ISSN No:-2456-2165

Ocean Wave, Industrial and Community Noise Evaluation of the New Calabar River, Rivers State Nigeria

Nte, Felix, Ugbana
Department of Physics, Faculty of Science
University of Port Harcourt
Rivers State, Nigeria

Teme, S. Clifford
Department of Geology, Faculty of Science
Rivers Stat University
Rivers State, Nigeria

Abstract:- The marine environment is vulnerable to a lot of pollutants from industrial and anthropologic activities. This study seeks to establish the noise level from the industrial, ocean waves and community sources. The research approach is survey and descriptive statistics. The coastal communities lies around N4˚300,00, and E 7˚00,00. The noise survey findings from flow stations are between 55 dBA-87dBA ± 5, depending on vector and machine condition. The average from ocean waves is 55-77 dBA including offshore platforms interferences, trawlers and bunkering vessels. The three community sampled include Buguma N 04˚74099'. E 006˚ 85366', Ama –Ido N 04˚ 74437˚ E 006˚ 85366' and Okpo community N04˚ 79529' E 006˚ 79276' and shows a high degree of variation between mid-week and week end festive seasons. The average noise for mid-week is 52 dBA while the average noise for festive season is 88 dBA, from the generators, electronic source and explosives. There was a correlation between population and noise level with Buguma topping the list with a total of 1059 youths as at the time of survey "578 males and 481 females" followed by Ama –Ido with a total of 378 youths, "205 males, and 173 females." The least in this survey is Okpo community with a total of 206 youths, 126 male and 80 females. The recommendation is for the local government intervention in terms of environmental health education following the fact that the same dynamite used in seismic activities is also used in fishing. At the end, a sensitivity impact evaluation was derived for the wildlife and biodiversity as they co-habit the environment.

Keywords:- *Environmental Impact; Noise; Ocean Waves*

I. INTRODUCTION

The marine and coastal environment of Niger Delta region of Nigeria is vulnerable to a lot of activities that boast the economy of the nation and citizenry but also has an adverse effect on the communities. These activities include; oil and gas exploitation, trawlers, oil bunkers, trade and commerce, modulate refineries and excessive deforestation and urbanization. This study seeks to establish the noise level with a view of comparing with standards to establish the health risk potentials. The three major areas of focus are the ocean waves and offshore activities, the flow stations and the community noise evaluation.

The coastal communities include; Chokorocho, Krakrama, Benkinkuri, Mabenkiri, Nyamkpo, Kemabo and Ikoluama, spartially scattered around N04º 3000' and E7º0000' at the mouth of the new Calabar river. The average population was 48 persons and about 15 house hold in each fishing unit due to declined fishing population by major oil spills from 28" truck oil pipeline which drastically reduced fishing in the region among other ecological woes. The noise from the ocean wave is a function of; wave length 'L', wave speed 'C', wave period 'T', acceleration due to gravity 'g',

$$\text{Thus } S = \frac{H}{L}, \quad C = \frac{L}{T} = \sqrt{\frac{g}{2\pi}l} \qquad and \quad L = CT \tag{1}$$

The noise associated to ocean wave and other background noise from bunkering, offshore platform and trawlers is put at 55dBA – 78dBA.

The flow station facilities and their noise sources are summarized in table 1. This gives us a minimum average of 55dBA and 87dBA ± 5 as maximum.

The analysis of noise level from the three communities is shown in figure 1and table 2,3,4. There is a correlation between urbanization, population and noise level which puts Buguma on the lead, followed by Ido and Okpo on a bearing of No4º74099' E006º85579', N04º74437' E006º85366' and N04º79529' E006 º79276' respectively. Similarly the youth population was found to be 1058 for Buguma, 378 for Ido and 206 for Okpo as at the time of survey.
The study established a sound impact ratio of 1:5:<X<10 for air, water, x = swamp ecology, and "solid" using the velocity of sound in the respective media by seismic principles.

A lot of studies have been done on noise survey and impact across the world to serve as foundation to the present study.

These studies include [1] – [17]

ISSN No:-2456-2165

II. METHOD

The study is a noise survey of ocean waves, the petroleum industry and their community base. To progress on the survey, we obtained a Department of Petroleum Resources, DPR permit from the presidency in Nigeria. We further galvanized CEL 231 and CEL 254 digital noise meter with A, B, C, D weighting corresponding to low, medium, high and impulsive noise respectively. Apart from basic logistic on land, air and sea, we obtained a local global positioning system to help us in the tracking of our sampling points. The results and analysis is as reflected in Table 1 showing summary of the readings from three Flow Stations.

Tables 2 is the world health organization (WHO) health impact recommended standards, fig 1 the summary of ten sampling points of each of the three communities while tables 3, 4, 5, 6, 7, 8, 9, 10 are independent and group sample results.

III. RESULTS

S/N	FACILITIES	OPERATION	NOISE LEVEL (Dba)	Range (m)
1	Wind level/ Helipad	Transport	60-80	500
2	Communication platform	Radio transmission	50-70	500
3	Oil pumps/engine/metering	Compression	80-100	1000
4	Perimeter drain and wall	Drainage	Negligible	Sink
5	Pipelines and manifold	Oil delivery	High pressure	Linear
6	Platform and gantry	`base/floor	Negligible	Static
7	Reservoir (fuel tank)/ gate vales	Storage	Negligible	Static
8	Rig stand/swids and operations	Base	65-135dBA impulsive	500
9	Roads and drill slot marine	Assess	Negligible	Static
10	Saver pit/flow channel	Drainage recycling	Negligible	Linear
11	Swamp dozer, pipeline	Excavation and laying of pipe	80-90	500
12	Test separators/scrubbers	Processing	70-90	500
13	Seismic blast “ exploration	Dynamites	100-140	1200
14	Simo pumps and bole hole	Pumping	60-80	400
15	Surge vessels	Vertical tank	50-70	200
16	Swamps and wild life	Ecological	Negligible	Random
17	Sewage/septic tanks	Discharge	Negligible	Static
18	Gasflare stark	Heat radiation and sound	N60-88	Zoom
19	Well head “ Christmas tree”	Well	Negligible	Static
20	Work site/ generators	Camp	60-80	500

Table 1:- Flow Station Facilities in Marine Environment From Cawthorne Channel

Average minimum 55dBA ±2, average maximum 87dBA±5. SPDC facility.

ISSN No:-2456-2165

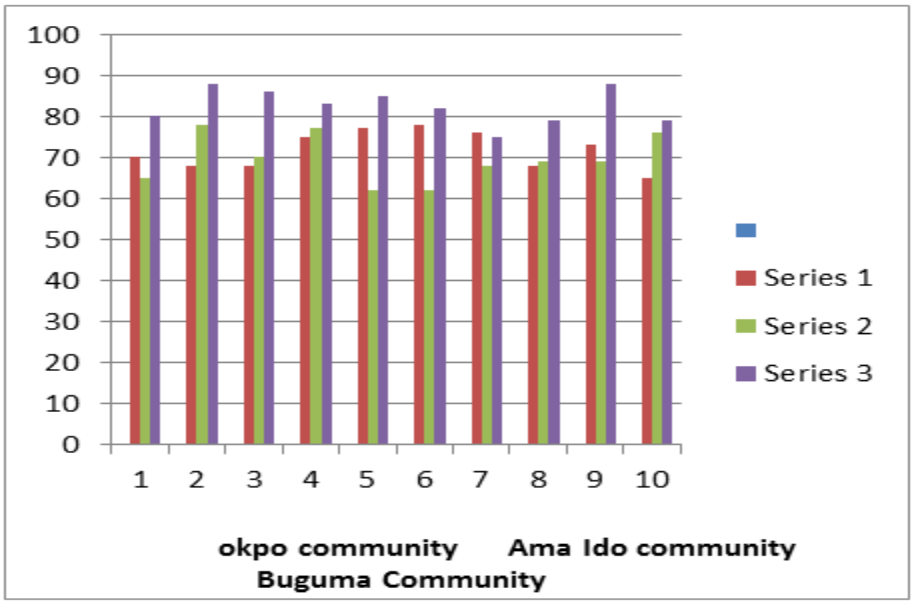

Fig 1:- Graph Showing The Various Sound Level For The 10 Different Station Measured In The Three Communities.

ENVIRONMENT	CRITICAL HEALTH EFFECT	SOUND LEVEL dB(A)	TIME (HOURS)
Outdoor living areas	Annoyance	50-55	16
Indoor dwellings	Speech intelligibility	35	16
Bed rooms	Sleep disturbance	30	8
School classrooms	Disturbance of communication	35	During class
Industrial, commercial and traffic areas	Hearing impairment	70	24
Music through ear phones	Hearing impairment	85	1
Ceremonies and entertainment	Hearing impairment	100	4

Table 2:- Noise Health Index by WHO (WHO, 2014) as a Reference Document

Source: world health organization (WHO), 2014.

	Sum of squares	Df	Mean square	F	sig
Between groups	861.117	2	430.558	19.645	.000
Within groups	591.750	27	21.917		
total	1452.867	29			

Table 3:- Analysis of Variane on Buguma, Okpo and Ido Community
Anova

Summary: the analysis of variance carried out on the data shows that there is a significant difference between the different sound levels in the three communities.

Multiple comparisons
Dependent variable: data
LSD

(I) Code	(J) Code	Mean Difference (I-J)	Std error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Akpo	Ido	1.65000	2.09364	.438	-2.6458	5.9458
	Buguma	-10.4500	2.09364	.000	-14.7458	-6.1542
Ido	akpo	-1.65000	2.09364	.438	-5.9458	2.6458
	Buguma	-12.10000	2.09364	.000	-16.3958	7.8042
Buguma	akpo	10.45000	2.09364	.000	6.1542	14.7458
	Ido	12.10000	2.09364	.000	7.8042	16.3958

Table 4:- Multiple Comparison of Sound Level between Akpo, Ido and Buguma Community

The mean difference is significant at the 0.05 level.

Summary: the results from the analysis shows that there is a significant difference between the sound level for Buguma community and Akpo community, Buguma community and Ido community, but there is no significant difference between Akpo community and Ido community.

GROUP STATISTICS					
	Code	N	Mean	Std. Deviation	Std. Error mean
Data	Sound at midweek	10	72.4000	4.76562	1.50702
	Sound at weekend	10	72.6000	4.29987	1.35974

Table 5

INDEPENDENT SAMPLES TEST										
		Levene's test for Equality of variances		t-test for Equality of means						
		f	sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. error Difference	95% confidence interval of the Difference	
									Lower	Upper
data	Equal variances assumed	1.461	.242	-.099	18	.923	-.20000			
	Equal variances not assumed			-.099	17.813	.923	-.20000			

Table 6:- Akpo Community: Group Statistics

Summary: the analysis shows that there is no significant difference between the sound level for the midweek and weekends.

GROUP STATISTICS					
	Code	N	Mean	Std. Deviation	Std. Error mean
Data	Sound at midweek	10	70.7000	5.39650	1.70652
	Sound at weekend	10	71.0000	5.98145	1.89150

Table 7

INDEPENDENT SAMPLES TEST										
		Levene's test for Equality of variances		t-test for Equality of means						
		f	sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. error Difference	95% confidence interval of the Difference	
									Lower	Upper
data	Equal variances assumed	0.43	.838	-.118	18	.908	-.30000	2.54755	-565220	-565220
	Equal variances not assumed			-.118	17.813	.908	-.30000	2.54755	-5.65624	-5.65624

Table 8:- Ido Community

Summary: the analysis shows that there is no difference between the sound level for the midweek and weekends.

GROUP STATISTICS					
	Code	N	Mean	Std. Deviation	Std. Error mean
Data	Sound at midweek	10	82.9000	5.46606	1.72852
	Sound at weekend	10	83.0000	4.24264	1.34164

Table 9

		Levene's test for Equality of variances		t-test for Equality of means						
		f	sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. error Difference	95% confidence interval of the Difference	
									Lower	Upper
data	Equal variances assumed	3.080	.096	-.046	18	.964	-.10000	2.18810	-4.69703	4.49703
	Equal variances not assumed			-.046	16.956	.964	-.10000	2.18810	-4.71739	-4.51739

Table 10:- Buguma Community

Summary: the analysis shows that there is no significant difference between the sound level for the midweek and weekends.

IV. SUMMARY AND CONCLUSION

- Sound is a mechanical disturbance that generates waves through an elastic or material media, by a process of compression and rare faction at the audible frequency range of 20-20,000 HZ.
- The intensity varies in air, water, swamp and solid in the radio of 1:5:<X<10 respectively.
- The physics behind the study is that when energy passes through a medium it results in wave type motion. In this context different types of waves may be generated depending upon the motion of particle in the medium . This could be transverse waves, longitudinal waves vibrational or shear waves in rotational form.

These principles are used to deduce that sound impact in marine environment is five times the value of the sound we measure in air

Thus:

$$\text{Imf} = \sum \frac{Pm}{\sum Pa} \qquad (2)$$

$$\text{and Eil} = \sum \frac{bpm}{\sum bpa} \qquad (3)$$

where Imf = Impact factor
Eil = Environmental impact level.
$\sum P_m$ = casualty rate in media
$\sum P_a$ = casualty rate in air
$\sum P_{pm}$ = Biodiversity population in the reference media
$\sum bpa$ = Biodiversity population in air.

The study established a strong correction between population, urbanization and noise level but a divergence in noise level during week days and during festive season with a range of 50dBA to 85dBA respectively.

It noted that the level of noise exceeded the world health organization standard on table 5 and recommend that the local government council come up with a health safety education for the citizenry in lue of the use of dynamite used for seismic activities from fishing and others.

REFERENCES

[1]. G. Eason, B. Noble, and I.N. Sneddon, “On certain integrals of Lipschitz-Hankel type involving products of Bessel functions,” Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)
[2]. W. Babisch, B. Beule, M. Schust, N. Kersten, and H. Ising, “ Traffic noise and risk of myocardial infarction”, Epidemiology, 5(6), 2005 pp.33-40.
[3]. F.S. Barnes, and B. Greenebaum, “Handbook of biological effects of electromagnetic elds: bioengineering and biophysical aspects of electromagnetic”, (3rd edn) Boca Ration, Fl: CRC taylor and francis press, 4(2), 2007, pp.333-352.
[4]. G.A. Belojevic, B. Jakovljevic, V.Z. Stojanov, and K.Z. Paunovic, “Nighttime road: traffic noise and arterial hypertension in an urban population”, Hypertension research, 3(4), 2008, pp.775-781
[5]. T. Bodin, M. Albin, J. Ardo, E. Stroh, P. Ostegren, and J. Bjork, “Road traffic noise and hypertension: result from a cross sectional public health survey in southern Sweden”, Environmental health, 8(2), 2009, pp. 38-43.
[6]. F.U. Nte, “Environmental physics innovations”, Lambert Publishers, Germany 2017.
[7]. P.I. Enyinna, and M. Onwuka, “ Investigation of the radiation exposure rate and noise level within crush rock quarry site in Ishiagu, Ebonyi State, Nigeria”, International journal of advanced research in physical science, 6(3), 2014, pp.56-62.
[8]. D.K. Doygun, and Gurun, “Analyzing andmapping spatial and temporal dynamics of urban traffic noise pollution: a case study in kahramanmaras, Turkey”, Environ. Monit Assess., 142, 2008, pp.65-72. DOI: 10. 1007/s10661-007-9908-7.
[9]. J.B. Alam, M.J.B. Alam, M.M. Rahman, A.K. Dikshit, and S.K. Khan, “Study on traffic noise level of Sylhet by multiple regession analysis associated with health hazards, Iran Journal of Environ”, Health Sci. Eng, 3.(2), 2006, pp.71-78.
[10]. O. Anomohanran, C.M.A. Iwegbue, O. Oghenerhoro, and J.C. Eghai, “Investigation of environmental noise pollution level of Abraka in Delta State, Nigeria”, Trends in applied Science research, 3(4), 2008, pp.292-297.
[11]. O. Anomohanran, and J.E.A. Osemeikhain, “Day and night noise pollution study in some major towns in Delta State, Nigeria”, Ghana journal of Science, 46, 2006, pp.47-54.
[12]. O. Anomohanran, R. Iserhien-emekeme, and O.L. Emekeme, “ Environmental noise assessment study of Aghor metropolis in Delta State”, Advances in Natural Science and applied Sciences research. 2(1), 2004. pp.168-178.
[13]. O.E. Abumere, J. O. Ebereno, and S. N. Ogbodo, “Investigation of environmental noise within port Harcourt city metropolis, Nigeria”, Journal of Physics, 1, 2006, pp.129-132.
[14]. O.S. Olayinka, and S.A. Abdulahi, “ A statistical analysi of the day-time and night-time noise levels in Illorin metropolis, Nigeia”, Trends in applied sciences research, 3(3), 2008, pp.253-266.
[15]. P.H.T. Zannin, A.M.C. Ferraia, and B. Szeremetta, “ Evaluation of noise pollution in urban parks”, Environment monitoring assessment, 118, 2006, pp.423-433.
[16]. P.K. Essandoh, and F.A. Armah, “ Determination of arbient noise levels in main commercial area of cape coast, Ghana”, Rearch journal of environmental and earth Sciences. 3(6), 2011, pp.637-644.
[17]. WHO, (2005). Occupational and community noise. WHO publication, WHO-OHS (2005).