Noise pollution implications of base transceiver stations of telecommunication industries in Nigerian.

O.B. Okedere[1], F. Elehinafe[2]

[1]College of Science, Engineering and Technology, Osun State University, Osogbo, Nigeria.
[2]Department of Chemical Engineering, Obafemi Awolowo University, Ile-Ife, Nigeria
Corresponding author: E-mail:okederetunjib@yahoo.com, phone: +234 - 8069057019

Abstract: The present study investigated the impact of diesel fueled generators used at base transceiver stations of telecommunication industries on the day and night time noise levels in the vicinity of residential buildings located around the base stations. The average noise levels were obtained as arithmetic mean of the maximum and minimum noise levels measured with EXTECH 407735. During each sampling the EXTECH instrument was positioned on a flat surface to minimize vibrations and switched on. Results showed that the average noise levels in the residential areas around the base stations exceeded the World Health Organization (WHO) recommended levels of 55 dB (A) and 40 dB (A) for day and night time, respectively. The average day time noise level of 43.6 dB (A) around the solar energy powered base station was however below WHO level. Siting of base stations within residential areas should be discouraged or alternative energy sources be considered.
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Introduction

Noise is all around us. It is an unavoidable part of our daily lives and has increasingly become a major burden on the quality of lives. Noise pollution is defined as a form of air pollution that is an audible unwanted sound that poses a threat to a person's health and well-being (Goines and Hagler, 2007). Noise pollution has been a subject of active investigation over the years (Koushki et al., 1999; Koushki et al., 2002; US FHWA, 2004; Thangadurai et al., 2005; Pachpande, 2005; Muthusubramanian et al., 2005; Banerjee and Chakraborty, 2006). Interest in this has grown because of its perceived hazardous effects on human health (Rabinowitz, 2000; Rosenlund et al., 2001; Lusk, 2002; McBride, 2004; Matsui et al., 2004; Stansfeld and Matheson, 2004; Goines and Hagler, 2007; NIDCD, 2007). In 1998 to 2000, it was estimated that approximately 28 million Americans suffer from hearing loss and almost 10 million Americans suffer from Noise Induced Hearing Loss (NIHL) with the cost estimated to be in the billions of dollars (NIDCD, 2007). Enforcement of safety standards have been achieved to a large extent in developed countries due to widespread appreciation of the hazards. Data for developing countries are scarce, but available evidence suggests that average noise levels are well above the level recommended in many developing nations (Suter, 2000; WHO, 2001).

The average noise levels in developing countries may be increasing because industrialization is not always accompanied by protection. Nigeria like many other developing countries has not attained electrical power generation level required to power its growing industrial sectors. As at the end of 2009 the installed electricity capacity of about 6,000 Megawatts with only a maximum of about 4,000 Megawatts available at any time (ECN, 2009). Studies on electricity demand, especially by the Energy Commission of Nigeria have shown that even with the on-going efforts, the installed generation capacity will not be able to meet the requirements of the projected growth rate of the country for attaining the Millennium Development Goals (MDGs) and the recent Vision 20:2020 (ECN, 2009). Consequently, most industries operate diesel fueled generators to meet their energy requirements. Telecommunication is one sector that has enjoyed tremendous boost in the past decade but the base transceiver stations (BTS) are being powered by diesel fueled generators. About 400000 base stations were expected to have been installed as at end of year 2010. It is important to state that majority of these base stations are located in clustered and densely populated residential areas possibly for security reasons, noise pollution is thus a concern.

This study was carried out to investigate the impact of noise emanating from generators used at BTS telecommunication industries in two Nigerian cities on the day and night noise level in the residential neighborhood. The impetus for this study was a desire to raise the level of awareness in the policy makers, investors and general public.

Study Area

The study areas were Lagos and Osun states which are located in the south west Nigeria. Lagos state is the industrial and commercial capital of Nigeria and until

1991, it was the administrative capital. Lagos has a population (NPC, 2006) of about 8, 100, 000 people and lies between longitude 3° 24' E and latitude 6° 27' N and covers an approximate area of 775 square kilometers. It has the largest concentration of base stations. Osun state on the other hand was created in 1991 with a land area of approximately 9, 251 km and population of 4, 137, 627 (NPC, 2006). It lies between latitude 7° 30'N and longitude 4° 30' E. The inhabitants are predominantly traders, artisans and peasant farmers.

Materials and Method

Measurement approach

The maximum and minimum noise levels emanating from the generators used to power base transceiver stations were measured with the aid of an EXTECH sound level meter (Model 407735). The average noise level was determined as the arithmetic mean of the minimum and maximum noise level recorded during each sampling. During each measurement, the EXTECH instrument was positioned on a flat surface to minimize vibration and switched on. The Base stations selected for the study were those having residential buildings around them and noise measurements were taken at equidistant positions from the BTS. For day time noise level five BTS were investigated in Lagos (Table 2) and Osun States (Table 3), respectively. For night time noise level, two BTS were investigated in each State (Table 4). In addition, one solar energy powered BTS (Table 1) was investigated in Lagos State.

Standards for Comparison

The noise levels measured were compared with the National Guidelines for Environmental Noise Control by Federal-Provincial Advisory Committee on Environmental and Occupational Health (CEOH, 1989),which sets acceptable day time road traffic noise level for residential areas to be less than 55 dB (A) and that for night not greater than 50 dB (A). This is similar to the recommendation of World Health Organization of 55 dB (A) for outdoor areas and night time 40 dB (A) (WHO, 1999).

Results and Discussion

The maximum and minimum as well as the average day time noise levels measured in the vicinity of the residential buildings located around solar energy powered BTS are summarized in Table 1. The noise level ranged between 36.4 and 50.7 dB (A) with an average of 43.5 dB (A) which is lower than the WHO recommended value. Results for day time noise level measurements in Lagos (Table 2) and Osun States (Table 3) for diesel engine powered BTS were in the range 72.5 – 78.9 and 76.9 – 81.8 dB (A), respectively which are far above the WHO recommended level. Similarly, the night time noise levels (Table 4) in both States exceeded the WHO values.

Table 1: Day Time Noise Level around Solar Energy Powered BTS in Lagos

B/N	Minimun noise level	Maximum noise level	Average noise level
Lagos 6	36.4	50.7	43.6

Table 2: Measured Day Time Noise Level around BTS in Lagos State

B/N	Minimum noise level	Maximum noise level	Average noise level
Lagos 1	71.2	75.2	73.2
Lagos 2	62.2	82.8	72.5
Lagos 3	69.4	85.0	77.2
Lagos 4	68.5	81.8	75.2
Lagos 5	75.4	82.4	78.9

Table 3: Measured Day Time Noise Level around BTS in Osun State

B/N	Minimum noise level	Maximum noise level	Average noise level
Osun 1	77.3	86.3	81.8
Osun 2	76.3	87.0	81.7
Osun 3	74.0	88.8	81.4
Osun 4	61.7	95.7	78.7
Osun 5	70.4	83.3	76.9

Table 4: Measured Night Time Noise Level around BTS in Lagos and Osun States

B/N	Minimum noise level	Maximum noise level	Average noise level
Lagos 7	65.1	69.0	67.1
Lagos 8	66.8	73.1	70.0
Osun 6	86.3	94.8	90.6
Osun 7	61.9	73.1	67.5

Adequate sleep is essential to maintain good health and mental functions (Patlak, 2005). Noise has been known to interrupt sleep and it causes both primary and secondary sleep disturbances. The primary effects experienced by occupants in the neighborhood may include difficulty falling asleep, differences of sleep patterns, and awakenings (Berglund and Lindvall, 1995). Levels attributable to sleep disturbance can be as low as a continuous noise greater than 30 dB or an intermittent noise that increases the amounts of awakenings per night (Goines and Hagler, 2007). Going by literatures above, the measured noise levels showed that the occupants of residential buildings around the BTS may be at risk of sleep disturbance at night. The average noise levels around BTS in Osun State were however observed to be higher than those of Lagos. The only reason adduced to this is that the BTS investigated in Osun State are older than those of Lagos State.

Conclusion and Recommendation

The study of the noise levels at residential areas located around the base transceiver stations in Lagos and Osun States, Nigeria has revealed that the contribution of base stations generators to noise pollution is significant. Sleep disturbance may be of serious concern as day and night time noise levels are well above WHO recommended safe levels. Control measure includes prohibiting the siting of base stations within residential areas or the use of more environmental friendly power sources.

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