise level measurements with [15] guideline values for community noise has been presented in Fig 1. The results show that the average noise level measured during the active period ranged

between 61.0 to 82.0 dB(A) with an area mean noise level of 73.2 dB(A) whereas, the area mean background noise level recorded was 48.5 dB(A). This result indicates an area mean deviation of 50.9% from normal background noise level within the surveyed area. This level of deviation is high and according to [16], could bring about normal speech interference which could lead to a number of personal disabilities, handicaps, and behavioral changes which may include problems with concentration, fatigue, uncertainty, lack of self confidence, irritation, misunderstandings, disturbed interpersonal relationships, and disturbed sleep. When sleep disruption becomes chronic, the results are mood changes, decrements in performance, and other long-term effects on health and well-being. The bar chart of Fig 1 shows that the minimum, area mean and maximum noise levels recorded during the active period were higher than the WHO [15] limit set for speech interference [35 dB(A)], sleep disturbance [45 dB(A)] and serious annoyance [55 dB(A)] but less than the limit set for hearing impairment [85 dB(A)].

Area ID	Estimated No. of Generators		Average Noise Level (dBA)		Deviation from Background Noise (%)
	0.65 KVA	2.5 KVA	Active	Background	
A	4	1	71.0	49.0	44.7
B	2	2	79.0	55.0	43.6
C	2	2	77.0	59.0	30.5
D	-	2	68.0	48.0	41.7
E	1	1	70.0	49.0	42.9
F	1	3	74.0	48.0	54.2
G	-	2	72.0	49.0	46.9
H	4	1	74.0	50.0	48.0
I	2	-	72.0	48.0	50.0
J	2	-	72.0	48.0	50.0
K	-	3	77.0	49.0	57.1
L	3	-	69.0	51.0	35.3
M	-	2	73.0	48.0	52.1
N	-	4	82.0	46.0	78.3
O	1	3	72.0	47.0	53.2
P	-	2	78.0	42.0	85.7
Q	2	2	74.0	40.0	85.0
R	2	2	78.0	52.0	50.0
S	1	1	61.0	48.0	27.1
T	-	2	71.0	50.0	42.0
U	-	2	72.0	50.0	44.0
V	4	-	75.0	42.0	78.6
Area Mean			73.2	48.5	50.9

Table 2 Average active noise level measurements compared with background noise within the surveyed area

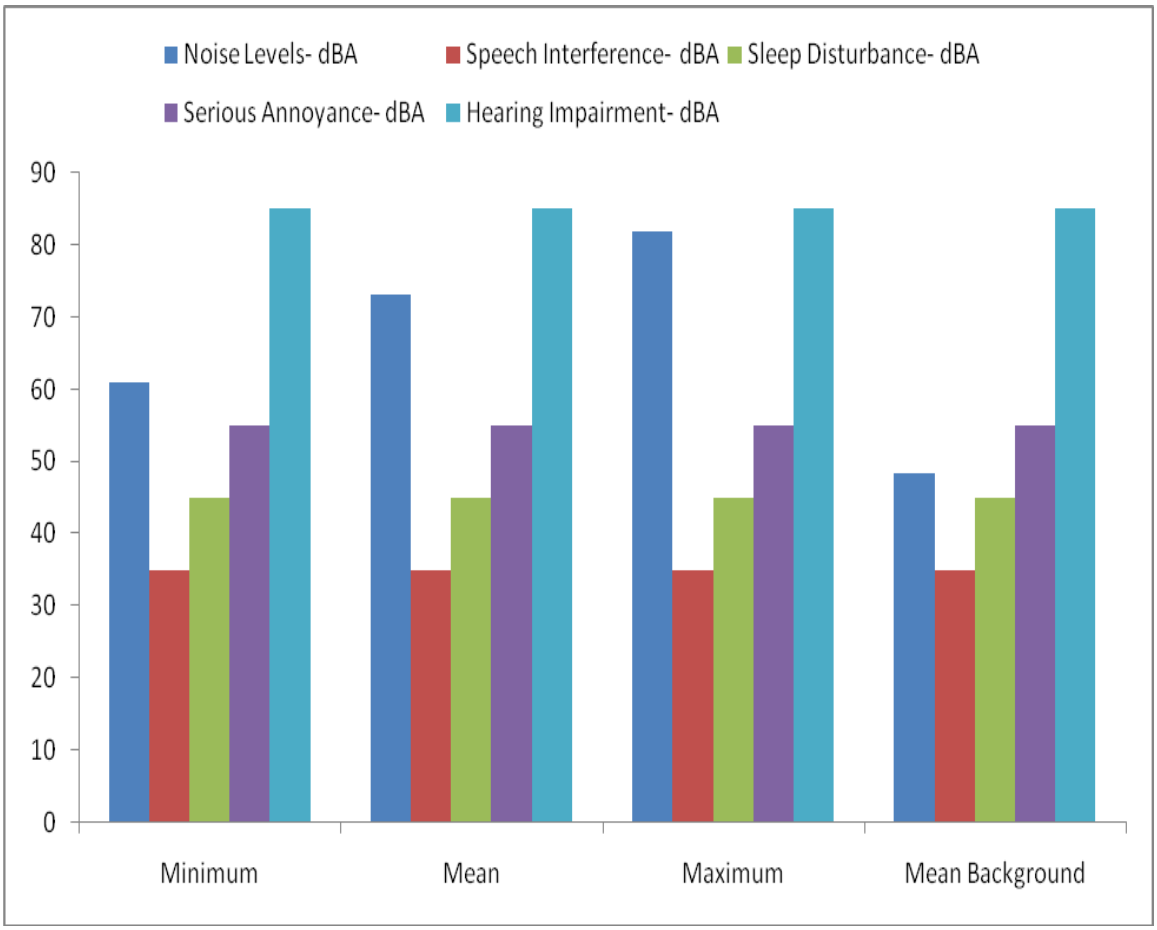

Fig 1 Active and background noise level measurements compared with (WHO, 1999) guideline values for community noise

4. CONCLUSIONS

The results obtained for the surveyed area indicate radiation exposure rate above normal background radiation. Also, the noise levels recorded during the active period were greater than the background noise level and the [15] limits set for speech interference, sleep disturbance and serious annoyance. Although the results obtained did not show that the use of power generating sets within the surveyed area can bring about deleterious health effect such as hearing impairment, their usage constitute environmental pollution since this has brought about instability in the normal environmental status of the area.

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