



Awareness and Exposure to Generator Noise Pollution in Nigeria

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Abstract

The acute shortage of electricity in Nigeria has led to indiscriminate, unregulated, and prolonged use of generators for electricity by her citizens, which contributes to noise pollution in the country. Although the Nigerian National Environmental Standards and Regulations Enforcement Agency (NESREA) has been charged with the responsibility to control noise pollution, many Nigerians fear the agency is ineffective. In this study, Nigerians in five cities were surveyed. The results of the survey confirm their fears and show that a majority of Nigerians are not aware of NESREA existence and its responsibilities. Similarly, an overwhelming majority of those surveyed want the Nigerian government or NESREA to be more aggressive in monitoring and controlling generator use in the country.

Keywords: Generators, Noise, Pollution.

Introduction

Nigeria's well-documented problems of dire electricity supply have led households and businesses in the country to result to prolong use of portable, stationary, and heavy-duty power generators to source electricity. There are literally millions of generators in use in Nigerian cities on a daily basis because of the inability of licensed power companies to generate, transmit, or distribute electricity to Nigerians. Awofeso¹ notes that about 90% of businesses and 30% of homes in Nigeria use generators for electricity supply daily. As BBC News² puts it, "60 million people own generators to provide electricity for their homes and businesses in Nigeria". In many cases, the generators are installed indiscriminately in residential and business premises irrespective of the noise impact and other pollutants there from^{3,4}. As an instance, it is common sites for a business plaza with say 70 stalls, to have 70 generators running simultaneously for the stall owners in times of power outage, which is frequent. The direct consequence of the proliferation of generator usage is unrestrained pollution of the environment and its attendant consequences on human health.

Backed by an Act of the country's National Assembly, the National Environmental Standards and Regulations Enforcement Agency (NESREA) has been charged with the task of protecting the Nigerian environment through enforcement of compliance with environmental laws, rules, and regulations⁵. On its website, the agency lists its functions that include enforcement of "compliance with laws, guidelines, policies, and standards on environmental matters through compliance monitoring of environmental standards on noise"⁶. As of this publication, it is difficult to ascertain the level of success the agency has recorded in executing this mandate because i. noise pollution in Nigerian cities appears to be on the increase with no

sign of abatement⁷ and ii. literature search of public archives and those of the agency's parent ministry shows no signs of regulatory guidelines or concrete evidence of regulatory successes. This and the apparent rise in the level of noise emanating from increased generator use in many Nigerian cities suggest a need for a public national awareness programmes and guideline for enforcing stipulated noise standards to protect Nigerians and the nation from the health and economic hazards from man-made pollution. Besides, it is doubtful whether the average Nigerian is conversant with the impact of noise pollution or the role of NESREA in helping to minimize its occurrence. This study is intended to examine awareness level of noise pollution.

Background: Given the huge and uncontrolled number of generators in use in Nigerian cities, it is likely that a good number of people in the country are exposed to harmful level of generator noise pollution. Exposure to excessive noise level endangers human health. A notable health hazard of noise pollution is hearing loss, although the degree of loss depends the exposure level, duration, and susceptibility of the individual. The United States Occupational Safety and Health Administration (OSHA) quoting the country's Bureau of Labour Statistics reports that "nearly 125,000 workers have suffered significant, permanent hearing loss" between 2004 and 2013 and that "more than 21,000 hearing loss cases were reported in 2009 alone"⁸. The World Health Organization⁹ and Office of Noise Abatement and Control (ONAC) of the Environmental Protection Agency¹⁰ of the United States note that excessive noise can cause cardiovascular and psychological problems for humans. The position is confirmed by Hammer et al who note that habitual exposure to environmental noise "causes a wide variety of adverse health effects, including sleep disturbance, annoyance, noise-induced hearing loss (NIHL), cardiovascular

disease, endocrine effects, and increased incidence of diabetes”¹¹. Exposure to noise causes other problems such as modification of social behaviours¹². The authors also reported studies that show a relationship between noise and high blood pressure. Table-1 shows some of the health effects of environmental noise exposure published by WHO.

Table 1
Noise/Sound level and health effect

Environment	Critical health effect	Sound level dB (A)	Time hours
Bedrooms	Sleep disturbance	30	8
Indoor dwellings	Speech intelligibility	35	16
School classrooms	Disturbance of communication	35	During class
Outdoor living areas	Annoyance	50 - 55	16
Industrial, commercial and traffic areas	Hearing impairment	70	24
Music through earphones	Hearing impairment	85	1
Ceremonies and entertainment	Hearing impairment	100	4

Source: World Health Organization¹³

The adverse effects of noise pollution have prompted nations and world bodies to establish standards for limiting noise exposure to humans, as well as guidelines for enforcing the standards. For instance the WHO-1 provides criteria for continuous and intermittent occupational exposure levels to noise in work environment and guidelines for community noise exposure¹⁴. South Africa regulates noise exposure under its Occupational Health and Safety Act (Act 85). One of the regulations forbids workers not wearing protective hearing equipment from exposure to noise levels higher than 85 dBA¹⁵. The Federal Government of Nigeria Official Gazette¹⁶ has established the National Environmental (Noise Standards and Control) Regulations, 2009. S. I. No. 35 to “ensure tranquillity of the human environment and their psychological well-being by regulating noise levels”⁶. The European Union (EU) has adopted a directive on minimum health and safety requirements regarding the exposure of workers to the risks arising from noise and provisions aimed at avoiding or reducing the exposure. The Canadian Centre for Occupational Health and Safety (COSHA) has established its standards for limiting noise exposure in the workplace. In the United States the EPA¹⁰ established acceptable environmental noise levels to protect public health and welfare.

Noise Exposure Limits: Many countries including Nigeria specify noise limits to which workers and the general public

may be exposed. Table-2 and Table-3 summarize the exposure limits adapted by Nigeria for both the general and work environments respectively.

Table 2
Maximum permissible noise levels for general environment

Facility	Noise Limits B (A) (L _{eq})	
	DAY (6 am to 10 pm)	NIGHT(10 pm to 6 am)
Any building used as hospital, convalescence home, home for the aged, sanatorium, and institutes of higher learning, conference rooms, public library, environmental, or recreational sites.	45	35
Residential buildings	50	35
Mixed Residential (with some commercial and entertainment)	55	45
Residential + industry or small-scale production + commerce	60	50
Industrial	70	60

Source: The Federal Government of Nigeria Official Gazette¹⁶

Table 3
Maximum permissible noise levels from a factory or workshop

L _{eq} dB (A)	Duration (Daily)	Duration (Weekly)
85	8 hours	40 hours
88	4 hours	20 hours
91	2 hours	10 hours
94	1 hour	5 hours
97	30 minutes	2.5 hours
100	15 minutes	1.25 hours
103	7.5 minutes	37.5 minutes
106	3.75 minutes	18.75 minutes
109	1.875 minutes	9.375 minutes

Source: The Federal Government of Nigeria Official Gazette¹⁶

Noise Pollution: Because generators are located in residential and business areas in Nigeria, the need exists for strict monitoring and control to ensure compliance with the maximum permissible noise limits. As noted already, continued exposure to noise above 85 dBA over time, will cause hearing loss^{8,17}. Sound level is measured in decibels, dBA. In general, the louder the noise, the less time that is required before harm is inflicted. The United States National Institute for Occupational Safety and Health as reported by Madison¹⁸ states that the maximum daily exposure time at 85 dBA is eight hours. In general, noise levels greater than 85 dBA will harm hearing in a shorter time than eight hours. Exposure to noise levels of 140dBA or greater can cause damage to hearing instantly to unprotected ears¹⁹. The details of the recommended noise exposure levels are shown in Table-4²⁰.

Literature Review: Generator noise pollution in Nigerian cities has been the subject of investigation and germinal literature for some time now. Ana, Luqman, Shednell and Awoaje assessed the noise levels of generators in Agbowo and Ajibode areas of Ibadan, Nigeria and found that the noise pollution levels exceeded the limits prescribed by WHO²¹. The researchers also reported incidence of hearing loss among residence of the areas, which appeared to be noise-induced. In their study of the noise levels produced by diesel-powered generators used by GSM base stations in Abuja municipality, Aderoju et al²² revealed that at distances of 10 meters 66% of the generators exceeded both the daytime and night time noise limits specified in Nigeria noise laws. In the same study, the authors reported 100% of the generators exceeded the specified night-time noise limits at 20meters away, although the noise levels were all below the daytime limits at the same distance. Nkeleme and Udoh²³ carried out a study of randomly selected diesel-powered generators installed for MTN GSM base stations in Nigeria to

find out if any relationship exists between the generator’s age and its level of noise pollution. The researchers observed that generators installed in 2004 have lower noise pollution level than those installed one year earlier, and concluded that age was a factor in the noise level produced by the generators. Anomohanran²⁴ studied noise pollution levels in Abuja, the capital of Nigeria. For the purpose of the study, the author divided the city into sevenzones. The findings showed that five out of the seven zones exceeded the noise pollution limits during the day, while all the seven zones were below the noise threshold at night. The author did mention the conditions under which the study was performed; for instance, whether or not there was regular electricity during the measurements.

In their investigation of the impact of generator noise on the health of the residents of Obantoko in Ogun State, Nigeria, Azodo and Babatope³ found that residents who were constantly exposed to high noise levels experienced hearing impairment, sleep deprivation, negative social behaviour, and cardiovascular problems. Yesufu, Ana, and Umar²⁵ studied generator users in two commercial communities in Ibadan, Nigeria to understand their knowledge and perception of generator noise and associated health hazards. The researchers found that the users have low knowledge of the dangers of generator noise to their health. The recurring theme throughout the literature reviewed revolves around the high level of noise pollution and knowledge of the harmful effects of generator noise in Nigeria. This leads to the question of (a) whether or not the average Nigerian is aware of the health effects of generator noise, (b) whether or not the Nigerian generator user is aware of the safety noise limits imposed by national laws and standards, and (c) what Nigerians think about the effectiveness NESRA’s noise monitoring programme.

Table-4
Maximum recommended noise dose exposure levels

Noise Source	Noise Level (dBA)	Max Exposure Time Per 24 Hours	Noise Source	Noise Level (dBA)	Max Exposure Time Per 24 Hours
City traffic	85	8 hours	Generator	112	56 seconds
Gas lawn mower, portable generator	88	4 hours	Portable and diesel generator, chain saw, leaf blower, rock concert	115	28 seconds
	90 - 91	2 hours		118	14 seconds
Stereo headphones, portable generators,	94	1 hour		121	7 seconds
	97	30 minutes		124	3 seconds
	100	15 minutes		127	1 second
Portable generator, concert	103	7.5 minutes		Jet airplane at 100 feet away	130-140
	106	3.7 minutes	Fireworks, small rifle	140	Danger
	109	112 seconds	Shotgun	160	Danger

Sources: Folmer and Martin¹⁹ and US DHHS²⁰,

Materials and Methods

One of the concerns about generator noise in Nigerian cities is the level of residents' awareness of its harmful effects and the Nigerian regulatory agency charged with controlling noise pollution in the country. To answer the question, a validated questionnaire was randomly administered to residents of different background, ethnicity, demography, and profession in the Nigerian cities of Abuja, Lagos, Benin City, Kaduna, and Port Harcourt. The survey was limited to cities because of the perception that Nigerians in the cities are more likely to use generators for electricity supply in their homes and businesses than those in rural areas. The questionnaire focused on three areas – noise pollution source, effect of noise pollution on human health, and noise pollution regulations. The questions asked ranged from noise pollution source(s) that bother respondents the most to knowledge of NESREA and its responsibilities.

Results and Discussion

The survey results show that Nigerians in cities are aware that exposure to noise pollution can be harmful to human health, and support aggressive government regulation of generator noise. For example, when asked about the noise source(s) that bother them most, 67% of respondents say it is generator noise while emergency vehicle noise comes a distant second with 12%. Figure-1 shows the sources of noise and how they that bother respondents.

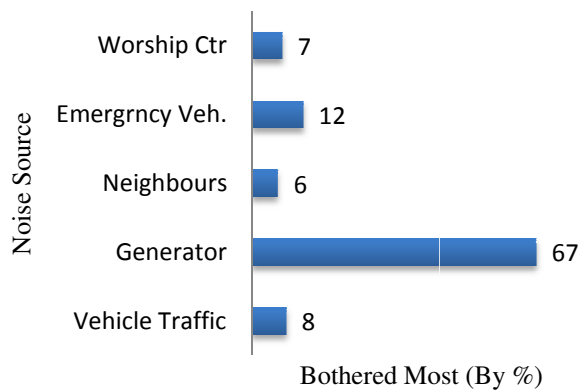


Figure 1
 Most bothersome noise source

In another example, which is shown in Figure-2, 96% of those surveyed believe they are sometimes or mostly exposed to generator noise pollution compared to 3% who believe they are not.

On whether they are aware that NESREA is responsible for monitoring and controlling generator noise pollution, 46% of respondents answer in the affirmative while 54% say they are not aware of the NESREA responsibility. The result is captured in Figure-3.

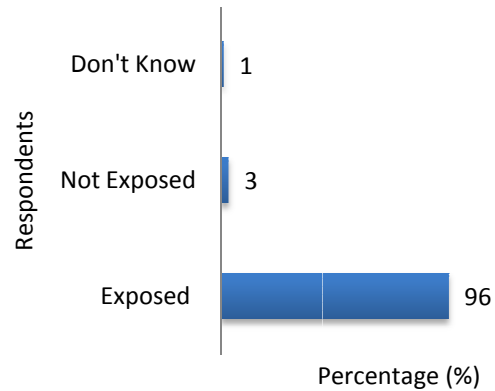


Figure 2
 Percentage of respondents who think they are exposed to generator noise

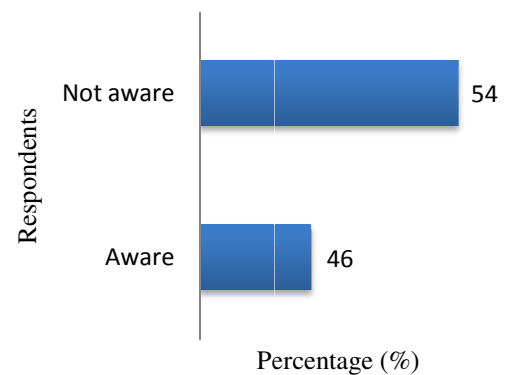


Figure 3
 Percentage aware of NESREA responsibility to monitor and control noise

On whether or not they support more aggressive monitoring and control of noise pollution, 82% of respondents say they support it.

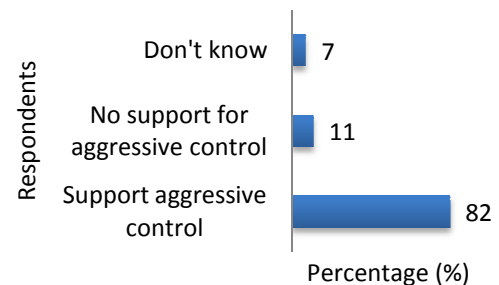


Figure 4
 Percentage support for aggressive monitoring and control of noise

The full results of the survey are shown in Table-5.

Table 5
Noise pollution survey results among nigerians

No	Question	Response	% of Respondents
1	The noise issue or issues that affect the respondent at home, workplace, or in general (A respondent allowed to choose more than one answer)	Generator noise	35
		Vehicle traffic noise	19
		Worship centre noise	17
		Generator & traffic noises combined	12
		Other noise sources	17
2	The noise sources or issues that bothers the respondent the most.	Generator noise	67
		Emergency vehicle noise	12
		Vehicle traffic noise	8
		Worship centre noise	7
		Other	5
3	Awareness that noise pollution can adversely affect a person's health.	Yes	92
		No	7
		Don't know	1
4	Whether the respondent thinks that he/she is sometimes exposed to generator noise pollution.	Yes	96
		No	3
		Don't know	1
5	Whether the respondent thinks that the level of generator noise is increasing in his/her workplace, neighbourhood, or community	Yes	74
		No	23
		Don't know	3
6	Whether the respondent has ever complained to someone about generator noise.	Yes	67
		No	33
7	Whether the respondent supports government regulation of generator noise.	Yes	86
		No	14
8	Whether the respondent has heard of the National Environmental Standards and Regulations Enforcement Agency (NESREA).	Yes	57
		No	43
9	Whether the respondent knows that NESREA is the federal government agency given the legal power to regulate noise pollution in Nigeria?	Yes	46
		No	54
10	Whether the respondent thinks the government or NESREA should take more aggressive steps to regulate generator noise.	Yes	82
		No	11
		Don't know	7

Discussions: Given the results of this study, it is fair to note that NESREA does not appear to be successful in creating noise pollution awareness and enforcing relevant noise pollution standards in Nigeria. For instance, 54% of those surveyed are not aware that the agency has the legal mandate to monitor and control generator noise, the most offensive noise pollution agent in Nigeria. Similarly, a whopping 74% of respondents think the level of generator noise is increasing in their workplace, neighbourhood, or community. The ineffectiveness of NESREA in monitoring and controlling noise pollution is summed up by overwhelming belief (82% of respondents) that NESREA needs to be more aggressive in enforcing noise pollution standards. As this study reveals, people are affected most by generator noise than any other noise sources in their homes, workplace, and general areas. Similarly, 67% of those surveyed say they are bothered most by generator noise than any other type of noise.

In listing the accomplishments of NESREA, Benebo²⁶ asserts that the agency has “commenced prosecution of environmental crime cases; with appreciable success” (p. 89). The author also states that the agency “enforces fully, the provisions of the National Environmental (Control of Emissions from Petrol and Diesel Engines) Regulation, which culminates in the effective ban on the importation of 2 stroke engines; and Motor vehicles not having emission reduction technology” (p. 92). These assertions suffer considerable standing given that no evidence relating to smog inspections on petrol and diesel engines could be found on ground or on the agency’s website. Similarly, it is not clear where and when generator noise pollution offenders have been prosecuted by NESREA as literature shows numerous instances of noise limit violations without consequences. The agency can and should bare its teeth and bite. In addition, there is a need for a public national guideline for enforcing stipulated noise standards to protect Nigerians and the nation from the health and economic hazards from man-made pollution.

Conclusion

The results of this study show Nigerians are worried about the impact of generator noise pollution and the inability of NESREA to control it. The results also suggest the need for NESREA to be more aggressive in sensitizing the Nigerian public about generator noise pollution as well as in monitoring and controlling generator use in the country.

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