Adamawa State University Journal of Scientific Research
ISSN: 2251-0702 (P)
Volume 6 Number 2, August, 2018; Article no. ADSUJSR 0602015
http://www.adsujsr.com

Assessing the Compliance of the Global System for Mobile Communication Operators in the sitting of Base Transceiver Stations in Jos South, Plateau State, Nigeria

Balami[1], D. and Mshelia A. D[2*] .
[1]Nigeria Environmental Standard Regulation and Enforcement Agency, Jos, Nigeria
[2]Department of Geography, Adamawa State University, Mubi, Nigeria
Contact: alfredmshelia@yahoo.com

Abstract

The increase in the number of Communication Mast in Nigeria air space has no doubt increased the dangers that are associated with masts. Today, most masts in the country pose grave danger to human lives and properties, ranging from collapsing of masts, oil spillage, and violation of setbacks, noise pollution, and vibration and envisage dangers of radiation. In this study, efforts were made to collect spatial data set on the coordinates of existing Base Transceiver Stations (BTS) in the study area using the hand held Global Positioning System (GPS), and analysis of the data base to determine the level of compliance of these BTS with National Environmental Standard Regulation Enforcement Agency (NESREA) 2011 Act. Minimum distance to closest building structure was determined using the standard measuring tape (Meters). Data collected were summarized in form of a table of frequency distribution and analyzed. Results showed that one hundred and fifteen (115) BTS spatially distributed over the study area. 78.26% of the BTS are owned by five (5) service providers (MTN, Airtel, GLO, HIS and Helous Towers). The compliance level according to the NESREA ten (10m) meter setback is relatively high (68%). Result also indicate that 46.09% of BTS have oil spill problems, an environmental concern, with MTN, Airtel and GLO accounting for 75%. The study recommends among others a synergy between Nigerian Communication Commission (NCC), NESREA, service providers and the community to ensure compliance and the engagement of Environmental Impact Assessment (EIA) for the siting of BTS.

Keywords: Compliance; Global System for Mobile; Communication Operators; Base Transceiver Station.

Introduction

Prior to the advent of Global System for Mobile Communications (GSM) in 2001, there were fewer communication masts erected by internet service providers (ISPs), banks, and government agencies, for the purpose of transmitting and receiving communication signals in Nigeria. But the licensing of GSM operators such as MTN and Airtel in 2001, Globacom in 2003, and Etisalat in 2009, led to the tremendous increase in number of communication masts, erected by these GSM service providers. Today, Nigeria has over 25, 000 erected masts from GSM operators which are littered across its airspace, aside those of the ISPs, and banks (Aderoju *et al*, 2014).

The increase in the number of communication masts in the Nigerian airspace, has no doubt, increased the dangers that are associated with masts (Bello, 2010). Today, most masts in the country pose danger to human lives and property, ranging from collapsed masts that have severally destroyed property worth millions of naira, and have killed several people in Lagos and other parts of the country, to the perceived grave health risk it likely cause to humans through radioactive emissions from base transceiver stations (BTS), commonly known as base stations (Aderoju *et al*, 2014). Although there had been no full scientific proof that emissions from mast could affect the human systems, there is however, a general belief that the emissions over a long period of time are capable of causing various degrees of cancer in human systems (Ojuh, and Isabona, 2015).

As the GSM technology progresses and the number of BTS increases, people living within close range of mobile phone base stations have become more and more concerned over the possible harmful effects of radio frequency radiation produced by these devices to their health (Kwan-Hoong, 2003 and Badru *et al*, 2016) such as headache and impaired memory

(Bortkiewicz, *et al*, 2012) and Akinyemi *et al*, (2014). The increasing need for functional telecommunication networks to service the desires and needs of the teeming users for effective communication and the use of mobile phones has increased dramatically over the last decade. The launch of Global System for Mobile (GSM) Communications in Nigeria in 2001 heralded a dawn of relief to teeming Nigerians. Today services like mobile TV, electronic payments, mobile tracking services, cheaper international calls, internet banking, and mobile banking etc. occasioned by mobile telecommunication are commonplace in the country (Hutter *et al* 2006).

According to Omoanatse and Okumo (2014), cellular communication systems require the use of the ten meter distance standard site of BTS for Nigeria Environmental Regulation and Enforcement Agency (NESREA act, 2011). Though the NESREA act of 2011 is belated because most BTS were eretect before the act (from 2001-2009), it still calls for concern for BTS to follow due standard set for its siting because of the health danger it poses on live of the people of the community where BTS are located.

When a user places a call, his or her handset communicates with a nearby base station, which then relays the call to a central switching office and then to the conventional land line telephone network. As the user moves about, he or she is "handed off" to other base stations. Thus, each base station is a low power radio station that serves users in a small geographic region called a cell. The location of each base station is determined by two different needs on the part of the system. One is to provide adequate coverage (i.e. provide adequate signal strength throughout the entire service area). The second is to provide adequate capacity (i.e. provide enough free channels to accommodate any user who might wish to use the system (Otubu, 2012).

As a system grows, base stations are installed closer together (to increase capacity) but operated at lower power levels to prevent interference among base stations. Thus, in urban areas base stations are closer together, but are operated at lower power levels, than in rural areas where the cells tend to be larger. The antenna height is critical; it must be high enough to provide coverage throughout the cell, but low enough to preclude interference with remote cells that re-use the same frequencies.

Depending on the needs of the system, the antennas may be from 10 to 100 meters above ground. Base station antennas are frequently located on tall tapered poles (called monopoles), much like lamp standards, or on towers of a metal strut lattice construction. Base station antennas may also be located on existing structures, such as water tanks, high-voltage transmission-line towers, or buildings. To reduce the aesthetic impact of their systems on communities, companies generally prefer to install their antennas on existing structures, and to co-locate where possible i.e. locate base stations from different companies on the same structure, (Omoanatse and Okumo 2014, Oliver, 2004).

The study area Jos south, which is one of the local government areas in Plateau state is also part of Jos-Bukuru metropolis, located between Latitude 09^{O} 38' & 09^{O} 54' N, and Longitude 08^{O} 42' & 08^{O} 58'E having an elevation that ranges between 1,230m (4,040ft) and a peak of 1,829 meters above the sea level around the Shere Hills. It has a total land area of 500.23 Sq Km (Michael, 2012).

Materials and Method

The NESRES Act 2011 of forms the yards stick for measuring the level of compliance of BTS for Nigeria environmental regulation. Data on Base Transceiver Stations (BTS) location were determined by a hand held GPS while that of minimum distance to building structure (off-set) was determined using the standard measuring tape (meters) for comparison with NESRES Act, 2011 of ten meter distance of BTS from building and other structures. Data collected from the field were compiled in excel and exported into the ArcGIS 10.2 software and reprocessed using the GIS technique. Data collected were analysed based on the service providers/nature of BTS, distance, settlement type and environmental concern regarding oil spillage from power generators at any identified BTS.

Results and Discussion

Spatial Distribution of BTS in Jos-South Based on Locality

Table 1, presents data on spatial distribution of BTS in forty-two (42) localities of the study area where 60.09% of BTS are located in fourteen (14) out of the forty-two (42) localities which include Wholshe 7.83%; Abattoir and Ray Field 5.22% each; Bukuru, Katon Rikkos, Kufan, Rantiya and Vom with 4.35% each; Zawan, NIPPS, Gura Topp, D/Kowa, Bukuru express and Anguldi with 3.48% each while 39.01% of other BTS are located of the remaining twenty-six (26) localities of the study area. The reason for the uneven distribution of BTS is not far-fetched from the differences in clusters of population of GSM service users based on variation of population of each locality in the area.

Table 1: Spatial Distribution of BTS in the Jos South Based on Locality

S/N	Locality	No. of BTS	Percentage %
1	Abattoir	6	5.22
2	Anglo	1	0.87
3	Anguldi	4	3.48
4	Angwan Baki	1	0.87
5	Angwan Doki	2	1.74
6	Bisichi	2	1.74
7	Bukuru	5	4.35
8	Bukuru Express	4	3.48
9	Bukuru Lowcost	3	2.61
10	D/Kowa	4	3.48
11	Diye	2	1.74
12	Domkatbali	1	0.87
13	Dorowa	1	0.87
14	Fwavei	1	0.87
15	Gold and Base	1	0.87
16	Gura Topp	4	3.48
17	Gyel	2	1.74
18	Kotom Rikkos	5	4.35
19	Kiir Rikkos	1	0.87
20	Kufang	5	4.35
21	Kuru	2	1.74
22	Low Cost	2	1.74
23	Little Ray Field	1	0.87
24	Mega Station	1	0.87
25	Millionnaire Squarters	2	1.74
26	New Abuja	2	1.74
27	NIPPS	4	3.48
28	Nungu Road	1	0.87
29	Police	1	0.87
30	Rantiya	5	4.35
31	Ray Field	6	5.22
32	Sabon Banki	3	2.61
33	Shaka	2	1.74
34	Shen	2	1.74
35	Silverbird	1	0.87
36	State Poly	1	0.87
37	Utunko Road	2	1.74
38	Vom	5	4.35
39	Wholshe	9	7.83
40	Zaramaganda	2	1.74
41	Zarmaganda	2	1.74
42	Zawan	4	3.48
	Total	115	100.00

Table 2. shows the distribution of BTS in the study area based on the settlement pattern where three (3) settlement pattern is identified in the study area: dispersed, linear and nucleated settlements were 26% of BTS are located in dispersed part of the locality to the west and south, 14.78% are located in Linear settlement, and 59.13% are located in the densely populated (nucleated) segment of the study area found to the north (figure 1) which is closer to the state capital Jos. The higher concentration of BTS in the more cluster areas corroborate the assertion by Omoanatse and Okumo (2014), and Otubu, (2012), where it is necessary to increase with population density the number of BTS to cater for the teeming population of users. The environmental implication here is that such community, become more susceptible to higher heath risk from collapse of BTS antennas, radio radiation, noise pollution from BTS power generators and oil spillage from leaks of surface and underground storage tanks.

Table 2: Spatial Distribution of BTS based on Settlement Pattern

S/N	Settlement Type	Number	Percentage %
1	Dispersed	30	26.09
2	Linear	17	14.78
3	Nucleated	68	59.13
	Total	115	100.00

Data in Table 3 shows the result of compliance level of Base Transceiver stations based on ten meter (10m) setback by National Environmental Standard and Regulation Enforcement Agency (NESREA). From the table, it is observed that forty nine (42.6%) out of the one hundred and fifteen (115) BTS (Table 1) have failed to comply with the standard of 10m setback as stipulated by NESREA Act of 2011 for National Standards for Telecommunications and Broadcasting Facilities, while sixty six (57.39%) met the compliance level or standard set by NESREA.

The breakdown of the ten meter BTS distance violators based on the different service providers in descending order of their degree of violation are; MTN (34.69%), Airtel (16.33%), Glo and HIS (10.20%) Etisalat (8.16%), Security operators (6.12%) and Multilink (4.08%) while 28.22% jointly operated by MTN/Glo, MTN/Etisalat also violated the ten meter setback. The high percentage of non-compliance by service providers (GSM and other operators of BTS) ten meters set back poses grave dangers to communities within such localities, which corroborate Aderoju *et al.* (2014), and Ojuh and Isabona, 2014) where dangers of Mast collapse, killed people, destroyed properties, caused oil spillage and noise pollution as well as dangers of radiation on inhabitants of the study area. Substantial part of the problems of BTS such as noise, vibration and oil spillage, gaseous emissions (diesel) are power related. This is because of continuous lack of or epileptic electricity supply from the Jos Electricity Development Company (JEDC).

Table 4 summarizes data based on service providers that have concerns regarding oil spillage .Fifty three (53.08%) out of the one hundred and fifteen (115) BTS have oil spill problems hence violating the National Oil Spill Detection and Response Agency (NOSDRA) act of 2006, while 62 (53.91%) have not been seen to have oil spill problems. The service providers with oil spillage concern in order of degree of oil spill pollution are MTN (35%), Airtel (15.07%), Glo (13.21%), Etisalat (11.32%) and the rest, Starcom, Security outfits, NTA, Multilinks, Hellows, and Towers stand at 24.88%.The oil spills from BTS tanks and reservoirs impact negatively on surface and ground water sources within neighborhoods of the study area. Ground water sources such as wells commonly used by households are likely to be contaminated by seepage of such oils or washed into surface water bodies (Rivers, dams, ponds) by run-off from rainfall, causing general land pollution.

Table 3: Spatial Distribution of BTS Based on NESRES 10 Meter Set Back Compliance Level.

S/N	Service providers	No. BTS that violate NESREA standard of 10m setback	Percentage %
1	Air Tel	8	16.33
2	Air Tel/COM	0	0.00
3	Air Tel/Etisalt/MTN	0	0.00
4	Air Tel/Glo	1	2.04
5	COM	2	4.08
6	Estisalat	4	8.16
7	Glo	5	10.20
8	Helous Towers	0	0.00
9	His	5	10.20
10	MTN	17	34.69
11	MTN/Etisalt	1	2.04
12	MTN/Etisalat/Air Tel	1	2.04
13	Multilinks	2	4.08
14	NTA/MTN/Scom	0	0.00
15	Security	3	6.12
16	Starcom	0	0.00
	Total	49	100.00

Table 4: BTS with Environmental Concerns Based on Oil Spillage

Service Providers	**No. of BTS**	**Percentage %**
Air Tel	8	15.09
Air Tel/COM	0	0.00
Air Tel/Etisalt/MTN	0	0.00
Air Tel/Glo	1	1.89
COM	2	3.77
Estisalat	6	11.32
Glo	7	13.21
Helous Towers	0	0.00
His	4	7.55
MTN	19	35.85
MTN/Etisalt	0	0.00
MTN/Etisalat/Air Tel	1	1.89
Multilinks	2	3.77
NTA/MTN/Scom	0	0.00

Conclusion

The study shows some environmental concerns regarding compliance to NESREA act of 2011 despite its belatedness. The level magnitude of violation of particularly the ten-meter setback for siting BTS as well as oil spill violation in the study area is not extremely dire, coming from the backdrop that most BTS were set up before the NESREA act. However, any form of violation of Nigeria's threatened environment should be steamed by agencies such as NESREA and NOSDRA

Recommendations

Base on the findings of the research, the researcher wishes to make the following recommendations;

- The creation of a synergy between Nigerian Communication Commission (NCC), NESREA, communication service providers and the community to ensure compliance with environmental standards by creating a common platform for decision making on matters concerning siting of BTS.
- Environmental Impact Assessment (EIA) of BTS sites should be carried out before the approval of such sites.

- Review of BTS compliance since act come after building of these masks where such BTS that did not fulfill the environmental requirements are relocated to safer sites or people and properties found to be closer to BTS should be relocated and compensated by the service providers.
- The use of alternate power supply sources like solar or wind energy by BTS could avoid oil spillage, vibration, and noise and air pollution from exhaust of the power generator.
- Regular supervision of fuel reservoirs is required to ensure no leakages by BTS owners / environmental agencies.
- Remediation of oil polluted BTS sites (surface and ground water, land surface) by the communication service providers.

References

Aderoju, O.M., Godstimes, J., Olojo, O., Oyewumi, A., Eta, J., Onuoha, H. U., Salman, K. and Nwadike, D. K. (2014) *Space –Based Assessment of the Compliance of GSM Operators in Establishing Base Transceiver Station (BTS*) in Nigeria using Abuja Municipal Area council as case study. *IOSR Journal of Environmental Science, Toxicology and Food Technology*. 8(10); 46-57.

Akinyemi, L.A, Shoewu, O.O., Pinponsu, O.A., Emagbetere, J.O. and Edko, F.O. (2014) Effects of Base Transceiver Station (BTS) in Ikeja Area of Lagos State, Nigeria. *The Pacific Journal of Science and Technology* 15; 173-179

Badu, R.A., Alwadood, J.A., Atijosan, A. O., Oloko-Oba, M.A., Babalogbon, B.A., Jesuleye, I.A., Alaga, T.A, Shaba H.A. (2016). Evaluation of Geo-Spatial Proximity of Mobile Communication (GSM) Base Transceiver Stations To Buildings in Ile-Ife, Nigeria. *International Journal of Scientific and Technology Research* 5(2); 87-91.

Bello, M.O. (2010). Effects of the Location of GSM Base Station on Satisfaction of Occupiers and Rental Value of Proximate Residential Property. *Journal of Computer information science*, (4), 159-170.

Bortkiewicz, A., Gadzicka, E., Szyjkowska, A., Politanski, P. Mamrot, P., Zmystony, M. and Szymczak, W. (2012). Subjective Complaints of People Living Near Mobile Phone Base Station in Poland: *International Journal of occupational Medicine and Environmental Health* 25; 31-40.

Hutter, H.P, Moshammer, H., Wallner, P., and Kundi, M. (2006). Subjective Symptoms, Sleeping Problems and Cognitive Performance in Subjects Living Near Mobile Phone Base Station Environment. *Medical Journal* 63, 307-313.

Kwang-Hong N. (2003). *Radiation, Mobile Phones, Base Stations and Your Health* Published by Malasia Communication and Multimedia Commission.

Michael, A.A. (2012). Effect of Mining on Farming in Jos South Local Government Area of Plateau State. *Nigeria Journal of soil Science and Environmental Management* 3(4); 77-85.

National Environmental (Standard for Telecommunications and Broadcast Facilities) Standard Regulations (2011) 5(4).

National Oil Spillage Detection and Response Agency (2006). NOSDRA Act, Nigeria.

Oliver K.E. (2004). Introduction to Automatic Design of Wireless Networks http://www.acm.org/crossroads/xrds 11-41/automaticdesign.html. (Accessed December, 2007).

Omoanatse, A.C. and Dkumo, E.J. (2014). Design and Implementation of a Map Building Model for Base Station Placement. *International Journal of Computer Applications*, 90(9).

Otubu, A.K. (2012). *Appraisal of the Application of Geographic Information System (GIS) in the Location of Telecommunication most in Ibadan, Oyo State*. An unpublished MSc URP Dissertation. Department of Urban and Regional Planning, University of Ibadan, Nigeria.

Ojuh, O.D. and Isabona, J. (2015). Radio Frequency EMF Exposure Due to GSM Mobil Phones Base Stations Measurement and Analysis in Nigerian Environment. *Nigerian Journal of Technology*, 34(4), 809-814.

Tebepah, E. (2015). The Cost of Telecommunication Evolution in *Nigeria Journal of Energy Technologies and Policy.* 5(10);17-26.