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EVALUATION OF NOISE POLLUTION LEVEL IN WARRI REFINING AND PETROCHEMICAL COMPANY (WRPC)], WARRI, NIGERIA.

Abstract

Evaluation of noise pollution level was done within the Warri Refining and Petrochemical Company (WRPC) complex with the aim of comparing the noise level data and recommended acceptable standards. A total of six (6) locations within the study area designated as Gas Turbine (GT), Managing Director (MD), Petrochemical Utility (PU) and Fluid Catalytic (FC) were selected. A sound level meter called the Sper Scientific 840013 Model was used to measure the sound/noise levels both in the morning and evening daily for 23 days running. Results showed that the highest noise level measured in the morning was recorded at Gas Turbine (104.1dBA), while the lowest morning reading was recorded at MD's Block (41.9dBA).The highest noise level measured in the afternoon was at Gas Turbine (100dBA), while the lowest afternoon noise level was recorded at MD's Block (37.6dBA). The highest noise level reading all through the sites was recorded in the afternoon at Gas Turbine (104.1dBA), whereas the lowest noise level reading was recorded in afternoon at MD's Block (37.6dBA).The highest and lowest mean average noise levels were 96.5dBA and 48.7dBA at site Gas Turbine & MD's Block respectively. It was concluded that the noise levels and mean average noise level in all the sites were above the FEPA, OSHA and NIOSH recommended permissible limits which could induce adverse hearing loss and other psychological effects on the workers, security guards, shop owners and passers-by respectively.

Key words: Pollution, noise, permissible limits, recommended standards.

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Introduction

Noise is defined as unwanted sound that creates annoyance and interferes in conversation, disturbs sleep and teaching-learning process; reduce work efficiency, causing stress and challenge to public health and it is silent killer problem growing day-by-day. (Debnath *et. al.*, 2012). Noise pollution contributes significantly to environmental degradation which seriously threatens human and other terrestrial lives and noise pollution ranks third behind air and water pollution. Common sources of environmental noise pollution includes construction and public works, road automobiles such as cars, lorries, trucks and motor cycles, neighborhood activities, road, railway and air traffic. Noise from industrial work places constitute industrial noise pollution and it is generally observed and agreed by many that the trend of noise pollution is on the increase in severity and magnitude due to population growth, technological advancement and urbanization.

Noise and vibration are both fluctuations in the pressure of air (or other media) which affect the human body. Vibrations that are detected by the human ear are classified as sound. We use the term 'noise' to indicate unwanted sound. Noise and vibration can harm workers when they occur at high levels, or continue for a long time. When sound signals possess properties or characteristics harmful to the growth and development of the listener, it can simply be classified as noise (Kalu, Egaga, Olayi & Ewa, 2010). Noise is an unpleasant sound. It is an erratic, inharmonious, meaningless or statistically random variation in sound pressure. Noise is a noxious agent with pervasive effect on human hearing or health. Noise has adverse effects on the psychological, physical and social wellbeing of man and can lead to permanent or temporary hearing loss, acoustic trauma, tympanic membrane perforation and ossicular chain disarticulation can result from excessive noise/blast (Hessel, 2000; Ahmed et al.,, 2001). Noise induced hearing loss is attributed to prolonged exposure to noise beyond the physiological recovery ad reversible point of the hearing apparatus. Noise pollution has been proven to aggravate hypertension and cardiopulmonary diseases associated with the increased release of cortisol and cathecolamine, sleep disturbance and anxiety disorders Agarwal and Swami, 2009;(Miedema,2007)

Environmental noise has been doubling over the years now. Noise is classified as industrial, transport and neighborhood noise. Major cities of the world are now facing problem of rise in noise pollution due to very high population, transportation, congestion and associated commercial and industrial activities (Chauhan, 2008). The increasing number of vehicles, musical instruments, small scale industries, and urbanization and human activities are the main source of noise pollution (Gangwa r*et. al.*, 2006).

Keerthana *et al.*,(2013) reported that besides the growing level of air and water pollution, road traffic noise pollution has been recognized rising as a new threat to the inhabitants of cities. The urban environmental quality of developing countries has been deteriorated by an unlimited increase of vehicles, infrastructure, and population. Consequently, the continuous increased intensity of traffic noise level due to the population has degraded urban quality of life. Road traffic noise is the big challenge for urban planners and environmental engineers to overcome road traffic noise in cities. Continuous high level of noise can cause serious stress on the auditory and non-auditory, and nervous system of the city dwellers. It is also leading cause of great annoyance for exposed population due to the poor conditions of engine, exhaust etc. In addition, there are various studies carried out on road traffic noise pollution, which cause severe health problems such as physical and psychological irritation, reduced human performance and actions, hypertension, heart problems, tiredness, headache and sore throat respectively. Noise is an unwanted sound; it causes social effects, feelings of disturbance, stress reactions, sleep disorders, some hormonal changes, increased blood pressure, increased risk of myocardial infarction, impairment of well-being and general quality of life. The effects of noise have been studied on human, animals, plants and buildings. Noise is a major factor that should be considered in the design and construction of new transport systems, as well as when improvements are made to existing systems (Abo-Qudais *et al.,* 2007). As such, there is an obvious need to measure and model noise pollution. Non-auditory physical health effects that are biologically plausible in relation to noise exposure and annoyance from noise exposure include changes in blood pressure, heart rate and levels of stress hormones. The biological mechanism linking noise to hypertension is thought to be mediated through sympathetic and endocrine stress response with subsequent acute changes in vascular tension.

Commonly employed way of sound measurement is the use of the sound metre that measures sound level pressure in noise pollution studies for the quantification of different classes of noise including industrial, aircraft and other environmental forms (Anomodharan, 2013).

Some of the ways to control noise pollution includes; Control at Receiver's End, Suppression of Noise at Source, Acoustic Zoning, and Sound Insulation at Construction Stages, Planting of Trees and Legislative Measures.

From the above discussion, it is evident that noise is not merely a nuisance but is a serious environmental problem and a health hazard.

Like all other pollutions, noise pollution needs to be controlled by measures which will maintain the acceptable levels of noise pollution for human beings and buildings as indicated.

As cited in Eboma,(2016), the generally accepted standard to minimize hearing risk is based on an exposure of 90 dBA for a maximum limit of eight hours per day, followed by at least ten hours of recovery time at 65 dBA or lower. The recommended maximum noise level near residential area, hospitals and educational establishments is 65 dBA. Onuu (as cited in Ochuko, 2013) who observed that all those in charge of the development of the city will need to know the area where the equivalent noise level due to road traffic noise is low so that schools and hospitals can be sited there. Noise experts, researchers and other environmentalist will need to know the noise level in an already existing area before they can assess the impact of environmental noise and control same in such an area.

Methodology

3.1 Description of Study Area

Warri Refining and Petrochemical Company (WRPC) was incorporated as a limited liability company on the 3rd of November 1988 after the merger of the then Warri Refinery and the Ekpan Petrochemical Plants.

Plate 1: A view of the WRPC Plant

The Warri Refinery, the first Nigerian government wholly owned refinery was commissioned in 1978. It was built to process 100,000 barrels of crude oil per day but was later de-bottlenecked to process 125,000 barrels per day in 1987. It was essentially built to add value to some of the refinery by-products such as propylene rich stock and decant oil.

The operability of these plants is contingent on the availability and reliability of the following facilities:

- Electric Power and Utilities: These are produced within WRPC and are critical to the

- steady processing of crude oil into petroleum and petrochemical products. They include among others steam, electricity, various types of water quality such as (firewater, process water, portable water, boiler feed water and cooling water), instrument and plant air and nitrogen.

  The company has a design potential to generate 125MW of electrical power from 3 Gas Turbine Generators and 3 Steam Turbo-generators (STGs). Design capacities of the facilities are:

- 2 ´ 15 MW extraction/condensing STG (STG-1 &2),
- 1 ´ 15 MW condensing STG (STG 3),
- 1 ´ 20 MW GTG located in the petrochemical facilities,
- 2 ´ 30 MW GTGs with 55 tonnes/hr waste heat boilers.

Some of the utility generating facilities within WRPC include:

- Water treatment plants
- Two Nitrogen Plants,
- Compressed air systems and Refinery and
- Petrochemical Effluent Water Treatment Plants.

It is located in Ekpan, Warri – Delta State, Nigeria.

Table 2: Co-ordinates of the study areas:

S/N	LOCATION / POINTS	COORDINATES	TIME	DATE
1.	PETROCHEMICAL UTILITY (PC UTILITY)	**5^{o} 34.2237’ N** **5^{o} 43.2383’ E**	0730HRS	19/11/2019
2.	REFORMING UNIT	**5^{o} 34.0518’ N** **5^{o} 43.9354’ E**	0740HRS	19/11/2019
3.	TOPPING UNIT	**5^{o} 34.0516’ N** **5^{o} 42.9354’ E**	0745HRS	19/11/2019
4.	FLUID CATALYTIC CRACKING UNIT (FCC)	**5^{o} 34.0583’ N** **5^{o} 42.9313’ E**	0749HRS	19/11/2019
5.	GAS TURBINE 1 AND 2 (GT 1 & 2)	**5^{o} 34.2238’ N** **5^{o} 43.3381’ E**	0754HRS	19/11/2019
6.	MANAGING DIRECTORS’ BLOCK (MD’s BLOCK)	**5^{o} 34.0783’ N** **5^{o} 43.2169’ E**	0807HRS	19/11/2019

A Sound Level Meter (SLM) was used to measure the noise level within Warri Refining and Petrochemical Company (WRPC) premises. The sound level meter were turned on and held comfortably in hand and pointed at the suspected noise source. The measurements were recorded at intervals of 30seconds for duration of 30minutes. The procedure was carried out in the morning (07:15-08:45am) and afternoon (15:45-16:15pm) Mondays to Fridays for a period of 23days.

3.2. Instruments for Noise Measurement

In situations where the accuracy of sound level measurements must be recorded and/or verified, it is necessary to calibrate the measurement instrument both and after the measurements are made. Software-based electro acoustic measurement systems that feature a SLM function also need to be calibrated if used for absolute Sound Pressure Level (SPL) measurements.

An acoustic calibrator provides the standard 94 dB or 114 dB (or both) kHz test tone and should also include the proper size opening or adaptor rings for the microphone(s) you intend to employ.

Recently there have been several acoustic calibrators introduced that provide very good accuracy for sound system and acoustics measurement. Sound Level Meter (SLM) may also be calibrated with a piston phone, but the cost of this device is prohibitively high and the high level of accuracy it provides is not practical for most general sound system related measurements.

The instrument used was the Sound Level Meter (SLM) of Sper Scientific Model 840013 Data logging Sound Meter featuring large LCD display.

Plate 1: Sound Level Meter - Model 840013, Decibel (Db) low range (dB) 30 / high range (dB) 130, Resolution (dB) 0.1, Accuracy ±1.5 dB, Response: fast (125 millisecond), slow (1 second) and Battery Type: 9v battery (1).

Alongside with the sound level meter, a stopwatch was used to determine the time the measurements were taken for accuracy.

3.3 Method for Data Analysis

Collected data was evaluated using the Statistical Package for the Social Science (SPSS) 16 and results were presented in simple descriptive figures and tables. The standard reference for analyzing the level of severity of the values obtained was based on the acceptable safety environmental noise levels of the WHO and FEPA. The following procedure were employed for the results analysis

- Data was tabulated/average statistically determined.
- A bar chart was used to show variations / similarities in data analyzed.
- Comparison to standard exposure tables to make deductions.
- A weighted average was calculated.

3.4 Basic Calculations

The personal averages and mean averages were calculated for each site using the formulas below:

Average = $\frac{Morning\ \ Reading\ +Afaternoon\ \ Reading}{Two} \ldots\ldots\ldots\ldots\ldots equation\ 1A$

Mean Average = $\frac{Sum\ \ of\ daily\ average\ \ reading}{Total\ number\ \ of\ days} \ldots\ldots\ldots\ldots\ldots equation\ 1B$

Table 1: Noise exposure limits for Nigeria (FEPA1991)

Duration Per Day (Hours).	Permissible Exposure Limits (dBA)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Results

The measured noise levels at the Six (6) sites in WRPC are presented in table 3.. The corresponding averages in the same table 3 are calculated for (morning and afternoon) using (equation 1A) above.

The noise measured indicated values in the morning ranging from 37.6 dBA in MD's Block and 104.1 dBA at the Gas Turbine; the highest noise was measured in the morning at the Gas Turbine (104.1 dBA) while the lowest was measured in the afternoon at MD's Block (37.6 dBA).

Also, the mean average was computed using the formula in equation 1B above and the mean average of 96.5 dbA was recorded at Gas Turbine whereas the lowest of 48.7 dBA was at MD's Block.

Table 2: Mean Noise level values for MD's Block at different times of the day

	LOCATION	MD's BLOCK Max. Allowable Limit (65 db.)		
	PERIOD	M	N	Average
S/N	DATE			
1	23/09/2019	46.1	40.3	43.2
2	24/09/2019	53.4	43.4	48.4
3	25/09/2019	63.7	41	52.4
4	26/09/2019	66.3	57.5	61.9
5	27/09/2019	63.6	61	62.3
6	30/09/2019	71.2	63	67.1

7	1/10/2019	48.4	40.1	44.3
8	2/10/2019	50	47.4	48.7
9	3/10/2019	50	45	47.5
10	4/10/2019	50.3	47.3	48.8
11	7/10/2019	48	40	44.0
12	8/10/2019	48.9	40	44.5
13	9/10/2019	50.8	49.5	50.2
14	10/10/2019	53.2	48.9	51.1
15	11/10/2019	50	45.5	47.8
16	14/10/2019	51.4	40	45.7
17	15/10/2019	50.1	40.1	45.1
18	16/10/2019	53.2	42.2	47.7
19	17/10/2019	45.9	46	46.0
20	18/10/2019	50.3	39.5	44.9
21	21/10/2019	45.9	37.6	41.8
22	22/10/2019	50.7	40.4	45.6
23	23/10/2019	41.9	39.8	40.9
TOTAL AVERAGE		**1119.4**		
No. of Days		**23**		
MEAN AVERAGE		**48.7**		

Table 3: Mean noise level values for PC Utility at different times of the day

	LOCATION	PC UTILITY Max. Allowable Limit (85 db.)		
	PERIOD	M	N	Average
S/N	DATE			
1	23/09/2019	71.2	70.5	70.9
2	24/09/2019	73.5	70.8	72.2
3	25/09/2019	75.8	74.5	75.2
4	26/09/2019	89.1	78.6	83.9
5	27/09/2019	88.9	86.9	87.9
6	30/09/2019	88.3	80.4	84.4
7	1/10/2019	87.8	88.1	88.0
8	2/10/2019	89.4	90.6	90.0
9	3/10/2019	96.2	89.5	92.9
10	4/10/2019	90.1	88.9	89.5
11	7/10/2019	88.3	89	88.7
12	8/10/2019	93.8	99.2	96.5
13	9/10/2019	89.4	90	89.7
14	10/10/2019	99.4	98.1	98.8
15	11/10/2019	98.6	96.4	97.5
16	14/10/2019	73	70.9	72.0
17	15/10/2019	70.5	71.8	71.2
18	16/10/2019	71.9	80	76.0
19	17/10/2019	79	83.5	81.3
20	18/10/2019	70.8	87.1	79.0
21	21/10/2019	89.3	85	87.2
22	22/10/2019	80.1	79.7	79.9
23	23/10/2019	87.4	78.9	83.2
TOTAL AVERAGE		**1935.1**		

No. of Days	23
MEAN AVERAGE	84.1

Table 4: Meann noise level values for Gas Turbine at different times of the day

	LOCATION	GAS TURBINE Max. Allowable Limit (85 db.)		
	PERIOD	M	N	Average
S/N	DATE			
1	23/09/2019	98.7	97.9	98.3
2	24/09/2019	100.3	90	95.2
3	25/09/2019	103.6	93.7	98.7
4	26/09/2019	103.7	91.9	97.8
5	27/09/2019	99.8	90.7	95.3
6	30/09/2019	99.1	89.9	94.5
7	1/10/2019	104	90	97.0
8	2/10/2019	100.1	99.7	99.9
9	3/10/2019	100.3	97	98.7
10	4/10/2019	99.8	89.6	94.7
11	7/10/2019	101.5	99.5	100.5
12	8/10/2019	100.2	97.9	99.1
13	9/10/2019	98.7	89.1	93.9
14	10/10/2019	99.9	90.2	95.1
15	11/10/2019	101.2	100	100.6
16	14/10/2019	104.1	99	101.6
17	15/10/2019	100	89.9	95.0
18	16/10/2019	99.8	89.8	94.8
19	17/10/2019	94.6	90.6	92.6
20	18/10/2019	101.1	98	99.6
21	21/10/2019	100.2	91.3	95.8
22	22/10/2019	94.3	89.6	92.0
23	23/10/2019	90	89.8	89.9
TOTAL AVERAGE		2220.1		
No. of Days		23		

MEAN AVERAGE	96.5

Table 5: Mean noise level values for reforming unit at different times of the day

	LOCATION	REFORMING UNIT Max. Allowable Limit (85 db.)		
	PERIOD	M	N	Average
S/N	DATE			
1	23/09/2019	60.5	62.2	61.4
2	24/09/2019	58.5	55.3	56.9
3	25/09/2019	54.6	50.6	52.6
4	26/09/2019	59.4	50.3	54.9
5	27/09/2019	57.4	59	58.2
6	30/09/2019	74.5	70.9	72.7
7	1/10/2019	65.5	61.2	63.4
8	2/10/2019	63.1	57.7	60.4
9	3/10/2019	53.1	50	51.6
10	4/10/2019	58	55	56.5
11	7/10/2019	55.3	51.1	53.2
12	8/10/2019	53.5	60.3	56.9
13	9/10/2019	55.8	54.7	55.3
14	10/10/2019	58.9	51.4	55.2
15	11/10/2019	51.6	50.7	51.2
16	14/10/2019	56.3	45.4	50.9
17	15/10/2019	59.5	47.1	53.3
18	16/10/2019	51.3	50	50.7
19	17/10/2019	47.8	47.9	47.9
20	18/10/2019	49.8	45.4	47.6
21	21/10/2019	59.7	60.7	60.2
22	22/10/2019	55.4	56	55.7
23	23/10/2019	50.6	50	50.3
TOTAL AVERAGE		1276.5		
No. of Days		23		
MEAN AVERAGE		55.5		

Table 6: Mean noise level values for Topping Unit at different times of the day

	LOCATION	TOPPING UNIT Max. Allowable Limit (85 db.)		
	PERIOD	M	N	Average
S/N	DATE			
1	23/09/2019	80.3	78.4	79.4
2	24/09/2019	55.1	57.6	56.4
3	25/09/2019	57	54.8	55.9
4	26/09/2019	57.7	52	54.9
5	27/09/2019	58.4	56.4	57.4
6	30/09/2019	66.6	64.9	65.8
7	1/10/2019	56	60.8	58.4
8	2/10/2019	59.5	53	56.3
9	3/10/2019	55	54.8	54.9
10	4/10/2019	56	56.1	56.1
11	7/10/2019	58.8	49.6	54.2
12	8/10/2019	51.3	50.3	50.8
13	9/10/2019	55.4	48.9	52.2
14	10/10/2019	63.7	47	55.4
15	11/10/2019	57.3	53.9	55.6
16	14/10/2019	57.2	50	53.6
17	15/10/2019	60.3	56.7	58.5
18	16/10/2019	55.2	48.9	52.1
19	17/10/2019	51.7	46.1	48.9
20	18/10/2019	54.8	60.1	57.5
21	21/10/2019	67.3	54.3	60.8
22	22/10/2019	53.9	49	51.5
23	23/10/2019	55.4	40.9	48.2
TOTAL AVERAGE		**1294.2**		
No. of Days		**23**		

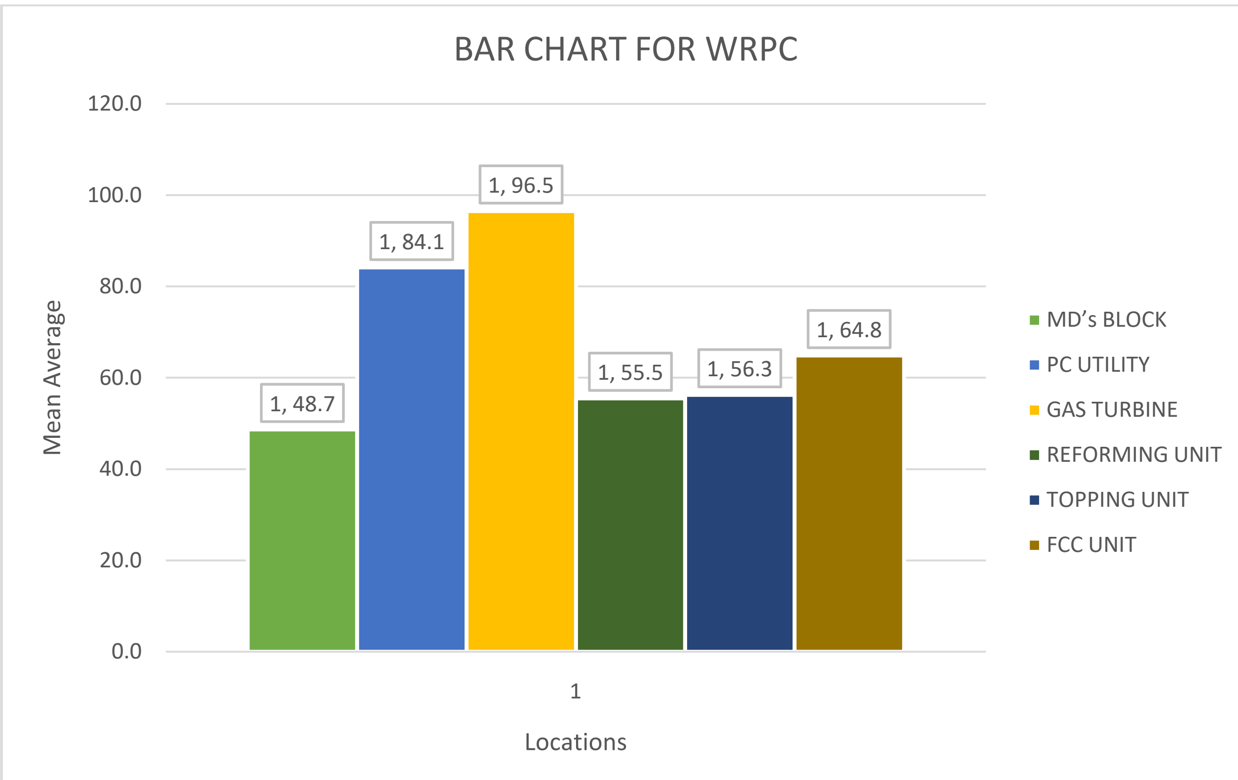
MEAN AVERAGE	56.3

Table 7: Mean noise level values for FCC Unit at different times of the day

	LOCATION	FCC UNIT Max. Allowable Limit (85 db.)		
	PERIOD	M	N	Average
S/N	DATE			
1	23/09/2019	83.5	81	82.3
2	24/09/2019	68	65.8	66.9
3	25/09/2019	61.3	59.1	60.2
4	26/09/2019	62	60.1	61.1
5	27/09/2019	61.3	58.5	59.9
6	30/09/2019	89.8	83.7	86.8
7	1/10/2019	78.1	66.7	72.4
8	2/10/2019	70.2	66.8	68.5
9	3/10/2019	58.3	60.1	59.2
10	4/10/2019	59.1	63.5	61.3
11	7/10/2019	61.7	61	61.4
12	8/10/2019	60	58	59.0
13	9/10/2019	58.8	62.6	60.7
14	10/10/2019	69.6	78.1	73.9
15	11/10/2019	60.8	59	59.9
16	14/10/2019	80.7	67	73.9
17	15/10/2019	69.4	60.6	65.0
18	16/10/2019	63.8	58.4	61.1
19	17/10/2019	59.6	56.8	58.2
20	18/10/2019	55.9	60.1	58.0
21	21/10/2019	66.7	61	63.9
22	22/10/2019	58.7	55.8	57.3
23	23/10/2019	61.3	60.7	61.0
TOTAL AVERAGE		1491.5		

No. of Days	23
MEAN AVERAGE	64.8

Plate 2: Bar chart showing the measured noise levels in the selected sites



Discussion of Results

As cited in Olayinka and Abdullahi in 2010. The environmental sound levels measured at a given location depend on a number of specific variables. In particular, many authors have found that the observed sound levels are mainly related to road traffic characteristics, and especially traffic volume, vehicle horns, rolling stock and tires, un muffed vehicles, etc. (Saadu *et al.* 1998; Amando and Jose 1998; Mansouri ,*et al.,* 2006). Several studies have demonstrated that the urban conditions of a given area are also a very important factor influencing the environmental noise levels (Nelson, 1998). There is variation in the noise levels with the period of the day and the nature of the location.

The measured noised levels at the WRPC are presented in tables 3-8 above. The corresponding averages and mean averages were calculated using equation 1A and 1B respectively.

The minimum and maximum SPL (sound pressure level) ranged between 37.6 dBA at MD's Block to 104.1 dBA at GAS Turbine at all the selected sites.

From the tables 3-8 above, the mean average noise level averaged over 23 days, for Gas Turbine with the mean average of 96.5dBA when compared with FEPA standard exceeds 92dBA over a 6 hour duration; therefore the reading is above the FEPA standard. This was due to the fact that data was collected inside the plant where much noisy activities are carried out. This comparison shows that workers in this location are exposed to high noise effect as it relate to the FEPA standard.

For MD's Block which its mean average noise level is 48.7 dBA, did not exceed the FEPA standard for the various time duration per day. This shows that the noise emanating from this location has little or no health effect on the hearing of the occupants and passersby around the vicinity.

Also, comparing with OSHA standard of 90 dBA for 8 hours and NIOSH standard of 85 dBA for 8 hours we will see in these readings that some values in PC Utility, Gas Turbine and FCC Unit are above these standards.

After all these comparisons, it was seen that the location with the highest noise level is Gas Turbine. The noise pollution levels are higher in the morning. Some of the sources/reasons for the high noise pollution by the Gas Turbine are:

1. Aging: Aging plants suffer the adverse effects of performance degradation and are surpassed by newer plants utilizing the latest technologies. These plants can recover performance lost to degradation and, in many cases, even surpass their original plant performance through major upgrades to their installed equipment. Gas turbine performance upgrade packages are available for most common models, and their use is one of the best means of breathing new life into an aging plant.
2. Intake noise: is created by the interaction of the axial air compressor rotor and stator, and is a function of blade number, tip speed, and pressure increase.
3. Exhaust noise: has higher amplitude and has lower frequency due to combustion process
4. Casing noise: is generated through high speed misaligned mechanical components in the turbine housing radiating to the outer casing
5. Lack of compliance to scheduled preventive maintenance. By performing a regular preventive maintenance, you can be assured that your equipment remains to operate under safe conditions, both for the machine and the operators. Possible issues can be nipped in the butt before they have a chance to cause harm.
6. Lack of spare parts to replace worn out components. Spare parts is the foundation for reliable plant operation and is crucial to a plant smooth operations.

7. Loosed foundation bolts due to vibrations. Several forces can work against foundation bolts and, therefore, affect their performance over time. If the object or objects to which the concrete is connected begins to fail, for instance, it can weaken the foundation bolts. Splitting is another potential problem with foundation bolts. If a split forms between the foundation bolts, they may come loose.

This study was carried out to evaluate the noise pollution levels in WRPC. The focus was on Six (6) selected locations. The present status of noise pollution among the selected locations poses a severe health risk to the workers. This study revealed that the mean average noise level of the selected locations over 23 days which includes MD's Block, PC Utility, Gas Turbine, Reforming Unit, Topping Unit and FCC Unit are 48.7dBA, 84.1dBA, 96.5dBA, 55.5dBA, 56.3dBA & 64.8dBA respectively, were not all within the FEPA recommended permissible limits and could induce adverse hearing loss and other psychological effects on the workers, security guards and passers-by.

8 The use of Personal protective equipment (PPE) such ear muff or plug should be made mandatory for all workers and visitors who are exposed to locations with high noise level.The purpose of personal protective equipment is to reduce employee exposure to hazards when engineering controls and administrative controls are not feasible or effective to reduce these risks to acceptable levels. PPE is needed when there are hazards present.

RECOMMENDATION

Based on the extensive study carried out, the following recommendations are made for the management of noise pollution in WRPC:

1. The use of Personal protective equipment (PPE) such ear muff or plug should be made mandatory for all workers and visitors who are exposed to locations with high noise level.The purpose of personal protective equipment is to reduce employee exposure to hazards when engineering controls and administrative controls are not feasible or effective to reduce these risks to acceptable levels. PPE is needed when there are hazards present.
2. Medical checkup should be emplaced to routinely evaluate the hearing status of the core staff that work in plants with high noise exposure.Regular health tests can help find problems before they start. They also can help find problems early, when chances for treatment and cure are better. By getting the right health services, screenings, and treatments, steps can be taken and it will increase chances for living a longer, healthier life.
3. Efforts should be made to redesign the components of the plants with sound proof materials to reduce the noise level that the workers who reside within the plants environment are exposed to.
4. Training and refresher training on the effect of noise pollution should be hold periodically, this will help the workers to be aware and be able to identify when health issues arises as a result of continuous exposure to the noise pollution. Refresher training helps to review, reinforce and upgrade participants' existing knowledge and skills.
5. Signage of noise pollution should be placed in strategic positions within the various plants; this is to pass warning and caution to the workers and visitors. Signage helps to promote, identify, provide information, and give directions or to raise safety awareness.

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