PROBLEMS OF ENVIRONMENTAL NOISE POLLUTION IN LUSAKA SCHOOLS:

An Ethical Case Study of M'tendere School Areas.

BY

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A Dissertation submitted to the University of Zambia in partial fulfilment of the requirements of the Degree of Master of Arts in Applied Ethics.

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DECLARATION

I Phillip Mwamba declare that this dissertation:

(a) represents my own work

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ABSTRACT

This study is an ethical evaluation of problems of environmental noise pollution in four school areas in M'tendere in Lusaka, i.e., Mahatma Gandhi, Old M'tendere, New M'tendere and Chitukuko Basic Schools. The study arose from the researcher's observation regarding the increase in aggressive behaviours from children that live in peri-urban areas where noise pollution is more prevalent. Due to non-existence of laws of country planning in these areas, there is rampant encroachment on many school areas and residential houses by taverns, bars, welding workshops and many other unplanned business ventures that produce deafening noise at most times. Noise from these economic ventures has become a serious environmental problem to the health of both adults and school-going children (Goines and Hagler 2006).

The main objectives of the study were to establish the problems of environmental noise pollution that influenced behaviour and the effective learning abilities of pupils in these schools and to ethically evaluate the issue of environmental noise pollution in the indicated school areas.

The study adopted qualitative methodology that involved the use of mixed research, consisting of an empirical part and an ethical analysis part. Data was collected using a questionnaire administered to the 80 pupils in the same schools and interviews with parents, teachers, businessmen and two officials, each from Zambia Environmental Management Agency (ZEMA) and Lusaka City Council Public Health Department. Many problems of environmental noise pollution were elicited from data that was collected. Decreased academic concentration and comprehension ability, decreased motivation and attention span, deterioration of hearing loss, high pitched speech stimulation and exhibition of aggressive behaviour towards one another in terms of perceived mistake made were some of the problems established from the findings of the study. A comparative analysis of the numbers of pupils that sat for final examinations with those that failed in each of the previous three years, reflected low academic performance of children in the studied areas of M'tendere.

The ethical evaluation used a contemporary version of Utilitarianism and rule-utilitarianism, the Precautionary Principle and selected Human Rights to come up with an ethical evaluation stance of noise pollution for the Government and the people in these noise prone areas to consider. The arguments posed conflicting interests between the demands for a serene learning environment that promotes the learning and health of pupils, against the socio-economic pursuits of business entrepreneurs. Yet the overall ethical evaluation concluded that noise pollution was a factor that negatively affected the school-going children and influenced their socio-emotional development and learning ability in schools.

Finally, the study made five recommendations. Among them are the legislation against noise pollution, the introduction of insulation policy of classrooms in noise prone areas and a more serious consideration of the *inner most body environment of the* people themselves, should be among the primary things to consider in all what is done for the sustenance of healthy bodies and minds.

DEDICATION

I dedicate this work to all godly foundation lovers, those who are deemed to uphold intrinsic values and principles of truth; those who seek for giant intellect and extensive research: men and women whose utterances stimulate thought that open vast fields of knowledge with sincere purpose to uphold truth, honesty, fairness and justice; those who try to commune the minds of men to the mind of God to have the highest education in which lies God's own method of development to people.

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Naturally, nobody sacrificed more financially than my family during my engagement in this study. Chilufya my first born daughter, Mwamba and Mulenga my first twin daughters, Lombe my only son, Kangwa and Mwenya my second twin daughters and my wife Chishimba, were denied the opportunity to enjoy from the finances that went to the payment of all the requirements for the Master's study.

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ACRONYMS AND ABBREVIATIONS

dB -	Decibels
ECZ _	Environmental Council of Zambia
EEG _	Electroencephalogram
EPA _	Environmental Protection Agency
EPPCA-	Environmental Protection and Pollution Control Act
GDP-	Gross Domestic Product
GNP -	Gross National Product
Hz –	Hertz
LCC-	Lusaka City Council
MUVI-	Name of a private Television station in Zambia.
Na^+ _	Sodium ions
OAU -	Organization of African Unity
PP –	Precautionary Principle
SoE _	State of the environment
UNESCO -	United Nations Education Scientific and Cultural Organisation
WHO –	World Health Organization
WTO -	World Trade Organization
ZEMA	Zambia Environmental Management Agency
ZNBC-	Zambia National Broadcasting Corporation

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

TABLE OF CONTENTS

PAGE

CHAPTER 1
INTRODUCTION

1.1 Background

The principal factor in human life is the avoidance of pain and disease while maximizing the generation of happiness and preservation of good health. However, there are some cases when human beings out-step the boundaries of the preservation of health and cause damage and create dangers, not only to their lives, but also to the lives of others. This is done by indulging themselves in activities that are too dangerous but are perceived to be least dangerous or of no danger at all to health and happiness. Some of these activities are pleasure generating, while others result from the pursuance of socio-economic pursuits which usually end up in various types of environmental problems of which noise pollution is one of them (Panneerselvam and Ramakrishnan, 2005).

Pollution is a global problem and is generally classified according to the environment in which it occurs, such as air, soil and water or according to the type of pollutant by which pollution is caused such as heat, light or noise. These and many other types of pollutants are dispersed in the environment globally. Pollutants such as chemical waste, thermal radiation and noise are persistently spread in the environment, rendering its ecosystem equilibrium and biotic components vulnerable and adversely affected (ibid).

However, among the life-threatening types of pollution, is the hazardous noise pollution which is associated with factors like human population explosion, unplanned urbanization, profit oriented capitalism and technological advancement, yet it is least understood as a potential health hazard (ibid). Though it is so, noise pollution is one of the oldest types of pollution and goes as far back as the time human beings started to congregate together in massive populations, but its intensity now has changed greatly. Like other types of pollution, noise pollution is a modern day growing problem that remains unaddressed globally. However, researchers like Goines and Hagler (2006) have called it a ‘modern plague’. Unlike *air, water, pesticide* and *solid waste pollution*, noise pollution is unique, most complex, and least understood form of energy pollution. It is not cumulative and is not dispersed over great distances, like air pollution. This means that once the generating source of noise ceases to operate, noise also dies out rapidly, yet it is a very serious hazard to

the health status of those who are affected by it (Rillo, 1979). This is true because there is considerable amount of research, documenting its effects on human auditory and non-auditory components, especially that of school-going children.

This study, however, discussed the problems of environmental noise pollution on school-going children in Mahatma Gandhi, Old M'tendere, New M'tendere and Chitukuko schools, with special focus on an ethical evaluation of environmental noise situation in these school areas of M'tendere in Zambia. Given the intensity and gravity of the problems centrering around the exploitative use of our environmental air space in which noise is dispersed by noise polluters, and the global health challenges which emerge from such irresponsible and selfish human acts, it is important for humans to understand the ethical value system that the quiet environment carries and how people should morally and judiciously respect it (Blackstone, 1974).

Nevertheless, in spite of the dangerous effects to human life so far documented by research world-wide, noise pollution levels in Lusaka's peri-urban settlements have continued to rise, being produced from bars, taverns, market places, night clubs and other business ventures that are dotted around schools and residential houses. Often, some of these businesses produce deafening noise at all times, including night times. People in these areas have ignorantly and blatantly ignored the flashing dangers of noise pollution the same way they had ignored the dangers of the use of tobacco many years ago, whose dreadful cancerous effects are there to be seen (Goines and Hagler, 2006). However, some of the effects have been felt and probably identified by only a few residents in Lusaka and Ndola, who have openly complained, according to media reports. It seems that their complaints have fallen on the deaf ears of authorities like the Zambia Environmental Management Agency (ZEMA) and the City Councils.

Therefore, considering a growing body of evidence on the effects of noise pollution, in particular deficits in academic performance and an increase in the aggressive behaviours of children, it became necessary to investigate from the ethical point of view the problems of environmental noise pollution on pupils' academic performance and social emotional development and response.

1.2 Statement of the problem

There is rampant encroachment on many school areas and areas where school pupils reside by taverns, bars, markets, nightclubs, welding workshops and other unplanned business ventures in most peri-urban settlements of Lusaka. The proliferation of such unplanned and uncontrolled economic ventures has resulted in the production of deafening noise. Despite some studies carried out in developed western countries such as the United States of America and Britain on the effects of noise pollution and few complaints from some residents in Lusaka, noise pollution levels have continued to rise (The Times of Zambia, 2008). This is particularly so in areas such as M'tendere, Kalikiliki, Kalingalinga, Mandevu and many other such areas. Further, it is seen that little or no effort has been done to curb this vice or to educate residents of these areas on the health and social effects that noise has on people, especially on pupils' academic performance and social behavioural potentials. The Zambia Environmental Management Agency (ZEMA), formerly known as Environmental Council of Zambia (ECZ) has not taken it as a serious human environmental hazard, despite few reported concerns from the public. Health campaigners in the Ministry of health and Non-Governmental Organisations (NGO_S) whose mandate is related to education, health as well as the negative social burdens have also remained quiet despite the increase in noise pollution. It has not been established whether or not noise pollution in these areas contributes to reduced pupils' academic performance and their aggressive behaviour in relation to others. Therefore, it is necessary to investigate this from the ethical point of view.

1.3 Aim of the study

To investigate problems of noise pollution on pupils in selected school areas of M'tendere in Lusaka urban and to ethically evaluate it with a view of mitigating it.

1.4 Research Objectives

1. To explain the effects of noise pollution on human beings in general.
2. To establish what problems teachers and parents have experienced with pupils due to noise pollution in the studied areas.
3. To find out how the academic performance and social behaviour of pupils from M'tendere schools are affected by noise pollution.

4. To ethically evaluate the causes and possible justification of noise pollution in the studied school areas.

1.5 Research Questions

1. What are the effects of noise pollution on human beings in general?
2. What problems do teachers and parents experience with pupils due to noise pollution in the studied areas?
3. How is the academic performance and social behaviour of pupils from M'tendere schools affected by noise pollution?
4. What causes and possible justification arise in the ethical evaluation of noise pollution in the studied school areas?

1.6 Theoretical framework

An issue of physiological disequilibrium in the human body that results into deleterious health effects and which further extend to the entire society's well-being is a serious ethical issue needing evaluation, with a view of mitigating it using appropriate normative ethical theories and principles. The researcher consequently used an appropriate theoretical framework that includes Utilitarianism, the Precautionary Principle and some human rights from the African Human and People's Rights Charter and the United Nations Convention on the Rights of the Child Charter.

1.7 Methodology

The study adopted the qualitative methodology that involved the use of mixed research, consisting of an empirical part and an ethical analysis part. This study was carried out in Mahatma Gandhi, Old M'tendere, New M'tendere and Chitukuko school areas of M'tendere in Lusaka urban district. Purposive or deliberate sampling was used to select these school areas as study sites, because the schools in M'tendere compound are surrounded by business ventures which produce continuous noise throughout the day and even beyond in the night.

The principal target group of participants were the 80 pupils from basic schools in M'tendere. These were selected by purposive and systematic random sampling of probability count of 'One-Two, One-Two' for the questionnaire. Pupils who fell on 'Two' were picked to answer the questionnaire. The other target groups

were the 6 parents, 10 school teachers, two officials, each from Zambia Environmental Management Agency (ZEMA) and Lusaka City Council Public Health department who were purposely chosen for the purpose of policy guidelines, laws and implementation strategies. Finally, the last target group was the 8 business owners whose businesses were allegedly to be the source of noise pollution in the sampled areas. The total sample involved 106.

The above respondents assisted in the provision of data through a research process that included: documentary research from textbooks, journal articles from the internet, hinari and pdf as well as from daily newspapers within the country. Interviews with parents, teachers, businessmen and officials were also done. Questionnaires were administered to pupils from each sampled school in M'tendere area.

1.8 Significance of the study

The emergence and increase of aggressive behaviours of juveniles towards others in peri-urban settlements has become a worry to parents, teachers in institutions of learning and indeed religious leaders. These children are only prone to bad vices, loaded with various lusts of all sorts that further derail their minds from attaining desirable academic outcomes and socially acceptable behaviour.

The awareness of the effects and problems of noise pollution on school pupils' academic performance and social behaviour makes the study important to both parents and education providers in learning institutions. It is also hoped that this study will provoke and generate interest in other researchers from other disciplines to carry out more research on noise pollution; on infants and pregnant mothers of which a good volume of contribution to the body of knowledge will grow for children in Zambia and worldwide.

Due to ignorance by the majority of the people in Zambia and the reluctance of the public health inspectors from Lusaka city council, the study exposes some human rights issues of children in noise prone areas for their autonomy, self-determination and awareness. Finally, the study is mostly important because it has not been studied before from an ethical viewpoint and would serve as a source of expanded horizons of knowledge that would help to mitigate the noise pollution problem in the affected areas.

1.9 Delimitation and limitations of the study

This study is a philosophical work that is restricted to investigating the problems of noise pollution in identified school areas in Lusaka urban in terms of academic performance and social behaviour. Though this study deals with sound energies that are capable of damaging the eardrum and other physiological components of the body, it will not measure and determine the number of decibels (dB) of minimum and maximum standard levels of noise from all polluter sources as stipulated in the WHO report of 1999. In addition to this, the study will not include any medical diagnosis like the use of a sphygmomanometer to ascertain certain blood pressure levels in the brachial arteries of the respondent children's arms to prove the cardiovascular effects of noise pollution on them.

The study limits itself to four schools in M'tendere. Among the limitations to this study, financial resources of the researcher were limited. Due to this, the schools chosen were few. Hence a large number of pupils, parents and business participants could not be reached, though wider coverage of that would have added more value to this work. In most cases, some respondents demanded for payment, without which no information was given. This also influenced the scope of the study negatively in cases where the researcher could not afford to pay for information.

1.10 Organizational Structure

This study consists of seven chapters. Each chapter deals with a specific topic and subtopics under consideration, leading to the ethical evaluation of environmental noise pollution problem in Lusaka schools is given. The study also presents an alphabetical glossary of the significant terms used in it for clear understanding.

Chapter 1 starts with the background to the study. It further consists of the statement of the problem, the aim, research objectives and research questions, significance of the study; a brief methodology; delimitations and limitations. Chapter 2 presents a detailed literature review with various topics such as; General overview of health effects of noise pollution on human beings; some auditory and non-auditory effects of noise pollution and its subtopics. The chapter is meant to broaden the scope and view of the reader to understand the effects of noise pollution on people, especially the school-going children.

(*See Appendix D)

Since the study is an ethical evaluation, Chapter 3 considers the ethical theories that are used in the evaluation. These are Rule-Utilitarianism and a contemporary version of Utilitarianism; the Precautionary Principle as well as the selected human rights from two Human Rights Chatters.

Chapter 4 gives an outline of the detailed methodology, indicating the area of study, sample sizes and instruments used by the researcher whilst Chapter 5 presents the findings of the study; their discussions and analysis. Chapter 6 portrays an ethical evaluation of the problem at hand using the selected ethical theories and principle. Finally, chapter 7 gives a comprehensive summary, draws a conclusion and makes recommendations.

1.11 Operational definitions of the study

It is important to be clear about the concepts that are used in the title of this study entitled: "Problems of Environmental noise pollution in Lusaka schools: An Ethical case study of M'tendere school areas".

Problems: According to Harper Collins Publishers, problems are some things or moral questions that are difficult to deal with and create difficulties for others but require solutions.

Environment: an external or internal condition of being or surrounding in which people live.

Noise: Jensen (1973) defines noise as unwanted or disturbing sound while Verma and Agarwal (2001) define it as sound without value or any noise that is undesirable by the recipient. This study accepts both views on this term.

Pollution: Panneerselvam and Ramakrishnan (2005) define Pollution as the deliberate or accidental contamination of the environment with poisonous or harmful substances usually introduced by human beings.

Therefore, in this case, 'environmental noise pollution' is applied in both contexts where the inner being of persons or the external surrounding in which people live is deliberately or unknowingly contaminated with harmful sound energy that may harm human beings.

Lusaka: the capital city of Zambia in which the sampled school institutions, accommodating grades ones to nine classes, (commonly known as basic schools) are situated.

Ethics: the moral principle or value concepts held by people, concerning how people ought to live or act when actions have good or bad effect on others.

Therefore, ‘an ethical case study’ means a study of an issue based on a system of moral principles about right and wrong, good or bad.

M’tendere: a compound, situated east of the town centre of Lusaka city, where this study was specifically conducted.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In this review of literature, we critically review the existing documentary evidence worldwide associated with environmental noise pollution and how this affects the performance of pupils in schools. We also look at the evidence available in Zambia on the effects of environmental noise pollution on the performance of school children. This study proposes the need for an environmental ethics extension from the traditional boundary of ethics that considers solely the external human and non-human environments, to include the threat to the inner human body environment and how pollutants of noise ultimately affect performance and behaviour of school going-children and people in general.

2.2 Meaning of Environmental Noise Pollution

The term 'noise' is defined by Smith et al. (2003) as unwanted or meaningless sound that may distract attention from cues that are important for task performance in people's communities. Jensen (1973) defines noise the traditional way as unwanted or disturbing sound, while Verma and Agarwal (2001) define it as sound without value or any sound that is undesirable by the recipient.

Verma and Agarwal's second thought in their definition of noise draws a boundary of adaptation whereby the recipient who is subjected to continuous or repetitive noise soon gets used to it. Though it may be so, noise pollution is harmful to human beings and other sentient beings. On the other hand, Panneerselvam and Ramakrishnan (2005) define 'pollution' as the deliberate or accidental contamination of the environment with poisonous or harmful substances, usually introduced by human beings. Smith et al. (2003) definition of 'pollution' agrees with that of Verma and Agarwal, who define it as unfavourable alteration in the physical, chemical or biological characteristics of air, land and water that may or will harmfully affect human life or that of desirable species, as well as the industrial processes, living conditions of people and their cultural assets (Verma and Agarwal, 2001).

Noise pollution may seem innocent in the thinking of many people, but it causes disturbances in the atmosphere, which in turn interfere with the systems of communication in the human body. This interference later has huge effects on the

sense organs, the cardiovascular system, glandular system and nervous system. In a similar manner, any foreign matter that is introduced in the body does almost the same to the inner molecular tissues as a rebound action within the body system, springing back from such sudden or foreign impacts (Goines and Hagler, 2006).

What, then, is 'noise pollution'? First, let me make a distinction between mere sounds and noise. Many sounds are beautiful, peaceful, awe-inspiring and edifying. These sounds are pleasant to hear. Other sounds are not necessarily beautiful and peaceful, but are acceptable by-products of human activities that we call 'noise'. As Jensen (1973), Verma and Agarwal (2001) define 'noise' and 'pollution' respectively, sound becomes unwanted when it interferes with normal life activities either by deliberate or by accidental contamination of the environment with such sounds. Environmental noise pollution, as outlined by Pople (1987), is therefore, a type of energy pollution in which damaging sounds are freely dispersed in the atmosphere and are freely audible. These noise contaminants are not in the real sense physical particles. They are rather invisible longitudinal and progressive waves, comprising of compressions and rarefactions that interfere with naturally occurring waves of similar type. However, these sound waves become noise pollution when they are dispersed into the biosphere in such great quantities that they begin to adversely affect the normal functioning of the auditory and physiological systems and have adverse health and social effects on human beings (Verma and Agarwal, 2001).

2.3 General Overview of Health Effects of Noise Pollution on Human Beings

Noise pollution is as serious and damaging as the releasing of any other form of energy pollutant, like heat or light in the environment, though its effects are not as immediate as in the case of heat. Goines and Hagler (2006) say that apart from being a temporary nuisance, noise pollution causes serious health effects on human beings.

For several decades now, many noise pollution studies have been conducted and all have shown that there are direct links between noise and health. For instance, Suter (1991) mentions some of the more noteworthy research studies that were done in the United States of America that confirmed adverse auditory and non-auditory effects on the people that were affected. Some studies went further and investigated the psychological and physiological effects of noise pollution on humans, involving the cardiovascular effects. Some of these studies were done at the University of

Miami, John Hopkins University and at Massachusetts Institute of Technology (Suter, 1991).

Goines and Hagler (2006) reveal in their study that noise produces direct and cumulative adverse effects that impair health and that degrade residential, social, working and learning environments with responding real economic and intangible well-being losses. They further argue that noise pollution interferes with sleep, communication and recreation. In addition to what they point out, Edworthy (1997) also adds that noise pollution can cause anti-social behaviour and can lead to chronic stress resulting in many secondary problems in children's learning skills.

In comparison to other types of pollutants such as solid waste, the control of environmental noise pollution has been hampered globally by insufficient knowledge about its effects by decision makers and monitors. Several researchers have attributed this ignorance to the fact that noise pollutants are not seen, tasted nor smelled, but are only heard. Due to this fact, they say that this explains why it has not received as much attention as other types of pollution, such as air or water pollution. It is clear that noise pollution is widespread and imposes long-term consequences on health. By 1971, a World Health Organization (WHO) working group concluded that noise pollution was a major threat to human well-being (Goines and Hagler, 2006). However, this assessment by the WHO has not changed the knowledge levels and the ways of intervention after so many years. If anything, the threat has intensified even more, especially in industrialised and densely populated urban areas.

2.3.1 Hearing impairment

Exposure to continuous noise of certain intensity levels, particularly over a lifetime, can lead to a progressive loss of hearing, with a decrease in the threshold of hearing sensitivity. Hearing impairment due to noise pollution is a direct consequence of the effect of sound energy on the inner ear. In other words, hearing loss can be referred to as an auditory health effect. If sufficiently loud, and probably continuous, noise pollution dispersed in the environment can cause hearing impairment that includes temporary or permanent hearing loss (Goines and Hagler, 2006). Schwela *et al*. (2005) add that apart from the progressive hearing loss, there is also a danger of instant ear damage that is caused by high intensity impulse sound like explosions. The permanent hearing loss is what is simply referred to as deafness. Any hearing loss can arise either from the damaged ear drum due to high frequency sound

pressure changes on it that may overcome the pressure balance of the *Eustachian tube* and that of the outside of the body, or may arise due to the extreme over sheared membranes in the organ of corti that may cause the hair cells to snap.

**For detailed information about the ear structure and its function see Appendix D.*

2.3.2 Interference with speech communication

Noise pollution interferes with the ability to comprehend normal speech and may lead to a number of personal disturbances, handicaps, and behavioural changes. This may include lack of concentration, fatigue, uncertainty, lack of an individual's self-confidence, irritation, misunderstandings, decreased working capacity, disturbed interpersonal relationships, and stress reactions. Some of these effects may lead to increased accidents, disruption of communication in the classroom, for example, and impaired academic performance. This is true particularly on vulnerable groups that include children, the elderly, and those not familiar with the spoken language that is being used (Goines and Hagler, 2006; Schwela *et al*., 2005).

2.3,3 Sleep Disturbance

If there is anything more essential to the human body, it should include its response to rest. Rest is the only physiological medicine needed by the human body to recoup lost energies. Indeed, human body parts are made in such a way that they cannot function properly without rest and energy. Rest can be termed as a period of inactiveness during which all the parts of the body function at low rate, and which enables the body parts to restore the expended nerve energy as well as to clean up all the excess debris that is generated during the vigorous activities of metabolism.[1] Apart from the rest phases that are determined by individuals' conscious choice, either due to tiredness or for leisure, nature has provided sleep as a natural rest in which the body cells, including those of the brain and the nervous system, cope with their eliminative and restorative functions. The eliminative function of sleep is seen in the morning when a person wakes up with a lot of debris that had been poured out

[1] **Metabolism** is a general term that involves two chemical processes of *catabolism* (breaking down of material) and *anabolism* (building up of complex material) that occur in living cells of an organism, resulting in growth, production of energy and elimination of waste — (Collins College Dictionary, 1995).

of the mouth and eyes after a good night's sleep (Wickens, 2005). Scientifically it has been proved that the primary purposes and benefits of uninterrupted sleep is its prerequisite for good body physiology. Wickens (2005) gives a clear definition and purpose of sleep by saying that sleep is a state of inertia where normal consciousness is suspended to serve a very important physiological role and if humans are deprived of sound sleep for a prolonged time, they undoubtedly begin to experience unfortunate physiological consequences that may be fatal. Therefore, the purposes of good sound sleep, according to Wickens, are the generation of nerve energy, the refuelling of the liver and other cells with glycogen, destruction of old cells and replacement of these cells with new ones, and finally the expulsion of debris and wastes from the body. However, environmental noise is one of the major causes of disturbed sleep. This is why Goines and Hagler (2006) and Wickens (2005) say that when sleep disruption caused by environmental noise becomes chronic, the results are mood changes, low or reduced performance due to mind-exhaustion, physical fatigue and reduced immunity. Others are failure to metabolise necessary metabolites, difficulty in making good decisions and many long-term effects on health of people. Schwela *et al*. (2005) also support these findings and Mc Kinney (1981) argues in a somewhat similar manner.

Wickens (2005) pinpoints the importance of fulfilling the four complete stages of sleep and depicts the evil that results from the tendency of under- sleeping. He paints an awesome picture by saying that when individuals have inadequate sleep, it means that not enough nerve energy is generated to meet the needs of the challenges of the body functions.

According to Wickens, sleep is more than the brain and body at rest. He says that sleep is not a passive winding down in response to tiredness, but a series of different arousal states that are actively produced by the brain. Vander et al. (1975), also agree with Wickens about the states of the brain during sleep. Basing their argument on the Electroencephalogram[2] (EEG) readings, they say that the brain as a whole does not totally rest during sleep. This is because there is no generalised inhibition of activity of cerebral neurons, and recognition of neural activity where

[2] **Electroencephalogram** (**EEG)** is a machine which records electrical brain activity by means of electrodes placed on the scalp that detects the very small voltages of the neurons firing beneath the skull and the meninges. 'The neural activity is then recorded on the polygraph, consisting of a moving strip of paper and marked pens for each electrode placement' (Wickens, 2005; 172).

some individual neurons are more or less active during sleep than during waking. However, they quickly note that, although sleep is not a period of generalised rest for the brain, it may represent a period of rest for specific elements during which nerve cells can replenish substrates necessary for their generation. Indeed, sleep is a special kind of rest designed and fashioned to provide a phase to recharge the depleting and almost emptied energy batteries of Adenosine Tri-phosphate (ATP)[3] in the cells and to urgently remove the by-product wastes of metabolism that the body produces.

Chanda (2012), agreeing with Wickens, says that sleep is crucial for normal brain function. She equates the importance of sleep to that of air, water and food. Due to its importance, she says that, "Chronic sleep deprivation, not only hastens, but amplifies age related ailments like diabetes, obesity, hypertension and more especially memory loss" (ibid: 24). She classifies sleep deprivation into two categories as 'voluntary' and 'involuntary' sleep deprivation. She says that involuntary loss of sleep is a result of continued mental activity during the night which may be caused by noise pollution because noise is a threat that upsets people's mental balance in many ways. Therefore, noise pollution can cause involuntary sleep deprivation by modifying sleep wakefulness and by disturbing the circulatory rhythms that cause unwanted metabolism and endocrinal changes in the body that later cause *insomnia*[4]. Chanda concludes that insomnia is hence a form of involuntary sleep loss.

Sleep deprivation has deleterious effects on human beings in general, but it is much more serious with regard to school-going children. This is so because sleep deprivation effects are not only physical like tiredness, but are also physiological and psychological. Before the physical effects manifest, the physiological systems of body are firstly affected by the creation of toxic agents within the individual's body which upset the two *autonomic nervous systems*[5], the *sympathetic*[6] and the

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[3] **Adenosine Tri-Phosphate (ATP)** is molecules in the body cells that store energy for later use.

[4] **Insomnia** is a form of involuntary habitual sleeplessness. It can be due to physiological problem resulting from Bio-chemical changes at the brain level (Chanda, 2012).

[5] **Autonomic nervous system** [autos = self, nomos = governing] is that part of the peripheral nervous system which controls activities inside the body that are normally involuntary such as the heart rate, peristalsis and sweating.

[6] **Sympathetic nervous system** is one of the antagonistic systems of the autonomic nervous system that increases metabolic levels and rates, hence, raising sensory awareness in the body.

parasympathetic.[7] After the autonomic nervous systems are affected, then the psychological well-being becomes affected and finally culminates into physical effects that are easily seen (Mc Kinney, 1981). Sleep disturbance does not only affect the learning environment at school, but it also affects the pupils' learning environment at home (Goines and Hagler, 2006)

Goines and Hagler (2006) emphasise that low frequency sound is more disturbing of adequate sleep than high ones, even at very low sound pressure levels, because low frequency components of sounds appear to have a significant detrimental effect on health that go beyond annoyance and body fatigue. But overall, noise-induced sleep disturbance is one of the critical components of community annoyance and can cause short-term as well as long-term adverse effects that researchers may not detect within the stipulated period of research. Some of these effects range from mood changes to loss of body immunity and insensitivity to community norms.

2.3.4 Cardiovascular effects

Several studies on physiological effects of noise pollution that have been carried out, show that short-term exposure to high dose levels of noise activates the autonomic and hormonal systems, leading to temporary changes in increased blood pressure and heart rate due to continuous vasoconstriction of arteries, arterioles and capillaries. These fluctuations in blood pressure make individuals susceptible to permanent adverse effects such as hypertension and ischemic heart diseases associated with exposures to high sound pressure levels (WHO, 2000; Schwela *et al.*, 2005; Edworthy, 1997).

Edworthy (1997) holds that the elevated blood pressure levels, especially in school-going children is associated with living or going to schools that are near a major noise source, such as an airport. One of the studies conducted near airports showed that though blood pressure levels of children exposed to major noise sources were within the normal range, the fact of concern, however, remained that they were higher than for children that were not exposed to major noise environments. In response to such findings, Edworthy expresses concern about these elevated blood

[7] **Parasympathetic nervous system** is one of the two antagonistic neuro-chemical systems that decrease metabolic levels and the rhythmic activities of the heart, restoring the sensory awareness to normal levels.

pressure levels in children because they appear to continue into adulthood thereby increasing the risk for cardiovascular diseases.

A growing body of evidence confirms that noise pollution has both temporary and permanent effects on humans by way of the endocrine and nervous systems. These either activate or deactivate biological stressors or redressers that elicit reactions to prepare the body for a vigorous activity such as a fight, a dance or even fear in a flight response (Taylor *et al.*, 1997). For this reason, noise can trigger both endocrine and autonomic nervous system responses that affect the cardiovascular system. For example, a loud noise would lead to over arousal, and can affect social behaviour and later induce stress. In the same vein, Steep (1983) agrees with Edworthy (1997) when he says that excessive noise does more than damage to the body system. It affects much of the nervous system, the endocrine system, the stomach and brings about emotions. Since hormones of the endocrine system are carried by the blood to all body tissues, the heart being the myogenic pump of blood is also adversely affected by noise, according to Steep's argument. The system of vessels that channel blood to and from tissues throughout the body does not only carry nutrients, oxygen and waste products like carbon dioxide and urea, but also carries the ever continually released hormones and other biological molecules like enzymes and co-enzymes. These bio-molecular chemical substances form poisonous substances like urea, make the **c**ardiovascular system defective and interfere with the reversible ionization of water and other soluble substances in the tissues, hence having difficulties in its distribution function.

Goines and Hagler summarise the cardiovascular effects by referring to the studies of individuals that were exposed to occupational or environmental noise. They say that such exposure of sufficient intensity and duration, increases heart beat rate and peripheral resistance and increases blood pressure, blood viscosity and levels of blood lipids (fats and oils). It also causes shifts in electrolytes, and increases hormonal levels of epinephrine, norepinephrine and cortisol in the blood.

Sudden and unexpected noise sounds evoke reflex responses, as well. Taylor and his colleagues say that cardiovascular disturbances are sometimes totally independent of sleep disturbance effects. Noise that does not interfere with the sleep of individuals may still provoke autonomic nervous system responses and secretion of epinephrine, norepinephrine, and cortisol. Hence many children who live in noisy

environments have been reported by Goines and Hagler (2006) to have elevated blood pressures and elevated levels of stress-induced hormones.

2.3.5 Impaired Task Performance

The effects of noise pollution on cognitive task performance have been well-documented by a number of researchers who include van Kempen (2010). van Kempen found that the effect of noise pollution on children attending school with higher noise levels made significantly more errors in their work than those in quiet schools. His group and other researchers have confirmed that noise pollution is a kind of stressor that impairs task performance at school and at work; increases errors, and decreases motivation. Noise pollution strongly affects reading attention. Two types of memory deficits have been identified under experimental conditions. These are recall of subject content and recall of incidental details, both these are adversely influenced by noise whose intensity levels is extreme (Goines and Hagler, 2006). Deficits in performance can lead to errors and accidents, both of which have health and economic consequences not only for the affected individuals but for others, as well.

Goines and Hagler argue however that cognitive and language development and reading achievement are more diminished in noisy homes than in quiet homes, even though the children's schools may be less noisy than average. They argue that cognitive development is impaired when homes or schools are near sources of noise such as highways and airports. Excessive noise affects learning, reading, problem solving, motivation, social fitness and socio-emotional development. Noise also produces negative after-effects on performance, particularly in children. It appears that the longer the exposure, the greater the effect. Noisy areas strongly heighten and affect children’s sympathetic response arousal that is indicated by increased levels of stress-related hormones, those that could have accumulated in the elevated resting blood pressure. According to Goines and Hagler, these changes occurred larger in children with lower academic achievement. As a whole, these findings suggest that schools and day-care centres should be located in areas that are as noise-free as possible (Goines and Hagler, 2006). They further suggest that more attention should be paid to the effects of noise pollution that affect the ability of children to learn, and also to the nature of the learning environment, both in school and at home. Moreover,

they are concerned that high and continuous environmental noise may contribute to feelings of helplessness in children.

2.3.6 Negative Social Behaviour and Annoyance Reactions

The agitated behaviour of people, especially that of the young ones is normally not well understood even by psychologists and philosophers of education, and worse still by traditionalists. This is because they have not fully understood the affective effects that certain environmental situations like noise pollution have on behaviour. Usually, the explanation of such behaviour ends at the association of behaviour with peer influence or lack of teaching of morals and values. Most of the traditionalists[8] have a limited list of what is caused by peer influence while philosophers of education have said that children should be taught proper moral behaviour and virtue that must be connected to the attainment of knowledge, skills and attitudes (Muzumara, 2012).

All these are just partial answers to the problems of social behaviour. The more complete answer lies in two environments, namely, the external and the internal molecular-tissue environment of the actual human being. That is where the problems of behaviour lie. Difficulties in task performance and emotional habits emanate from there. The second environment reflects the nutritional molecules and other psychoactive substances that are ingested in our bodies or which the body forms in its metabolic activities, and the habitual response to the elimination of such debris that the body produces. The first is what we do to the natural environment itself, and noise pollution is one of those negative activities that humans do to the external environment (Wickens, 2005).

In response to the general belief brought about by the traditionalists, commenting on what 'negative peers' stands for, Carson and Lewis play with the word 'peers' itself and say that the word stands for: "People who Encourage Errors, Rudeness and Stupidity" (Carson and Lewis 2000: 54). In other words, peers are not the generators of bad behaviour but are simply the emitters or reflectors of such behaviour which friends learn and adopt. Indeed, negative social behaviour and annoyance may stem from such friends, but the big question is where do peers get such emotional habits and negative behaviours from? While there may be many

[8] **Traditionalists** are individuals who adhere to the handed over beliefs and traditional practices, down from generation to generation.

answers to this, noise pollution is surely one of the contributors to these emotional habits.

Noise is one of the stressors that brings about feelings of helplessness and feelings of displeasure, leading to annoyance (Schwela et al., 2005). These types of feelings may result in fights or probably in thefts or some other evil act. Schroeder (1983) agrees with Schwela in principle when he says that all harmful emotional behaviours are created and impressed in the mind before any action is manifested. All rude or abusive individuals who lack tact or consideration for other people in all that they say or do usually have one sort of disequilibrium or another in their inner environment. They usually respond with impulsive bursts of rage or anger that may result in serious accidents and injury.

To understand this, Goines and Hagler (2006) define annoyance as a feeling of displeasure or aversion or distress associated with any agent or condition believed by an individual to affect him or her adversely. Noise has been considered as a serious and very harmful factor to health, often referring to as a nuisance. It produces the same kinds of effects as other stressors do, perhaps even worse. Annoyance increases significantly when noise is accompanied by vibration or by low frequency components. The term annoyance does not cover the wide range of negative reactions associated with noise pollution which include anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation, or exhaustion (Suter, 2003). However, Goines and Hagler say that the social and behavioural effects of noise exposure are complex, subtle, and indirect. These effects include changes in everyday behaviour that stress the body of the individual affected. Although there are many factors and causes of stress, noise pollution has been identified as one of the major causes of stress to the minds of millions of people (Goines and Hagler, 2006).

Other less direct effects of annoyance are disruption of one's peace of mind, the enjoyment of one's property, and the enjoyment of solitude. Goines and Hagler amplify the seriousness of annoyance and say that greater annoyance is observed when noise is of low frequency, or is accompanied by vibrations that contain low-frequency components, or when it contains impulses such as the noise of gunshots or explosion. Annoyance is greater when noise progressively increases rather than remaining constant.

2.3,7 Disturbances in Mental Health

Today, people everywhere are under mental strain. Business pressure, family and individual troubles worry millions. The fears generated by excessive stress cause mental disorders in many people and are robbing millions of them of good health and happiness (Hoeh, 1983). Some of these troubles are caused by noise pollution because excess noise pollution induces nervous disorders related to stress and anxiety, which include worry, failure, inferiority, sickness, insanity and probably death. Knowing such consequences, Steep said, "High noise levels are not just disagreeable, they are injurious to health and peace of the mind" (Steep, 1983: 39).

The brain "houses" the mind of a human being; his memories, thoughts and emotions, wishes, aspirations, and disappointments, and the person's capacity for consciousness, reflections and free will (Wickens, 2005). The brain enables the human being to operate in a negative or positive manner. It consists of specialised cells, called neurones, whose function is to communicate with each other with a mechanism similar to an electric on-off switch. Noise pollution acts as stimulation to this mechanism of neurones and transmitters because it arouses both physical and chemical components of the body, such as hormones, to be released continually without proper utilization of them. This abnormal action brings about stress to the systems. The physical and chemical disturbances of the inner structures of the body are what give rise to peculiar human behaviour. Hence, continuous or excessive noise pollution affects the mind, making it vulnerable to disease and to emotional disorders (see, Hoeh, 1983).

Wickens (2005) reveals that many population studies have suggested associations between noise and mental-health indicators, such as rating of well-being, symptom profiles, the use of psychoactive drugs and sleeping pills, and mental-hospital admission rates. His argument agrees with that of Hoeh who says that in some instances, uncontrolled emotions that result due to the effect of debilitating noise pollution related to stress may result in feelings of inferiority, in mental inadequacy and in sexual impotency as one fear leads to another until the whole mental outlook and one's physical health are permanently impaired (Hoeh, 1983).

Having too much stress to this extent, a person may turn to alcohol and many illegal drugs to anesthetize it. Consequently, due to impaired systems, caused by the effects of noise pollution, other individuals have tried *sedatives* that include *tranquillizers* and *sleeping pills,* as Wickens has observed above. This is because

such drugs have a temporary calming effect on the brain. Such tranquillizers include valium and *alcohol* that help to slow down the functions of the brain to make them sleep and relieve their emotional fear. Stimulants like *nicotine* and *cocaine* are also used to stimulate or speed up the sexual drive or speed up the action of the brain and make it more alert. Others go further and take hallucinogens like *cannabis* (or marijuana) to hallucinate themselves to begin sensing something that does not actually exist.

Excessive noise indeed, causes a lot of pain to the head and to other parts of the body. Worse still, the stress that it causes, generates a lot of pain. In response to such pain, others go for painkillers like *morphine* and *heroin*, which are obtained from opium. These drugs suppress part of the brain, responsible for the sense of pain (Sbcaf, 1987; Hoeh, 1983). Individuals that fall prey to such drugs in order to calm pain not only increase the problem of stress but also introduce some pathological dangers of the drugs to the body. For example, sedatives, stimulants and painkillers, if taken in their wrong circumstances rather than if taken under doctor's instructions are extremely harmful. They may impair the person's judgement and make him clumsy. They may injure and damage the body cells especially that of the brain, the kidneys and the liver.

Noise pollution, however, is not believed to be a cause of mental illness per se, but it is assumed to accelerate and intensify the development of latent mental disorders as indicated above. Children, the elderly, and those with underlying depression may be particularly vulnerable to these effects because they may lack adequate coping mechanisms. Children in noisy environments find the noise annoying and report a diminished quality of life (ibid).

2.4 Noise pollution in Zambia

Noise pollution in all urban settlements is anthropogenic and most people in Zambia do not know its health and social effects. Many Zambians are consciously aware of the effects of climate change as well as the effects of uncollected garbage on their health, but know very little or nothing at all about the pathological health and social effects that noise pollution has on school children and all people in general in noise prone environments. Though very few know that environmental issues are linked to health issues of the people, the majority of them are in my view ignorant of facts of human inner-molecular and tissue environment which has to be protected at all costs.

2.4.1 Noise Pollution Situation in Urban Centres in Zambia

Generally, all human beings are exposed to different types of environments of which two are prominent. Firstly, is the natural environment, usually called the first nature, from which all matter is derived, and second is the human environment that is mostly created and accepted by human beings themselves (Oruka, 1994). A metropolitan settlement like Lusaka urban is one of the examples of human created environment in which noise pollution is severe and ubiquitous. It is widespread because of population growth, unplanned urbanization and profit oriented capitalism.

Indeed, Zambian cities, especially Lusaka, are experiencing rapid human population growth, which is accompanied by rapid development pressure with high demands for housing and other types of infrastructure. This rapid growth of population has led to the concentration of residences in cheaper peri-urban areas like M'tendere, Kalingalinga, Kalikiliki and others, where less or no control of municipal governance exists. For this reason, sporadic squatter settlements, informal sector and sometimes-illegal business activities have continued to mushroom. These types of businesses, from the look of things have contributed to extreme noise pollution in these areas, and the city councils or the Zambia Environmental Management Agency seem not to have control over them and may not even be concerned.

Despite the fact that there is no researched record done so far anywhere in Zambia about noise pollution, noise pollution is assumed to have reached very high levels. This is confirmed by the sporadic editorial reports and complaints from residents in various townships in the daily papers. An example of such editorial reports is one that appeared in the Times of Zambia of 21st July 2008. The editorial read as follows:

> We welcome the decision by the Ndola City Council (NCC) to confiscate a public address system, which was being used to play loud music and promotional messages from a shop on Chisokone Road.
>
> It has been common, not in Ndola only, but elsewhere in Zambia, for people wishing to attract customers to play loud music without regard for the acoustic discomfort of others. In fact, not only shops, but night clubs and individuals are also guilty of this.

In addition to the Times of Zambia editorial comment, other media reports have been made in the recent past in Lusaka with such headlines as "Lusaka townships record high levels of noise pollution." One example in question is the case of Rhodes Park residential area where one of the residents, Ismail, had posted a complaint on the internet face-book in 2010 about noise pollution to the nation,

reporting on the illegal-but legalised nightclub that was responsible for all sorts of noise pollution during the night. It read in broken English as follows:

> Dear Zambia,
>
> There is a certain night club opened up on Logos and playing very loud music even on week day, what permission was given by Council to have these allowed in residential area and what criteria was used to obtain. Need suggestions.

Many suggestions were posted on the Internet. In response, many said that corruption was at its best in Zambia when it came to matters of illegality. Immediately The Council responded quickly through ZANIS on 23rd September 2010, as follows:

> **Lusaka residents advised to register complaints of Noise Pollution**
>
> The Lusaka City Council has advised residents to make formal complaints at local authority when they experience noise pollution. Lusaka City Council Public Relations Manager, Mulunda Habeenzu said that the Local authority could not intervene unless members of the public register a formal complaint. He was responding to the case of Rhodes Park's residence report on loud music played at Barclays Sports Complex until early hours of the morning, hence disturbing their peace."

According to unrecorded noise levels in Zambia, the major high noise level areas have been undoubtedly assumed to be compound communities, market areas, bars, taverns as well as on roads. This assumption is in reference to the population density of both people and the motor vehicles on the roads. Leisure activities in compound communities are always accompanied by extreme noise, usually produced during festivals such as New Year's day, Christmas day, celebrations of football victories, and political campaign rallies during which loud music is played at high frequencies. During these occasions of leisure time, burning of fireworks and spontaneous sounding of '*vuvuzelas*' or plastic trumpets, car horns and drums are common events. In addition to these noise sources, are the born again churches who play loud musical instruments to attract youthful members. Apart from loud music, their preaching and prayer sessions are characterised by emotional shouting and some of these sessions are done overnight. From a resident's perspective, noise pollution in Zambia is a serious problem even though there has never been a comprehensive survey done to justify this so far.

It is clear from the discussion above that noise pollution does have an effect on people's hearing mechanism and their health. This study has focused on academic performance and social behaviours of pupils in schools. The findings will help to close the gap in knowledge on the subject.

CHAPTER 3
THEORETICAL FRAMEWORK

3.1 Introduction

This chapter presents the ethical theoretical framework of the study. This theoretical framework will guide the collection of relevant data for this research and inform the ethical evaluation. The ethical theoretical framework will involve the use of Utilitarianism, the Precautionary Principle and Human Rights Declarations, with specific focus on relevant declaration charters like the African Charter on Human and People's Rights and the UN Convention on the Rights of the Child

3.2 Utilitarianism

Utilitarianism is a kind of consequentialism which is itself one of the three major approaches to normative ethics. The other two are virtue ethics and deontology. What then is consequentialism that utilitarianism embraces? Mulgan (2007) explains the meaning of consequentialism as an appropriate response to value and the urge to promote value so that it may make the world a better place by maximizing the good (Walter 2012). It means that actions are morally right or wrong, depending on their consequences, and that an action is right if it brings about the best outcome of the choices available. For example, "if health is valuable, then it is obviously good to promote people's health" (Mulgan, 2007: 132), by choosing the right option among the alternatives, considering the well-being of everyone that is involved.

In other words, all that Mulgan and other contemporary utilitarian thinkers are saying is that right actions are those that maximize good consequences and minimize bad ones. The right act in any given situation is the one which, among the available alternatives, produces the best balance of benefits over harms to individuals affected by it (Ashford, 2005).

Utilitarianism can then be summarized by a succinct principle that was coined by Bentham, called 'Utility Principle' (or 'Utilitarian Principle'). This principle summarizes the utilitarian view and can simply be stated as follows: *An act is morally right if and only if there is no other possible act that has, overall seen better consequences.* Although utilitarianism may seem to be a homogenous theory, it is indeed not so. Therefore, it is important and appropriate to state that utilitarianism *per se* is not a single ethical theory, but is a family of related theories which are

extensively applied to many moral issues globally. It is a view that bases normative properties (said as rightness or wrongness) only on consequences. These ethical theories help to give an answer to the question when the applied action is morally right. It must be emphasized here that all utilitarian theories are standards for the evaluation of actions as morally right or wrong by determining how the well-being of individuals is affected by such actions (Walter, 2012). Therefore, once carefully and rationally utilized, they bring and support the answers to the particular ethical problem at hand.

3.2.1 Versions of utilitarianism

Apart from ***Act-utilitarianism***, there is another version of utilitarianism called ***Rule-utilitarianism*** which says that the right action follows from the rules that would maximize well-being if everyone followed them. The advantage of rule-utilitarianism is that it is closer to common sense (Mulgan, 2007). It cherishes the standard of utilitarian commitment to maximize happiness, yet it embraces a strict adherence to rules. Rule-utilitarian thinking holds that an evaluation of decisions should be done on the basis of moral rules. The belief is that the ideal rules are those where the consequences of everyone following them would be better than the consequences of everyone following any other set of rules (ibid). Take the moral law expressed by the Ten Commandments as enshrined in the Bible, for example, which are alluded to as universal ethical demands on all the people. Such laws undoubtedly promote acts that bring good consequences to all, even to those who find pleasure in doing wrong acts to others.

3.2.2 A contemporary version of utilitarianism

This is the view that agrees that right actions are ones that maximize good consequences while it disagrees with Jeremy Bentham and John Stuart Mill that happiness is not the same as pleasure, or happiness and pleasure are not the only kind of good consequence or unhappiness or pain the only kind of bad consequence. The principle allows for the possibility that acts may have many kinds of good or beneficial consequences over harms. The principle subscribes to the fact that the right act in a given situation is the one which among the available alternatives produces the best range of benefits over harms.

What follows are the key elements of the modern version of utilitarianism. These elements are numerated below.

Welfarism is the view that whether actions are right or wrong depends only on their contribution to the ultimate good, that is, to the well-being of those that are affected by such actions (Walter, 2012; Ashford, 2005).

1. *Universal consequentialism* is a view that holds that all moral rightness depends on the consequences for *all* the people or sentient beings (like animals or humans) that are affected by an act. It is opposed to ethical egoism and altruistic approaches to the individual's well-being, which are particularistic and not universalistic (Walter, 2012).
2. *Equal-consideration.* As the term itself depicts, equal-consideration wipes out all individualistic biases or partiality that people have when an act is made by an agent. In determining moral rightness, the benefit to one individual matters just as much as similar benefits to any other person. This view is summarized in a slogan that says '*all who count; count equally'* (Walter, 2012).
3. *Total consequentialism* is the view that moral rightness depends only on the total net good in the consequences as opposed to the average net good or consequences for individual person (ibid).
4. *Maximizing consequentialism.* Moral rightness of an action depends only on which consequences are best as opposed to mere satisfaction or an improvement over the status quo. In other words, it can be said that an action is morally right only if there is no other alternative that can yield better consequences than those that are available to the agent (ibid).

The contemporary version of utilitarianism that will be employed in the ethical evaluation is the utility principle that spells that an act is morally right if and only if it is the one that produces the best balance of positive over negative consequences for everyone affected, taking into account a broader range of benefits and harms. This will involve the identification of the consequences of the act, both short and long term. A comparison of consequences of the act to the consequences of the alternative acts that would be available to our case after which a judgement about the ethical issue will be made.

3.3 The Precautionary Principle (PP)

The Precautionary Principle is an ethical principle whose origin dates back to the 1970s. It is a value principle that demands for wisdom of action and concern of the potential risks or harms that are uncertain, but caused to the environment or human beings by the activities carried out by people. The principle itself originated from the environmental considerations and concerns that preoccupied the minds of many environmental philosophers for a long time, especially with the emergence of increasingly unpredictable, uncertain and unquantifiable, but possibly catastrophic risks. The principle has since matured into a powerful ethical principle that has been applied to various branches of applied ethics, and has been recommended as a policy guide in making ethical judgments or assessments of choices that science and technology manifest in our daily lives (UNESCO, 2005).

Indeed, apart from being a valued principle, it also enables us to cope with scientific uncertainties in the assessment and management of risks. This principle reflects the wisdom of action to be taken under uncertainty in the early detection of dangers to a number of social, economic, and environmental systems, as a result of the ventures that people undertake. Therefore, the applicability of the Precautionary Principle to various social, scientific and technological issues is indeed very beneficial to the well-being of both humanity and the environment. This is because of challenges, dangers and hardships that new knowledge and innovations from scientific research have brought and may continue to bring to both humanity and the natural environment. Thus, there should be ways and means to abate such challenges, dangers and hardships partially or fully. For example, with increased environmental impacts of growing populations and industrialization, UNESCO reports that the environment is no longer able to cure itself and it has to be helped in repairing the damage inflicted upon it by various human activities (ibid).

With this awareness by ethical philosophers of people's roles in dealing with the community or global environmental commons, a need for the societies to harness the Precautionary Principle as a curative tool measure of anticipated risks was necessary. To facilitate ethical decision-making, the United Nations Educational Scientific and Cultural Organization (UNESCO), together with the World Commission on Ethics of Scientific Knowledge and Technology (COMEST) brought together a group of experts who proposed a clear definition of the Precautionary Principle that provided clarifications for possible users of the principle. This

established an ethical platform that ensures a proper risk management and correct information delivery to the public and to policy makers (ibid).

To show the importance of the Precautionary Principle, the United Nations included it in the 1992 Rio Declaration on environmental development, during the world conference that was held in Rio de Janeiro in Brazil. It has also been included in the United Nations Framework Convention on Climate Change and later was incorporated into the article on precaution of the World Trade Organization (WTO) agreement on Sanitary and Phytosanitory Measures of 1994, as well as into the Biosafety Protocols that were approved in Montreal in January 2000 (ibid).

This great concern in providing a good ethical platform is not only on behalf of the present generation, it also includes future generations with a view that human life has always been, and will always be, full of risks, putting emphasis on sustainable development, food safety and environment protection (ibid).

Why then is the Precautionary Principle chosen as one of the ethical tools in this research on noise pollution? UNESCO (2005) states that the application of the Precautionary Principle only becomes possible when reliable scientific information is either insufficient or inconclusive or uncertain, but preliminary scientific evaluation indicates that there are reasonable grounds for concern of the potential dangers or effects on the environment or human beings. In other words, the Precautionary Principle is applicable to this research because there is a considerable amount of scientific uncertainty about causality, magnitude, probability and the nature of harms to people that may be brought about by noise pollution. Therefore, the data to be collected and considered in this research is much dependant on such conditions set under the correct application of the Precautionary Principle as it is stated in the following definition.

> When human activities may lead to morally unacceptable harm that is scientifically plausible, but uncertain, there is a need to act now, and it is currently impossible to reduce the uncertainties, proportional actions shall be taken to avoid or diminish that harm (UNESCO, 2005, 14: 31).

3.4 Relevant Human Rights Declarations

This research involves Human Rights and therefore it is appropriate to use relevant Human Rights Declarations in the ethical evaluation of noise pollution. In this section, Human Rights are explained and the appropriate and applicable articles that

will be used in the ethical analysis of the problems of environmental noise pollution in the identified school areas of M'tendere are stated.

Human rights are rights possessed by all human beings simply because they are human beings. They are regarded as equal rights of all humans and are always at odds with cultures and ideologies which give fundamentally different moral foundations to people. Therefore, human rights should be claimed so that people seek and promote their interests and advance their courses of life in an enjoyable manner. Referring to people's interests, UNESCO (2005) says that people's interests are many and they represent a domain of morally essential elements of life like speaking freely, choosing their own careers and determining their life style, as well as living in a healthy environment which is free from hazards like those generated by the effects of noise pollution.

There is a difference between 'human rights' and 'legal rights'. Human rights differ greatly from legal rights. Human rights belong to the category of moral rights that existed prior to any legal right ever formulated, while legal rights exist in virtue of given laws. Human rights are rights through which legal rights and rules can be evaluated to be just or unjust, relating to life and living of human beings and can never be extended to the non-human world. In other words, they are referred to as inalienable and universal rights so that being human one cannot lose them, no matter how badly ones behaviour may be.

3.4.1 African Charter on Human and People's Rights, *(Rights and Duties)*

This charter is on Human and People's Rights. It was adopted by the eighteenth Assembly of Heads of State and Government on 27th June 1981 in Nairobi, Kenya, but entered into force on 21st October 1986. African states and members of the Organization of African Unity (OAU) were parties to this convention. With the OAU charter in mind, which stipulates 'freedom, equality, justice and dignity, the member states solemnly reaffirmed the pledge, made in Article 2 of OAU, to eradicate all forms of injustices from Africa and to promote international cooperation with regard to the charter of the United Nations and the Universal Declaration of Human Rights.

The following are the appropriate and applicable articles that will help in the ethical evaluation of the problem of noise pollution in Chapter 6:

Article 9

Every individual shall have the right to receive information.

Article 14
The right to property shall be guaranteed. It may only be encroached upon in the interest of public need or in the general interest of the community and in accordance with the provisions of appropriate laws.

Article 16
Every individual shall have the right to enjoy the best attainable state of physical and mental health. States parties to the present Charter shall take the necessary measures to protect the health of their people and to ensure that they receive medical attention when they are sick

Article 17
Every individual shall have the right to education. The promotion and protection of morals and traditional values recognized by the community shall be the duty of the State.

Article 24
All peoples shall have the right to a general satisfactory environment favourable to their development.

Article 27
1. Every individual shall have duties towards his family and society, the State and other legally recognized communities and the international community.
2. The rights and freedoms of each individual shall be exercised with due regard to the rights of others, collective security, morality and common interest.

3.4.2 UN Convention on the Rights of the Child

Article 3
1. In all actions concerning children, whether undertaken by public or private social welfare institutions, courts of law, administrative authorities or legislative bodies, the best interests of the child shall be a primary consideration.
2. States Parties undertake to ensure the child such protection and care as is necessary for his or her well-being, taking into account the rights and duties of his or her parents, legal guardians, or other individuals legally responsible for him or her, and, to this end, shall take all appropriate legislative and administrative measures.
3. States Parties shall ensure that the institutions, services and facilities responsible for the care or protection of children shall conform to the standards established by competent authorities, particularly in the areas of safety, health, in the number and suitability of their staff, as well as competent supervision.

CHAPTER 4
METHODOLOGY AND METHODS

4.1 Introduction

The study used qualitative methodology that involved the use of mixed research consisting of an empirical part and an ethical analysis part. The researcher found this approach more suitable in the exploration of the theoretical basis for the study of the problem of noise pollution. The researcher also saw it important to have a clear link between the philosophical framework and the methods that were employed in the empirical data collection to meet the objectives that were set for this study.

4.2 Research design

This research will follow a case study design in the quest to solve the problem of environmental noise pollution in Lusaka schools and will adopt qualitative methodology. To obtain the required data, a questionnaire, in-depth interviews and observation methods will be used. The data will be obtained through a questionnaire administered to a sample of 80 pupils from targeted schools in M'tendere. In-depth interviews will be carried out with 6 parents, 10 teachers, 8 business persons in sampled sites and 2 officials, one each from ZEMA and Lusaka City Council. The researcher will carry out observations of teachers taking part in teaching and also conduct personal interactions with pupils to observe and confirm primary data that will be obtained. The obtained primary data will be analysed qualitatively.

4.3 Sources of data

The source of secondary data included textbooks from different sources like the University of Zambia and ZEMA libraries; journal articles from the Internet; hinari and pdf as well as daily newspapers within the country. The primary data was carefully elicited from interviews with parents, teachers, businessmen and officials, each from ZEMA and Lusaka City Council. Much of the primary data was sourced through a questionnaire administered to pupils from M'tendere school areas.

4.4 The Area of study

The study was carried out in identified school areas of M'tendere in Lusaka urban district. M'tendere is a highly populated compound area, east of the town centre of

the city of Lusaka and boarders with Kalingalinga and Helen Kaunda compounds to the west, Chainama and PHI to the north, NRDC and Kalikiliki to the north-east while Kabulonga and Hibex Hill to the south. (**c f. Figure 4.1).**

4.5 Sampling techniques and sample size

Purposive or deliberate sampling was used to select the study site. This is because the schools in M'tendere compound are surrounded by several bars, taverns, markets, welding workshops and other business ventures which produce continuous noise of all sorts throughout the day and even in the night. In addition to this, these business ventures are dotted among residential houses where the school pupils come from.

The target groups were selected using the purposive sampling method, while the respondents for the study were sampled using convenience and purposive sampling methods, based on the research questions formulated.

A total of 80 pupil respondents were sampled. This principal target group of participants was purposively sampled thus: 20 pupils from each of the four government basic schools in M'tendere. To select these 80 respondents from the target group, a purposive and systematic random sampling of a probability count of 'One-Two, One-Two' was adopted to pick respondents to the questionnaire. Pupils who fell on 'Two' were picked to participate in the activity of answering the questionnaire. The second target group were 6 parents to some of the pupils who live within a radius of about 300 to 400 metres from the sources of noise pollution. These were randomly spoken to after cordial acceptance to provide information to this research. The third target group comprised 10 school teachers to whom questions on the experience of problems of noise pollution on pupils observed by them were posed. These were purposively made available with the help of the Head of the particular school. The fourth target group were the two officials, one each from Zambia Environmental Management Agency (ZEMA) and Lusaka City Council Public Health department who were purposively chosen to provide data on policy guidelines, laws and implementation strategies. Finally, the fifth group that was interviewed was that of the 8 business owners whose businesses were alleged to be the source of noise pollution. Their selection was purposive and some were interviewed after an appointment was made while business people trading in the open were immediately interviewed upon acceptance. Table 4.1 below shows the distribution of the total number of the participants in the study.

Table 4.1 Showing distribution of sample, respondents and instruments used

Instrument		**Questionnaire**	**Interview**			
Respondents		Pupils	Parents	Businessmen	Teachers	Officials
Area	M'tendere	80	6	8	10	
	ZEMA					1
	LCC					1
Total	**106**	**80**	**6**	**8**	**10**	**2**

Below is a table of names of schools and the number of pupil respondents per sampled school to the questionnaire of seventeen structured questions.

Table 4.2: Showing pupil number of respondents per school in M'tendere Schools.

Name of the School	**Number of pupil respondents**
Mahatma Ghandi Basic (M'tendere)	20
Old M'tendere Basic (M'tendere)	20
New M'tendere Basic (M'tendere)	20
Chitukuko Basic (M'tendere)	20
Total Number	**80**

4.6 Ethical protection of participants

Voluntary participation was very cardinal to this research. The researcher sought for informed consent from all participants, especially from those individuals who had to provide private information or information attached to their business or profession. Anonymity and confidentiality was also core to this study. Respondents were assured that the information they were to give would be kept confidential, so they were encouraged to give honest and complete answers. The researcher hoped that this helped to avoid biased responses.

4.7 Empirical Data Collection and instruments used

The above samples of respondents provided data through the research process that included:

1. **Documentary research** in which secondary data was sourced from textbooks, journal articles from the internet and local newspapers.
2. **Interviews** with parents, teachers, business persons and officials.

4.8 Data analysis

Data about the problems of noise pollution on school pupils obtained from pupils themselves, parents and teachers were compared, augmented and crosschecked with secondary data. Data was then logically organised and analysed according to categories, patterns and meaning. Synthesis and generalisations of concepts were made and harmonised which later helped in the ethical evaluation of the problem.

4.9 The philosophical Method:

This study chose to employ the Deductive approach which is also called the Straight Forward-Application Model of applied ethics. This approach consists of an ethical assessment of results obtained from the empirical research, using the logical arguments based on relevant human rights declarations, the contemporary version of utilitarianism, rule utilitarianism and the Precautionary Principle.

With the deductive approach in mind, the ethical evaluation of noise pollution was carried out with deductive reasoning. The researcher assessed critical arguments for and against the establishment of noise generating business ventures around schools and within residential areas.

Map of M'tendere and some of its bordering neighbours

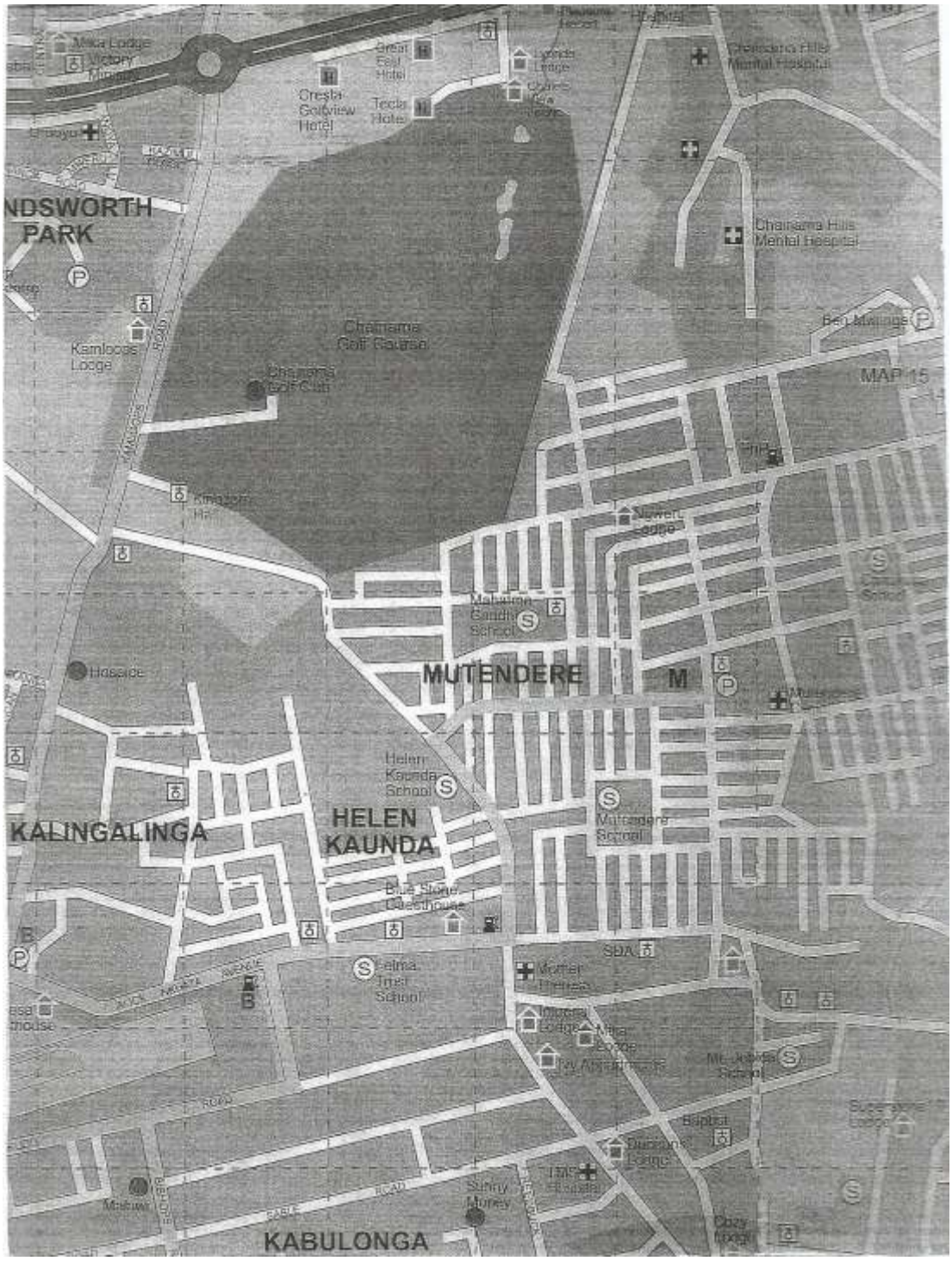

Figure 4.1 Map showing M'tendere

(**Source:** Street Guide. 2014. Livingstone & Lusaka. A-Z, 9th edition, page 28).

CHAPTER 5
FINDINGS, DISCUSSION AND ANALYSIS

5.1 Introduction

This chapter presents the research findings obtained with the use of the research instruments administered to 106 respondents. Some of the empirical data collected is tabulated in some cases, while in other cases the data will only be discussed and then analysed.

5.2 Findings

5.2.1 Responses from pupils (c f Table 5.1 for an overview of pupils' responses)

Eighty representing 100 per cent of the pupil respondents indicated that they lived in noise polluted places and most of the loud noise was being produced during the day time while moderate noise was being produced during night-time. Regarding whether this noise was annoying them or not, only seven (8.75%) out of eighty of the pupils who lived in noisy areas felt minimal annoyance by such noise, while seventy-three (91.25%) out of eighty indicated that there was no annoyance. Although the majority of the pupils indicated that noise did not annoy them, all of them indicated that they had difficulties in their studies due to exposure to noise. This means that 100 per cent of pupils that lived in sampled areas had difficulties in their studies due to noise. Seventy-six out of eighty pupils indicated that noise affected their academic performance.

The above findings are confirmed by the report from the teachers who, indicated that pupils were affected by musical noise that made them sing and sometimes dance along to that noisy music that came from bars and '*Tuntembas'* or small-scale retail shops during the lessons.

On sleep disturbance, fifty-six (70%) of the pupils indicated that they were sometimes awakened from their sleep during night time. Seventy-six (95%) of them said that they experienced sleep loss and when they woke up the next day, they felt tired and sometimes slept or dozed during class time.

It was found that fifty-five (69%) of the pupils did not think that noise pollution adversely affected their health, while twenty-one (26%) did not know. Only four (5%) of them knew very little about the matter.

Table 5.1 shows pupils' responses from M'tendere sampled schools, based on the questionnaire presented to them.

Question and Question number	Number of respondents out of 80	Percentage (%)	Response
1. Do you live in a noise polluted area?	80	100 %	Yes
2. If the place is noisy, when do you hear this noise	76 4	95% 5%	All the time During day time
3. How noisy is your school surrounding?	71 9	89 % 11 %	Very noisy Little nosy
4. How loud is the noise that you hear?	56 15 9	70 % 19 % 11 %	Very loud Loud Moderate
5. Does noise annoy you?	7 73	9 % 91 %	Little No
6. Do you have difficulties in studying due to noise?	80	100 %	Yes
7. Do you think noise affects your academic performance?	76 4	95% 5%	Yes No
8. Does noise awake you up from your sleep during night time?	56 24	70 % 30 %	Yes No
9. Have your ever experienced sleep loss?	76 4	95 % 5 %	Yes No
10. Do you think noise affects your health adversely?	55 21 4	69 % 26 % 5 %	No do not know know
11. Is noise generally a problem?	80	100%	Yes
12. Do you think there should be noise regulation in your area?	76 4	95 % 5 %	Yes No
13. Do you attend disco shows?	71 9	89 % 11 %	Yes No
14. Do you listen to music through ear phone	62 18	78 % 22 %	Yes No
15. Have you ever heard ringing sounds in your head?	77 3	77 % 23 %	Yes No
16. Do you easily get angry when you are provoked by someone?	54 26	68% 32%	Yes No
17. Suppose you friend deliberately steps on your toe, what would be your reaction?	61 19	76 % 24 %	-Step on his/her/also. -Report to the teacher.

Though this was so, seventy-six (95%) as against four (5%) of the pupils supported the idea of noise regulation in their communities, and after the researcher's free interactions with them, they realised that noise pollution in their communities was a serious problem. Responding to the issue of ringing tones or tinnitus in their heads or ears, seventy-seven (96%) as against three (4%) of the pupils heard ringing tones in their ears. Fifty-four (68%) as against twenty-six (32%) of the pupils accepted that they easily got angry once they were provoked. Sixty-one (76%) reflected the intolerant behaviour that showed no chances of forgiveness while nineteen (24%) of them reflected tolerant behaviour or that of having the people in authority to judge over *prima-facie* situations.

5.2.2 Responses from parents (c f Table 5.2 for an overview of parents' responses)
Six representing 100 per cent of the parents indicated that the situation of noise was severe in the area. Though all the parents recognised the presence of noise pollution in their areas, four (67%) of the parents were not aware of the effects and problems that noise pollution has on people. Only two (33%) of the respondents had little or scanty knowledge of its physical and social effects rather than its effects on health.

Four (67%) of the parents indicated that noise pollution had a bearing on the bad academic performance of their children. Two (33%) of them indicated noise pollution had a bearing on the fair performance of their children.

In relation to pupils' social and other types of behaviour, five (83%) of the parents said that the behaviour of children in general was below the standard. This was also accompanied by little respect expected for public property exhibited by these children.

On the manner in which the children generally talked to one another, 100 per cent of the parents confirmed that their children spoke at high pitch (tone) even when they were talking to a person who was near them. They all also agreed that their families were always disturbed from their sleep by noise at awkward hours.

Asked what they would want the government to do about the noise situation in their areas, five (83%) of the parents wanted the government to put a law that would minimize noise pollution. Others suggested that Lusaka City Council should involve residents in noise pollution campaigns. Only one (17%) of them did not know what way the government could do to protect them from noise polluters in order for them to enjoy peaceful moments during day and night times. Asked about

the kind of education they would offer their neighbours about noise pollution, all indicated that they would merely advise them not to make noise that would disturb others.

Table 5.2 Showing parents' responses and percentage from M'tendere School areas

Question	Number of Respondents (6)		Percentage (%)
	M'tendere	Remark	
1. How is the noise situation in and around your residential area?	6	Severe	100 %
2. Are you aware of the effects and problems that continuous noise pollution brings on humanity?	4 2	Not aware Aware	67 % 33%
3. How is the academic performance of your children?	4 2	Bad Fair	67 % 33%
4. How is the moral behaviour of children here?	5 1	below standard Moderate	83 % 17 %
5. Do your children speak with a high tone even when they are talking to a person who is near to them?	6	At high tone	100 %
6. Are you and your family disturbed in your sleep by noise from the surroundings?	6	Disturbed	100 %
7. What help would you ask the Government to offer to protect you from such noise polluters so that you can enjoy peaceful night sleep and day?	5 1	Make laws Do not know	83 % 17%
8. What education would you offer to your neighbours about the dangers of noise pollution?	6	To stop making noise around	100 %

5.2.3 Responses from Teachers

Of all the ten teachers interviewed, all reported that the noise situation around their schools was bad and said it came from bars, taverns, night clubs, '*tuntemba'* or small scale retail shops and welding workshops. Most times these bars and taverns closed at 24.00 hours or 01.00 hours while night clubs continued up to dawn. In addition to this, they said that *Call-boys* that call for passengers to board the early buses that go to *Soweto* market for orders at 03:30 or 04.00 hours also contributed to noise pollution in the area. These teachers also added that, due to the loudness of music

that comes from these places, pupils always sung or danced along to some of the songs that were played while they were in class. They said that in this way teachers were also affected. Hence, teaching was also adversely affected. In fact, three of the teachers confirmed having tinnitus in their ears.

All of teachers said that pupils were not easily motivated and were not keen to do any challenging academic work. These teachers added that the children found it difficult to get instructions from teachers. They said that sometimes pupils kept on doing the same things that they were stopped from doing and remain persistently doing so for a long time until they were loudly told not to do so. The other aspect that the teachers reported on was that of pupils always talking aloud even in the situations that required a soft and moderate speech tone. They also added that pupils constantly showed restlessness and would always talk to or touch pupils next to them. They said that pupils were always in the mode of wanting to talk to someone or pinching friends even in a situation that demanded silence, such as an examination time and always liked quarrels with their fellow pupils. In addition to that, they were aroused to run to areas and be part of situations that were disturbing, like a fight. Such pupils were said to fail to do their home-work most of the times and always looked tired and often dozed in class. Asked what factors were contributing to such kinds of behaviours, all responded that they were not very sure, but guessed that noise pollution could have a part to play in this. One of the teachers narrated an incidence were an epileptic pupil always had epileptic seizures whenever there was a loud noise or a bang. It was during that interview when this teacher now suspected that the epileptic seizures could have been triggered by noise pollution.

Some teachers however, suggested that there be legislation against noise pollution with a heavy fine or punishment for the violators. Teachers argued that this would guarantee that polluters would never pollute such environments purposely, with or without selfish motives to gain monetary benefit. They also said that heavy monetary punishment or short-term imprisonment would deter even the notorious noise polluters from being casual about polluting such environments with noise which negatively affects others' well-being and hamper their own happiness.

5.2.4 Responses from businessmen

8 businessmen were interviewed, whose businesses were alleged to pollute the schools' environment with noise. Among the list of businesses in which the

businessmen of M'tendere were engaged in were bars, taverns, welding shops and *'tuntembas'* or small-scale retail shops. All the businessmen indicated economical survival in terms of earning a livelihood as the major reason for setting the kind of businesses they were engaged in. No one indicated both economical survival and the need for use of corporate responsibility.

Asked what benefits the residents were getting from such businesses, seven (88%) of them cited pleasure and economical well-being while one (12%) said that he did not know. On the awareness of their businesses generating noise that affected school pupils, all of them showed much ignorance and knew nothing about the health effects or any problem that noise pollution has on human beings. When they were asked on how they could balance their business interests with that of the community in terms of a healthy environment; especially that of the school-going children, they said that there was nothing they could do apart from providing a livelihood for themselves and their families. In addition, they were not ready to suggest any way to the government how they could be helped in order for them to continue with their businesses while being mindful of their community's well-being. Two (25%) of them were even fearful that this researcher was a spy, sent by the government to get information that would endanger their business interests.

5.2.5 Responses from Zambia Environmental Management Agency (ZEMA)

ZEMA was aware of the situation of noise, not only in Lusaka urban but in all urban settlements, and about the encroachment of some school areas by noise generating businesses. Asked why they were not taking any steps as an agency towards the abatement of noise pollution situation in those places, the official at ZEMA said that it was not their responsibility, but that of the city councils. It was the councils that were mandated to allocate and manage the business and residential plots. Responding to question 4 that reads as follows:

> Does ZEMA, as an agency responsible for abating any type of pollution in Zambia have the basic sound level meters and their derivatives, such as noise dose-meter, intergraded sound level meters, graphic level recorder and community noise analyzers to measure sound levels of noise in communities like M'tendere?

The official said that since it was not ZEMA's responsibility to abate noise, the Agency had no basic sound level metres and their derivatives and hence no

departmental office for noise pollution abatement and control was set up within ZEMA as enquired.

Responding to the question on which environmental legislation regarding noise pollution has been enacted, the official referred to The Environmental Management Act No. 12 of 2011 which was repealed and replaced The Environmental Protection and Pollution Control Act of 1990. He quickly pointed out that the mentioned Act was not specifically an act on noise pollution, but has a portion called 'Division 6-Noise' **[See Appendix B]**. Part of this Division legally defines noise and noise emission levels for which both need the instruments that they were found lacking to measure them. (See section 68 and 69 below).

> **68** Subject to section *sixty-nine*, a person shall not emit noise in excess of the noise emission standards established pursuant to section *seventy*.
> **69.** (1) Notwithstanding section *sixty-eight*, the inspectorate may grant a permit allowing excessive emission of noise under such terms and conditions as it may determine.
> (2) Where an exemption is granted under subsection (1), workers exposed to excessive levels of noise shall be adequately protected in accordance with the directives of the Agency.

When asked why ZEMA had not been reporting on noise pollution in its two types of the State of the Environmental Reports (SoE) to the general public, the official quickly cited two reasons. The first reason is that of being ignorant on the issue, while the other one was that of the attitude of most people. This is the attitude of 'taking things for granted' that 'noise' is just one of minor nuisances' which is to be enjoyed in certain circumstances. These, the official thought, perhaps could even be the reasons for not having legal implementation support laws for The Environmental Management Act No. 12 of 2011.

5.2.6 Responses from Lusaka City Council (LCC), Public Health Department

The official said that the Council was aware of the noise pollution situation in most settlement areas in its jurisdiction. This is because some residents from different compounds had either written in various print media or had appeared on ZNBC or MUVI Television stations. These complained about the noise situation in their areas which they said was disturbing their peace, either during the day or during the night. The official also expressed awareness of residential and school areas encroachment

by noise generating businesses that were alleged to have been approved by its workers.

Asked what could be the effects of noise pollution to human beings apart from that of disturbance, the official pointed out a few social effects that included sleep loss and obstruction of essential speech communication. Asked again whether the squatter control unit that was established in the then Ministry of Decentralisation in 1985 was still in force, the response was that it was not in force due to political interference to appease the voters. He attributed the present ugly situation to corruption.

Indeed the situation was ugly and when further asked whether there was no planning department in the council to plan for the city's outlook, the official said that sometimes plans were overruled and upset by political interests over national interests. He also said that most of the businesses in question were approved through corruption hence making the vice as if it was a normal way of life.

The official informed the researcher that in the Public Health Act, volume 17 Chapter 295 (an Act that provides for the prevention and suppression of diseases and generally to regulate all matters connected with public health in Zambia), there was no specific section that talked about noise pollution management in learning institutions and residential areas. He added that the Act only revealed the nuisances under sections 64-70, part (ix) of sanitation and housing. He pointed to Section 67 of this part which talks about what constitutes a nuisance. Among the nuisances, the official outlined dwellings or premises or situation so affective to people as deemed to be a nuisance to be dealt with by the authorities in view of their injurious or dangerous nature to health. Asked about the way forward in eliminating or minimizing noise pollution in the city, the official said that it calls for all stakeholders' efforts and commitment to chart the way forward, which means a lot for all the residents of the city.

5.2.7 Findings from the researcher's observations

The researcher made the following observations in Old M'tendere, New M'tendere, Mahatma Gandhi and Chitukuko basic schools in M'tendere as he observed some teachers, teach in their classrooms.

1 Pupils were usually noisy even in a situation that demanded quietness like reading and answering a comprehension exercise or writing a test.

2 Pupils talked at high pitch even when they talked to neighbours.

3 Pupils kept on doing what had been stopped by the teacher for some time unless they were told repeatedly on the same issue (e.g. ”sit down”, some pupils would remain standing up until a repeat of the same statement was done much louder and in an unfriendly tone).

4 Many, if not all of the pupils, lacked concentration on what they were doing without an interval of talking – even speaking to themselves. In other words, they had shortened attention-span to academic materials.

5 Most of the pupils tended to became angry quickly.

Apart from the above observations, the researcher also collected examination result analyses for 2010 to 2012 from three of the four basic schools under study. (c f Table 5.3). Chitukuko basic school was not ready to release this particular information at the time of data collection for this study.

Table 5.3: Showing Grade 7 and 9 final Examination Result Analyses for2010 to 2012, obtained from Mahatma Ghandi, Old M’tendere and New M’tendere basic schools.

Name of school	Year	Grade	Number sat	Number selected	Percentage passed (%)	N0_ failed	Failed (%)
Mahatma Ghandi	2010	7	546	202	37	344	63
		9	288	47	16	241	84
	2011	7	512	101	19	411	81
		9	331	34	10	297	90
	2012	7	470	288	61	182	39
		9	391	38	10	353	90
Old M’tendere	2010	7	276	140	50	136	49
		9	81	64	79	17	21
	2011	7	352	99	28	353	72
		9	201	66	32	135	68
	2012	7	323	121	37	202	63
		9	135	35	26	100	74
New M’tendere	2010	7	374	117	31	257	69
		9	410	193	47	217	53
	2011	7	325	128	39	197	61
		9	603	312	52	291	48

*According to teachers, the low academic performance of pupils in the above table was very likely related to the noisy environment in which the schools were located.

5.3 Discussion and Analysis of Results

This section of the dissertation presents the interpretation and comments on the empirical data that have been presented above on the problems of environmental noise pollution in the studied school-areas of M'tendere.

All the children, parents and teachers were in agreement that noise pollution situation in M'tendere was bad. This justified the result that revealed that 100 per cent of the pupils who answered the questionnaire had difficulties in their studies due to noise pollution. This was supported by the teachers' report that pointed to loud music from different business sources which made pupils sing or dance along with the songs that were played while lessons were going on. These teachers also added that, due to the loudness of music that came from these places, teachers themselves were also affected and hence, teaching was also negatively affected. According to the teachers, these children sometimes failed to concentrate in their lessons and in their personal study time, hence the identification of the *decreased academic concentration and less comprehension ability problem.*

The other findings indicated that 76 per cent of the pupils were academically affected by noise; 70 per cent had their sleep disturbed while 95 per cent of them had sleep loss, such that when they woke up the next day, they felt tired and sometimes dozed during lessons. The dozing was partly due to inadequate sleep and loss of it that resulted into feeling weak and caused the pupils to doze during lessons. Hence the problem of *fatigue and dozing of pupils during lessons.*

The study indicated that 100 per cent of teachers reported that pupils in the studied schools were not easily motivated and were not keen to do challenging academic work. These teachers also pointed to pupils' difficulty in receiving instructions in class from their teachers. Therefore, *decreased motivation zeal and attention span problem* arose due to the dozing moments which made it difficult for them to consistently remain alert and get instructions from teachers. This was due to the fact that they were fatigued and could not easily be motivated as shown by the results above. Wickens (2005) identifies lack of adequate sleep, whose function among others is to help in the off-loading of poisonous debris that weakens the brain once they are in excess, as the factor to suspect for the above problem. This means that all the metabolic reactions' by-products that crowd and poison the body's inner environment are better removed during a sound and adequate night sleep (Chanda, 2012).

Verma and Agarwal (2001) and Taylor et al. (1997) say in support of the above observation that inadequate sleep contributed to the impaired focussing in the brain, both for sight and for memory. Due to this information, there is a reason to suspect that their loss of sleep could have inhibited the pupils' flow of information to and from their brains as the teachers taught, affecting the attention capacity to learn.

Hundred per cent of the teachers interviewed cited pupils patronizing bars and taverns for entertainment during the evenings as a contributing factor to pupils' failure to do their home work. It was also cited as a source of their tiredness and dozing during lessons, as earlier indicated. This was another problem of environmental noise pollution in the studied school areas whereby noise acted as *leisure and entertainment bait during and after lessons.* According to teachers, this problem affected pupils' academic potentials to learn in class and also contributed greatly to the chances of failure to do their homework. It also robbed them of the time to study their academic work in preparation for their examinations.

Deterioration of hearing loss is another problem of environmental noise pollution that was reflected in most pupils in the studied school areas. The results show that there was an indication of some hearing problem in some pupils. This was seen from the response given by the teachers, confirmed by parents and the researcher's observations. These results say that some pupils kept on doing the same thing that the teacher had stopped them from doing, but remained persistently doing it for a certain period of time until they were told to stop by shouting at them. An example of this was in the case of the teacher saying, "Sit down!" Some pupils would remain standing up until a repeat of the same statement was said much louder and in an unfriendly tone. That is when they could sit down.

In another vein, the study also revealed that children in these school areas always talked loudly even in a situation that required a soft and moderate speech tone. This observation was made by both teachers and the parents. The researcher's observations also confirmed that pupils were usually noisy even in a situation that demanded quietness like reading and answering a comprehension exercise or even writing a test. These children were also reported to talk at high pitch even when they talked to someone next to them. From this finding, s*peech stimulation and conditioning problem* was elicited in which pupils talked loudly even in situations that demanded low or medium pitched tone. This problem arose as a result of the conditioning of the mind and the speech system to noisy situations. Secondly, the

information was interpreted and given meaning within the noisy context so that a decision was made that noise must be overcome in order to be heard and they spoke in a louder manner. Then the response was passed on to the appropriate areas of the brain where conditioning and adaptation was done. Hence, pupils always spoke loudly even when there was no noise that they wanted to overcome in order for them to be heard (Taylor et al., 1997).

Interestingly, 91% of the pupils indicated little or no annoyance to noise pollution, contrary to the literature review in chapter 2. Only 9% of these pupils were reported to have indicated annoyance to noise. What could be the interpretation to this variance in the findings? In agreement with both findings, the explanation to this is based on psychological information on conditioning called '*Instrumental conditioning*' (Vinacke, 1968). Vinacke talks about this instrumental conditioning which is sometimes called '*respondent behaviour*' which depends on the elicitation of some response by perpetual stimulus. The perpetual stimulus in turn conditions the individual to that situation. *Sound conditioning* was what could have caused many of these children living in the same noisy environment to feel little or not bothered at all by the noise.

In addition to these problems of environmental noise pollution on these children, 68% of the children acknowledged that they easily got angry when they were provoked while 76% of them reflected aggressive behaviours to others who seemed to have wronged them. This finding was confirmed by the teachers who said that pupils were in a mode of wanting to talk to or pinching their friends and always quarrelling with them. In addition, the study reported that pupils always ran to situations that were disturbing, such as a fight. All what is stated above indicated that these children enjoyed violent acts which showed the *exhibition of aggression and intolerant behaviour of pupils towards one another in terms of perceived mistakes made* was another problem deduced. The finding above confirms the literature review record on exhibition of aggression and intolerant behaviour postulated by Schroeder (1983) and Schwela et al (2005). Goines and Hagler (2007) also agree with the correlation in this finding as they conclude on this issue that noise pollution *per se* is not believed to produce aggressive behaviour but, in combination with provocation, pre existing anger or hostility, alcohol or other psychoactive agents, noise may trigger aggressive behaviour. They also say that when stress levels in the bodies are raised, they lead to annoyance and violent behaviour. The intolerant

behaviour that was indicated was probably as a result of what Goines and Hagler revealed.

Hundred per cent of the businessmen in the noise prone area of M'tendere had no keen interest in the healthy living of others and were not ready to improve the quality of life in terms of a quiet environment. Looking critically at this business community, one could see a society that portrayed pure ignorance of the effects of noise pollution, selfishness and also a total disregard for the rights of others, not to mention those of school children.

Though ZEMA reflected the Environmental Management Act No. 12 of 2011, the agency does not take noise pollution seriously. This is shown through its library materials which do not show any literature on noise pollution. It seems that noise pollution is considered as a mere nuisance that would not bring deleterious health and social effects on human beings. From responses given by officials from ZEMA and the Lusaka City Council, it is noted that there was no coordination between the local councils and ZEMA itself on matters pertaining to environmental noise pollution.

However, from the results discussed above, the following are the problems of environmental noise pollution that have been elicited in a numerated manner:

i) Decreased academic concentration and less comprehension ability.
ii) A leisure and entertainment bait during and after lessons.
iii) Decreased motivation zeal and attention span.
iv) Deterioration of hearing loss.
v) High pitched speech stimulation.
vi) Fatigue and dozing moments of pupils during lessons.
vii) Sleep disturbance and mood changes.
viii) Reduced attention span.
ix) Exhibition of aggression and intolerant behaviour of pupils towards one another in terms of perceived mistakes made.

However, in view of all what has been discussed, these problems greatly contributed to low academic performance and abnormal behaviour of the children in these schools. Table 5.1 suggests a likelihood of low academic performance when the numbers of pupils that sat for examinations are compared to the numbers of those who had failed for the period indicated.

CHAPTER 6
ETHICAL EVALUATION

6.1 Introduction

The hall mark of this chapter is to harvest a rational ethical conclusion by evaluating the empirical data that is allied with the philosophical reasoning of the ethical theories and principle that have been cited in chapter 3. These ethical principles of thought include: Utilitarianism (relying much on a contemporary version of utilitarianism and rule-utilitarianism), the Precautionary Principle and selected articles of human rights from pin-pointed human right charters. These will help in arriving at what ought to be done as we evaluate and come up with the ethical justification or not of environmental noise pollution in Lusaka's M'tendere school areas as required by the fourth research objective in chapter 1.

6.2 Options and effects on the affected

The findings of this study raise two fundamental ethical concerns. The first one is that which has to do with the livelihood of some people while the other one is that which has to do with the health and the academic well-being of school-going children, either in the short, medium or long term bases in their lives. Due to these, the following questions are intended to be answered directly or indirectly as we deal with these two ethical concerns in relation to the problem of noise pollution.

1. Are noise polluters around schools and residential areas of M'tendere justifiably right to pollute these environments with noise in their pursuit to attain their economic well-being using noise generating businesses at the expense of school-going children's well-being?
2. Does polluting the school and residential environments where pupils learn and live result in the many kinds of good or beneficial consequences over harms of all the concerned individuals, according to the contemporary version of utilitarianism?
3. Do school-going children in these areas have any inalienable rights to be protected from such noise polluters by the Zambian Government, or the society at large?

4. What is the Government's interests and benefit in the economic lay out of the country's Gross Domestic Product (GDP) and Gross National Product (GNP) from such noise polluting businesses?

Considering the five minimum conceptions of morality to our ethical reasoning, there are two options that impartially consider the interests of all the people affected and at the same time justify the use of the precautionary principle and the selected human rights articles from the selected human rights declaration charters. However, since the identified concerns hinge more on bio-ethics than on environmental ethics, bio- medical information is preferably required to support this evaluation without bias.

Generally, both options have positive and negative consequences for the affected individuals and entities that include pupils, parents, teachers, business persons and the government of the republic of Zambia. So which option should be chosen?

6.2.1 Option 1 Continue with the state of affairs of noise pollution status quo

6.2 1.1 Positive effects of Option 1 on the affected individuals

Many potential polluter business owners in M'tendere had argued that their businesses earn them and their families a livelihood. They contended that their businesses made them feed, clothe and take their children to school. They also argued that their businesses contributed much towards the sustenance of Government's operations through several taxes that they paid directly and indirectly. Others also stated that they wanted to be successful and fulfil their goal in life by utilizing this situation. Apart from the benefits accrued to them, these businesses also employ a good number of people who also sustain their own families in many ways and also pay taxes to the government which in turn brings development to the nation and boost the well-being of the general citizenry of the country.

The majority of the parents benefited from goods and services that these businesses provided. Some businessmen, who are also parents to some of the school-going children, argued that the noise generated from such ventures like welding, bars, taverns and others was unavoidable and necessary because it acted as a bait to attract and call customers to their business premises which in turn allowed their profits to increase. Once their profits increased, as parents they would pay for all the school

prerequisites for their children and be able to feed them properly. On the side of the government, there would be no loss of revenue for its operations and some people would remain employed or would continue to be engaged in one kind of gainful economical venture or another.

6.2.1.2 Negative effects of Option 1 on the affected individuals

Even though some people like businessmen and their workers benefited from such noise generating ventures, they and their families were also affected by noise pollution, as it has been shown from the discussion and analysis of results above. Problems such as sleep disturbance, gradual hearing loss, bad emotional moods and other effects had already affected their children in the studied schools. Hence in this way, they were also directly or indirectly affected.

On the side of the school-going children, the compounding problems of noise affecting them had a negative effect on their creativity, analysis, problem-solving and investigative approach to life, both in the classroom and outside school. This is reflected by the problems listed in chapter 5. This meant that pupils' learning and studying time was always disturbed and pupils were always at risk of failing to complete their homework tasks due to inadequate sleep resulting from many hours of exposure to noise. This automatically led to poor health and poor academic performance, as indicated by this study. If this is allowed to continue, pupils would be at risk of those acts of noise pollution whose silence span would be non-existent and might cause them even more risks and harms.

As discussed in this study, pupils had developed and attained short attention span in their acquisition of academic concepts during their lessons and also developed and exhibited aggressive behaviour in relation to others as shown by the results above. In addition, teachers on the other hand, as guides in pupils' progress, complained that they were mentally affected in their teaching responsibilities. This became a drawback in their quest to rightfully motivate and teach pupils in a manner that would promote rightful acquisition of knowledge, skills and attitudes that are helpful in the understanding of their immediate environment and the world at large.

In the present noisy environment, parents spent money on buying books, uniforms and the PTA levied funds on their children's education for little or for nothing at all, according to their expectations. This however, may make parents to lose trust and confidence in the school system of education. In addition, parents that

did not economically or socially benefit from such business ventures continued to suffer emotionally and physically from the consequences of noise pollution. Worse still, the government for example, continue to spend more money on schools that impacts less or negatively on society's well-being in general.

6.2.2 Option 2: To close and relocate all noise generating businesses around schools and residential areas to other appropriate areas.

6.2.2.1 Positive effects of Option 2 on the affected individuals

This alternative option would benefit the pupils in so many ways, in terms of health and educational well-being. This means that there would be a stable, healthy nation of individuals that would be well and adequately educated, morally upright with rational judgement in solving issues that would affect them and others. Generally, all the vulnerable children, parents and others that are always involuntarily subjected to noise pollution would also be protected from noise pollution in the same way they are protected from other forms of pollution by government. The school-going children would have greater opportunity to have all unbarred physiological abilities that would help in applying themselves fully, academically and learn effectively. Such a move would produce more capable men and women who would fit in all spheres of human endeavour that would strive towards the maximization of people's potentials and well-being.

On the other hand, only genuine, morally and ethically oriented business persons would get into economic and social ventures for the benefit of all the affected individuals and entities in such noise prone areas. The government on this basis would gain a lot from the charges that would be levied on offenders who would violate the relocation move and law, for example if the polluter-pay principle legislation was introduced. All in all, the local authorities in Lusaka would develop a society that is well ordered, a society which is not only designed to advance the good but which is also effectively regulated by a public conception of justice and free from corruption.

6.2.2.2 Negative effects of Option 2 on the affected individuals

Closing such businesses in such areas would bring with it a number of negative consequences on some people.

The idea of relocating the relevant noise generating businesses to appropriate areas would not cater for every businessman, knowing the situation of land shortage in Lusaka urban. This situation would deprive a large number of the affected businessmen, their employees and their families of a source of livelihood that would be suddenly cut short. This action would increase their poverty levels which loom high everywhere in all peri-urban areas of Zambia at the moment. The action would also multiply the number of unemployed people in the country. This in turn would reduce the taxable income to the government, reduce local individual investment, and the country would ever remain undeveloped in the economic sense. This means that the government would not adequately manage well in its provision of services to the people due to the loss of revenue to meet government costs, as well as not facilitate people's initiatives to engage adequately in developmental projects through the provision of education and training.

6.3. Application of theories and principles used

6.3.1 Contemporary version of Utilitarianism

In our evaluation of the two positions of action, we seek for the greatest overall benefits, both in the short and long term for all the people that are involved in the issue of noise pollution in the studied areas. The option that allows the pollution of the school and residential environments with noise in the course of people's businesses is a wrong act according to utilitarianism. This is because there is an alternative option 2 that has many kinds of good or beneficial consequences over harms of option 1. According to Mulgan (2007) and Walter (2012), beneficial consequences are explained as appropriate responses to value and the urge to promote value so that it may make the world a better place by maximizing the good. Walter further says that *maximizing consequentialism* is a moral rightness of an action that depends only on consequences that are best as opposed to mere satisfaction or an improvement over the status quo. Stopping all noise generating activities around school and residential areas and relocating them to appropriate areas, is a better act. This is justified when we look at the possible risks of noise pollution on pupil's physiological and psychological health, their academic progress in schools as well as on their moral health and that of future generations.

Therefore, according to utilitarianism, polluting the school and residential environments with noise where pupils learn and live respectively does not result in

the greatest good consequences for all the affected. Noise does not address the broader range of benefits to the affected and the nation at large. Rather, it results in much harm to the pupils and to others that are affected. According to utilitarianism, the well-being of others that are affected by one's consequential actions is what determines the moral worth of that action based on maximising the good of the outcomes (Mwanza, 2011). Business people are aware that the noise their businesses create is not healthy for others but they feel they have no other option at present in view of their need for livelihood. However, they would be willing to relocate if another option was available.

Indeed, the question posed earlier above seeking for polluters' rightful justification in polluting the school and residential environments with noise just for them to earn a living has little ethical support according to utilitarianism. The answer to the question is 'NO' because, according to the basic idea of utilitarianism, the action is morally right if and only if it has better consequences than any other alternative that is available to the agent. This means that the livelihood of all the business persons that are involved in noise pollution of the school environments do not only have this one option to earn their livelihood and to support government's operations. The action is, therefore, not morally justifiable in that it does not produce better consequences for the affected school-going children, parents and the teachers. Again, considering the *welfarism* of the people affected, the action is considered wrong or right depending on its contribution to the well-being of all the affected. Empirical data obtained in this regard attested to the fact that such businesses contributed so much to the noise pollution which brought with it many problems that affected pupils' well-being. Therefore, any consequence that takes away from the well-being of the affected is a bad consequence and its action should not be considered for any ethical mitigation of any ethical issue.

Although option 1 minimally benefits some children in terms of livelihood, taxes to government that pay teachers' salaries and build schools, the fact on the ground showed that the majority of the businesses in the area did not directly pay taxes to the local or the central government. In spite of this failure, their actions have continuously led to the deterioration in pupils' learning capabilities and their general health. Furthermore, many parents in the area continued to spend a lot of money on supporting their children in their school prerequisites even when their performance was below society's expectation. According to most people's expectation, the

‘quality of education’ refers to two things: the quality of what is learned, such as its relevance, appropriateness and effectiveness of delivery by teachers and the quality of the learning environment, not only of the existence of infrastructure, but also of a conducive learning and quiet environment (MOE, 1992).

Therefore, it is justifiably right for residents of M’tendere and the Lusaka City Council to commit themselves to the maximization of total consequentialism, welfarism and equal consideration as the bases for promoting the moral rightness of all the actions whose consequences are best for the well-being of all human beings within its confinement.

6.3.2 The Precautionary Principle

The proportional actions of Option 2 above should be adopted by the Lusaka City Council in order to maximize consequences that promote moral rightness of all the actions whose consequences are best for the well-being of all human beings. This is in line with the precautionary principle which aims at achieving lower or more acceptable risks or hazards, as prescribed by its working definition stated in chapter 3.

Considering the scenario of noise pollution in the studied areas, we find that there exist human activities that generate a lot of noise pollution that has led to morally unacceptable harm, both in terms of physiological health and in the deterioration of the academic progress of school-going children. All these are scientifically plausible because several scientific investigations have been done, confirming such types of harm, like those investigations that were done at John Hopkins University in the United States of America and elsewhere (Suter, 1991).

Though there were many spotted defects and problems on the pupils, related to sleep deprivation, loss of hearing and others due to noise pollution, some of the causes of these effects were not clear, meaning that they were uncertain and hence the need for an immediate action. This is because it seems impossible for the Zambia Environmental Management Agency and the Lusaka City Council to reduce the uncertainties and ignorance about the present or anticipated types of harm of noise pollution.

The potential for noise pollution to lead to morally unacceptable harm and un-quantified possibilities of harm is indeed sufficiently serious and even may be irreversible for the present and future generations. It is therefore morally

unacceptable to overlook the acts that perpetuate such types of risks on people, let alone the school-going children. It must be known that there are certain things that people are not aware of that are instrumentally good to the affected and seem distinct from their well-being. Components like getting an education and enjoying the atmosphere of peace is part of the instrumental good that should not be overlooked in the pupils' welfarism. These components do not only enhance pupils' well-being but also the moral relationship among individuals. Therefore, the proportional actions such as the ones proposed in option 2 ought to be taken in order to avoid or diminish the health defects and the academic problems of children in these noise prone school areas.

In trying to find a lasting solution to bad consequences of noise pollution in Lusaka schools, it must be understood that noise pollution is a problem created by rapid human population growth and industrialization technology, clustered in a limited environmental space. Unless these factors do not continue to be tolerated, the problems of noise pollution will be unavoidable. However the problem is not insurmountable.

6.3.3 Rule Utilitarianism

In enforcing option 2, rule utilitarianism supports one of the proposed recommendations from the pupils, parents and teachers of legislation against noise pollution with a heavy fine or punishment for the violators. Teachers and parents argued that this would guarantee that polluters would never pollute such environments purposely, with or without selfish motives to gain monetary benefit. They also said that heavy monetary punishment or short-term imprisonment would deter even the notorious noise polluters from being casual about polluting such environments. In view of rule utilitarianism, it points out that the right action follows from the rules that would maximize the general well-being if everyone followed them. Therefore, a strict adherence to ideal rules made on the basis of moral consideration would bring better consequences to those that would follow that set of rules. This idea, in my view with a combination of scientific and ethical investigation and public action could abate this problem of noise pollution in human clustered populated areas like M'tendere.

6.3.4 Human Rights

In the light of what is fundamental and sustainable, the second option stands more appropriate for the promotion of the rightful acquisition of knowledge, skills and attitudes by school-going children of M'tendere than option 1. Further, the axiological stance of this option is more on intrinsic value which is more cardinal to humanity than the instrumental value that many people cherish more. The consideration of value is a paramount issue because it is out of value that duties are derived. The value that one gives to anything or to others reflects the duty that he expresses towards them as he endeavours to pursue his socio-economic ventures to bring satisfaction to his own being. Therefore, the option embraces more importantly the value and duty that is enshrined in the human rights which are the basis of legal rights. For it is a considered view that human rights are natural claims and freedoms that humans have in recognition of their human worth and against which people have an obligation or duty to evaluate their actions as just or illegal.

According to A*rticle 16* of African Charter on Human and People's Rights that says that, "Every individual shall have the right to enjoy the best attainable state of physical and mental health. States parties to the present Charter shall take the necessary measures to protect the health of their people and to ensure that they receive medical attention when they are sick". This is a claim right and, as such; it demands an obligation on others, including the business persons of M'tendere and all those who perpetuate noise pollution in other areas. It calls for them to have a moral obligation not to pollute the school environments, an act that jeopardizes or reduces the pupils' standard of living in terms of the right to enjoy the best attainable state of physical and mental health. This is both in academic and physiological attainment. *Article 27*, section 1 and 2 of the above charter demands the duty of everyone to his family and community and is subject to morally recognise and respect the rights and freedoms that promote the general welfare of all. In this case, the article provides for a moral obligation from polluters of noise to respect, as a duty the welfarism of the school-going children.

In the same vein, *Article 24* of the African Charter on Human and people's Rights, talks about the right of every person to a general satisfactory environment favourable to their development while *Article 17*, reminds individuals that they have the right to education. The majority of business persons of M'tendere operate as gladiators as they provide entertainment alongside their main businesses. Such acts

exploitatively disturb the school environment and later harm the pupils' mental and academic health. This is morally unacceptable because it takes away their human right to a clean, safe and healthy environment. Apart from being deprived of a healthy environment, these pupils are also deprived of the right to quality educational attainment. Despite the Environmental Protection and Pollution Control Act of 1990 and later the Environmental Management Act No. 12 of 2011, the public, the ZEMA and the Lusaka City Council have not taken responsibility over noise pollution as stated under Division 6 of the Environmental Management Act No. 12 of 2011. **[See, Appendix B]**. These, have judiciously failed to apply this preventive policy that is intended to limit the production and spread of noise pollution in the studied areas of Lusaka. This is so because Cap 1 of the Environmental Management Act No. 12 of 2011, section 4, subsection 1, 3 and 4a and b, says so, as I quoted below.

> (1) Subject to the constitution, every person living in Zambia has the right to a clean, safe and healthy environment
> (3) A person may, where the right referred to in subsection (1) is threatened or is likely to be threatened as a result of an act or omission of any other person, bring an action against the person whose act or omission is likely to cause harm to human health or the environment.
> (4a) The action referred to in subsection (3) may seek to (a) prevent, stop or discontinue any activity or omission which threatens or is likely to cause harm to human health or the environment. (b) Compel any public officer to take measures to prevent or discontinue any act or omission which threatens or is likely to cause harm to human health or the environment.

The ZEMA and the Lusaka City Council, as government institutions have not only failed in this regard, but have also failed to provide relevant information to the people about the dangers of the effects of noise pollution, according to *Article 9* of the African Charter on Human and People's Rights. In addition to the demand for information to people and the right to education, *Article 17* of the same charter emphasises the promotion and protection of moral and traditional values. Therefore, the Ministry of Education is to blame while the City Council is greatly to blame on the issue of encroachment of the school grounds by squatters, as stated by *Article 14* of the same charter. All these state parties were supposed to ensure that all school-going children were protected and cared for so that all acts that take away their well-being are minimized as stated by *Article 3,* section 1 to 3 of the United Nations Convention on the Rights of a child.

The need for education and information for the people in the studied areas is cardinal because this could have deterred the indiscriminate production and the spread of noise at awkward times if remedies were demanded through the courts of law by the affected individuals and institutions.

However, due to the intricacy of the ethical issue at hand and the rational fact-value evidence gathered in this research, the researcher is ethically obligated to take option 2 as a rational choice and endorse the contemporary version of utilitarianism, Rule-utilitarianism and the Precautionary Principle. This option adequately covers the utilitarian thought, the precautionary principle and is consistent with the moral code that supports human rights. The option reduces philosophical conflict of interests of people and also reduces people's exposure to continuous noise pollution which reveals signs of damage to the physiological, psychological and the social health of the affected. These damages leave pupils prey to other shocks in their lives, such as bad emotions and wrong appetites that lead to addiction to drugs and other habits of a permissive life that contributes to problems in schools and society in general. Option 2 would reduce the reported annoyance and aggression that pupils exhibited from the empirical data obtained on the effects of noise pollution on sleep disturbance.

CHAPTER 7
SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Summary

The perceived poor academic performance and manifestation of negative social behaviour of children in M'tendere were the major concerns that precipitated this study. The causes of such performance and behaviour of children were not immediately clear, but are somewhat being associated with heavy noise pollution that is presently uncontrolled in these school areas.

Results of this study are consistent with those studies that were done in many developed countries about the effects of noise pollution. It has been established that excess noise pollution around school areas causes more effects which in turn bring more problems on school-going children. The study shows that all the children that were exposed to severe noise pollution reflected low academic performance and several negative behaviours. The study further established that there are many problems of noise pollution that emanate from such effects of noise pollution as indicated and listed in chapter 5. Such problems include: deterioration of hearing loss, speech stimulation in terms of instrumental conditioning effect, (Vinacke, 1968), lack of academic concentration, sleep disturbance that resulted in mood changes and dozing moments of children during lessons. Others were decreased motivational and comprehension ability, memory loss and exhibitions of aggression and intolerant behaviour of pupils towards one another in terms of perceived mistakes made (WHO, 2000).

In response to awareness of the effects and problems of noise pollution, Option 2 that suggests for relocation of all noise generating businesses around schools and residential areas to other appropriate areas has been recommended as an evaluation option, according to utilitarianism, the precautionary principle and human rights.

7.2 Conclusion

7.2.1 Conclusion from findings

The problems of environmental noise pollution in Lusaka schools, as in the case of M'tendere have been evidenced by the results obtained from teachers, parents and pupils themselves. The evidence has led to the elicitation of environmental problems

of noise pollution in those school areas.

The empirical data is found to be in consistent with the information from the literature that indicates that, pupils in severe noise polluted environments experience such effects as outlined in the literature (Goines and Hagler, 2006). It is important, however, to note here that M'tendere school areas are not the only ones that are seriously affected by the problem of noise pollution as random visits taken by the researcher to other school areas show. Many school areas in Lusaka urban were found equally encroached by noise polluting business ventures as M'tendere is. **(See appendix C).**

However, it is not fair to conclude that all the abnormalities in terms of academic performance and negative behaviours, exhibited in school-going children in M'tendere are attributed to noise pollution. This is the reason why the researcher advanced the physiological perspective in the analysis of results, for which currently there is little or no enough significant data to prove or disprove such claims. However, it calls for more integrated faculty research on this issue to prove or disprove these claims.

7.2.2 Conclusion from the ethical evaluation

In view of what has been stated in Chapter 5 of the analysis and discussion of results and in Chapter 6 of the ethical evaluation to justify any of the two options, awareness and caution in whatever is being pursued in order to yield the many kinds of good or beneficial consequences than the harms is very important. This is so because happiness and pleasure are not the only kind of good consequences or unhappiness or pain the only bad consequences (Mulgan, 2007). However, since the position has been identified as an alternative to the minimization of noise pollution in Lusaka schools, the study ethically concludes that relocation of all noise generating businesses to appropriate areas is the best option according to the ethical framework that has been employed. Yet the overall ethical evaluation concludes that noise pollution was a factor that negatively affected the school-going children and influenced their behaviour and their learning potentials in schools. Nevertheless, the researcher honestly admits that with the limitation of thought in trying to come up with the best option, there could have been other best possible option that could have better consequences than the consequences that have been presented.

7.3 Recommendations

Some of the recommendations arising from this research do not only concern the well-being of pupils in the affected schools of M'tendere, but they cut across society as a whole that could be affected by similar conditions of environmental noise pollution as stated in the research. The negative outcomes observed and analyses led to the following recommendations.

1. The Government should make laws that would help in the curbing of noise pollution in residential areas, working places, schools, churches and market places.
2. Government must introduce an insulation policy of classrooms in schools that are in noise prone areas to reduce the impact of noise on learners by putting sound absorbent materials in them.
3. Government should strengthen the regulatory mechanisms for implementation of Act number 12 of 2011; division 6, section 76 to 79 on noise pollution and fine-tune noise pollution ordinances and enforcement methods.
4. Government should relocate necessary noise generating business ventures from school and residential areas to reduce the pollution of noise on schools.
5. There should be a more serious consideration of th*e inner most body environment of* the people themselves, and it should be among the primary things to consider in all that is done for the sustenance of healthy bodies and minds.

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GLOSSARY

Adenosine Tri-Phosphate (ATP) is molecules in the body cells that store energy for later use.

Agent is someone who causes an effect on something that brings either positive or negative change in its well-being.

Amplitude is the maximum distance the wave moves backward or forward from its rest position.

Auditory canal is a hairy channel, made of special cells that secrete waxy material, which catches germs, and dust particles and prevent them from getting into the ear.

Autonomic nervous system [autos = self, nomos = governing] is that part of the peripheral nervous system which controls activities inside the body that are normally involuntary such as the heart rate, peristalsis and sweating.

Bio-ethics is a branch of applied ethics that investigates issues concerned with medical and biological concerns.

Cannabis (or marijuana) is a hallucinogen drug that causes the individual person to sense something that does not actually exist.

Cochlea is about 35 mm long structure of the inner ear filled with the endolymph and the perilymph and houses the organ of corti.

Concentration is the first activity essential for understanding or comprehending whatever one reads or learns. It is the power to free the mind from everything else and fix it on the matter at hand.

Destructive interference of sound is the act of causing damage or distortion to sound waves.

EEG (Electroencephalogram) is a machine which records electrical brain activity by means of electrodes placed on the scalp that detects the very small voltages of the neurons firing beneath the skull and the meninges. 'The neural activity is the recorded on the polygraph, consisting of a moving strip of paper and marked pens for each electrode placement.

Frequency is the number of vibration cycles completed by a sound wave per second

Hypothalamus is a brain region situated at the base of the forebrain, immediately beneath the thalamus and is responsible for the regulation of many physiological activities such as hunger, thirst, sleep and temperature regulation. It is also responsible for integration of many basic behavioural patterns which involve correlation of neural and endocrine function of the internal environment.

Impulsive sounds are sounds that are suddenly produced.

Incus (anvil) is the second bone of the ossicles which vibrates when it is disturbed by the vibration effects of the malleus.

Insomnia is a form of involuntary habitual sleeplessness. It can be due to physiological problem resulting from Bio-chemical changes at the brain level.

Intermittent sound is sound that occurs at intervals.

Inner-molecular and tissue environment is the surrounding within the cells of the body and the fluids within those cells where chemical reactions take place.

Malleus (hammer) is the first bone of the ossicles that is attached to tympanic membrane or ear drum.

Metabolism is a general term that involves two chemical processes of *catabolism* (breaking down of materials) and *anabolism (building up of complex materials)* that occur in living cells of an organism, resulting in growth, production of energy and elimination of waste.

Morphine and heroin are painkiller drugs that relief pain and are obtained from opium.

Neurosis is a fundamental disorder of nervous system and involves the symptoms such as insecurity, anxiety, depression and irrational fears.

Psychosis is an abnormal sign or symptom that affects the mind, causing people to change the way they think, feel. Perceive things and behave.

Nicotine and cocaine *are s*timulant drugs.

Organ of corti is a region in the cochlea that consists of the tectorial membrane, the basilar membrane, the sensory hair cells and the auditory neurons. This is the region where transduction of sound waves into electrical impulses occurs.

Ossicles are the three tiny bones in the middle ear, namely, *malleus* (hammer), *incus* (anvil), and *stapes* (stirrup).

Oval window is a membranous boundary that separates the middle ear and the fluid-filled inner ear of the cochlea and the semi-circular canals.

Pinna is a flap on the side of the head, made of gristle cartilage that keeps it stiff to enable it catch sound waves and directs them into the hairy *auditory canal*.

Pituitary is a principle gland at the base of the brain and is divided into two sections known as *anterio*r and *posterior* pituitary. It stores and secretes all the hormones that are synthesized by the hypothalamus.

Round window is a membranous window through which pressure of sound waves in the inner ear is released, to prepare for the next incoming sound waves and is dissipated into the air of the middle ear as the vibrations.

Sedatives: These are drugs that have a soothing or calming effect on the human brain.

Semi-circular canals contain receptors sensitive to gravitational movements that help in the maintenance of the body balance.

Sleeping pills: These are pills that relax the brain cells responsible for sleep function.

Stapes (stirrup) is the third bone of the ossicles that vibrates when is disturbed by vibrations of the incus, which later vibrates the oval window.

The Eustachian tube is tube that connects the air-filled chamber of the middle ear to the pharynx or the mouth cavity, whose work is to balance the air pressure between the middle ear and the outside.

Tinnitus is a physical condition experienced as noise or ringing tone, buzzing in the ears or head of a person when no such external physical noise is present, caused by an intense and sustained high noise levels.

Traditionalists are individuals who adhere to the handed over beliefs and traditional practices, down from generation to generation.

Tranquillizers are drugs that calm someone suffering from anxiety, tension and other upsets.
Tuntemba are make-shift shops, usually situated along the road sides.
Tympanum is another name for eardrum.
Utility: this is the usefulness or benefit of any consequences or item available to the interest of the affected individuals or sentient creature.

APPENDICES

APPENDIX A1

THE UNIVERSITY OF ZAMBIA
SCHOOL OF HUMANITIES AND SOCIAL SCIENCES
DIRECTORATE OF POST GRADUATE STUDIES
DEPARTMENT OF PHILOSOPHY AND APPLIED ETHICS

Questionnaire for Pupils

Name of Researcher: Mwamba Phillip

Topic of Study: *Problems of noise pollution in Lusaka schools: An Ethical case study of Mutendere and Woodlands school areas.*

Level of Study: Master's level

Supervisor: Prof George Spielthenner

Dear respondent,

I am a Postgraduate student at the above mentioned institution, who is undertaking a research about Problems of noise pollution in selected schools in Lusaka. You have been selected to participate in providing information to this research, which is part of my studies. This information is purely for academic purposes only. You are requested to respond as truthfully as possible to the items below. Your response will be treated with strict confidence as possible. Please note that you do not need to indicate your name.

Instructions: Please put a tick (✓).

1. Do you live in a noisy polluted place? **Yes** ( ), **No** ( ).
2. If the place where you live is noisy, when do you hear this noise? **During day** ( ), **During night** ( ). **All the time** ( ).
3. How noisy is the surrounding of your school? **Very noisy** ( ). **Little noisy** ( ), **Not noisy** ( ).
4. How loud is the noise that you hear? **Very loud** ( ), **loud** ( ), **moderate** ( ).
5. Does noise annoy you? **Very much** (**), Little** ( ), **No** ( )
6. Do you have difficulties in studying your school work during your study time set on your study time table due to noise around the area were your live? **Yes** ( ), **No** ( ).
7. Do you think noise affects your academic performance? **Yes** (**)** **No** ( )
8. Does noise awake you up from your sleep during night time? **Yes** ( ), **No** ( ).
9. Have you ever experienced sleep loss during night time and later feel tired when you wake up in the morning? **Yes** ( ), **No** ( ).
10. Do you think noise affects your health adversely? **Yes** (**), No** ( ), **I do not know** ( )
11. Is noise generally a problem? **Yes** ( ), **No** ( ).
12. Do you think there should be noise regulations in your area? **Yes** ( ), **No** ( )
13. Do you attend disco shows? **Yes** ( ), **No** ( )

14. Do you listen to music from musical instruments through ear phones? **Yes** ( ), **No** ( ).
15. Do you at any time hear ringing tones or sounds in your ears or head which are not coming from any source of sound? **Yes** ( ), **No** ( ).
16. Do you easily get angry when you are provoked by someone? **Yes** ( ), **No** ( ).
17. Suppose your friend steps on your toe which seems deliberate to you, what would be your reaction? **Slap him/her** ( ), **humbly tell him/her to be careful** ( ), **step on his/hers also** ( ), **report him/her to the teacher** ( ). [Choose only one].

APPENDIX A2

THE UNIVERSITY OF ZAMBIA
SCHOOL OF HUMANITIES AND SOCIAL SCIENCES
DIRECTORATE OF POST GRADUATE STUDIES
DEPARTMENT OF PHILOSOPHY AND APPLIED ETHICS

Research Interview Schedule (For ZEMA Official – semi standardized interview)
Name of Researcher: Mwamba Phillip
Topic of Study: *Problems of noise pollution in Lusaka schools: An Ethical case study of Mutendere and Woodlands school areas.*
Supervisor: Prof George Spielthenner
Level of Study: Master's level
Note of Assurance: The participants willingly engaged in providing data to this study are assured of anonymity if they so wish. But, they are also free to permit this researcher to be literally quoted.

1. Prof/ Dr/Mr./Mrs./Miss……..……is ZEMA aware of the prevailing noise pollution situation in Lusaka's urban and peril-urban residential areas, if it does, are you aware that some school areas are encroached by noise polluting businesses that disrupt the learning process of the pupils?
2. What steps are you taking as ZEMA about this situation?
3. Principle number 13 of the Rio Declaration on Environment and Development says that states like Zambia shall enact effective environmental standard management objectives and priorities that should reflect the environmental context to which they apply.
   a) Which environmental legislation regarding noise pollution has been enacted in Zambia?
   b) What environmental standards are set in the case of environmental noise pollution?
   c) Do Environmental Protection and Pollution Control Act of 1999 have a legal backing on noise pollution in Zambia?
4. Does ZEMA, as an agency responsible for abating any type of pollution in Zambia have the basic sound level meters and their derivatives, such as noise dose-meter, intergraded sound level meters, graphic level recorder and community noise analyzers to measure sound levels of noise in communities like M'tendere?
5. If you do not have these basic sound level meters, then, how do you assess and control the impact of community noise pollution in noise prone areas?
6. .Principle 10 of Rio declaration urges states to provide and make information available to citizens so that they can know and have access to judicial and administrative proceedings, including redress and remedy. Noise pollution has so many effects on people. In which ways as an agency have you provided this kind of information to people?

7. Does ZEMA have a list of some of the adverse physical, psychological, physiological health effects or consequences of noise pollution on human beings vis-à-vis the problems that noise pollution could have on school going children?

8. If there is such a list, would you kindly avail this list to me for the benefit of this research?
9. Have the Environmental Protection and Pollution Control Act of 1990 and amended act of 1999, passed by the Zambian Government, have a legal backing on noise pollution?
10. In addition to question 9, is there a departmental office of Noise Abatement and Control with ZEMA as it is in the United States of America?
11. ZEMA has done very well in informing the general public on general environmental issues through a continuous but periodic production of the 'State of Environment (SoE) Outlook Report' which is in two types (The Zambia Environmental Outlook Report and the District State of Environment Outlook Report). Why don't both reports report on environmental noise pollution issues?

APPENDIX A3

THE UNIVERSITY OF ZAMBIA
SCHOOL OF HUMANITIES AND SOCIAL SCIENCES
DIRECTORATE OF POST GRADUATE STUDIES
DEPARTMENT OF PHILOSOPHY AND APPLIED ETHICS

Research Interview Schedule (For teachers– semi standardized interview)
Name of Researcher: Mwamba Phillip
Topic of Study: *Problems of noise pollution in Lusaka schools: An Ethical case study of Mutendere and Woodlands school areas*
Supervisor: Prof George Spielthenner
Level of Study: Master's level.
Note of Assurance: The participants willingly engaged in providing data to this study are assured of anonymity if they so wish. But, they are also free to permit this researcher to be literally quoted.

1. Prof/ Dr/Mr./Mrs./Miss……How are the noise situation here from other sources apart from that of the pupils?
2. Do pupils in your class or classes less likely to solve challenging academic problems and to persist on until they find answers for them?
3. Are there pupils in your class who always decide to let you pick choices for them instead of them exercising their option?
4. Do you find difficulties in motivating your pupils in doing their school work?
5. Do your pupils respond to home work or your self-generated result oriented options of learning in your teaching methodologies, approaches and strategies?
8. Are your pupils always noisy or always in a talking mood even in a situation that demands quietness and concentration--- or even talking to themselves sometimes?
9. Generally, how do you find the talking moody of the pupils in the school? Do they talk at high pitch even when they are talking to a near friend?
10. If they talk like that, do they release that they are actually talking on top of their voices?
11. Have you in your teaching experience in this school noticed pupils keeping on doing what they have been stopped from doing until you keep on reminding them, for example, 'Sit down' and some remain standing until you repeat the command?
12. From your own perception and experience, what would you attribute all the negative responses and behaviour of the pupils to?
13. What is you general view of the pupils' behaviour in the school, in terms of quick annoyance, quarrels, dress and generally, respect towards public property, their fellow pupils, people in authority and adults in general?

APPENDIX A4

THE UNIVERSITY OF ZAMBIA
SCHOOL OF HUMANITIES AND SOCIAL SCIENCES
DIRECTORATE OF POST GRADUATE STUDIESDEPARTMENT OF PHILOSOPHY AND APPLIED ETHICS

Research Interview Schedule (For Lusaka City Council Health Department Official – a semi standardized interview)
Name of Researcher: Mwamba Phillip
Topic of Study: *Problems of noise pollution in Lusaka schools: An Ethical case study of Mutendere and Woodlands school areas.*
Supervisor: Prof George Spielthenner
Level of Study: Master's level
Note of Assurance: The participants willingly engaged in providing data to this study are assured of anonymity if they so wish. But, they are also free to permit this researcher to be literally quoted.

1. Prof/ Dr/Mr./Mrs./Miss……..., is Lusaka City Council aware of the prevailing noise pollution situation in Lusaka's urban and peril-urban residential areas, if does, are you aware as council that some school areas are encroached by noise polluting businesses that disrupt the learning process of the pupils?
2. What could be the effects of noise pollution to human beings, apart from that of disturbance?
3. Does the squatter control unit that was established in the ministry of Decentralization in 1985, when Michael Sata was Governor of Lusaka, still in force?
4. If it is in force, why do we have the squatters encroaching school areas with noise generating businesses?
5. If it is not, why was it abolished?
6. Is there a planning department that advises council members about residential, business and education institution planning sites?
7. Is the council aware that most of the businesses that they approve generate a lot of noise that affect many people, including school going children?
8. Do we have a noise control act apart from the Environmental Protection and Pollution Control Act of 1990 and 1999 amendment act?
9. Do you have an established dose-response in relationship to safety levels of noise to prevent its adverse effects on the communities?
10. What is the way forward in eliminating or minimizing noise pollution in the city?
11. Does Lusaka City have the basic sound level meters and their derivatives to measure sound levels of noise in communities like M'tendere?

APPENDIX A5

THE UNIVERSITY OF ZAMBI
SCHOOL OF HUMANITIES AND SOCIAL SCIENCES
DIRECTORATE OF POST GRADUATE STUDIES
DEPARTMENT OF PHILOSOPHY AND APPLIED ETHICS

Research Interview Schedule (For Business persons– semi standardized interview)
Name of Researcher: Mwamba Phillip
Topic of Study: *Problems of noise pollution in Lusaka schools: An Ethical case study of Mutendere and Woodlands school areas*
Level of Study: Master's level.
Note of Assurance: The participants willingly engaged in providing data to this study are assured of anonymity if they so wish. But, they are also free to permit this researcher to be literally quoted.

1. Mr./Mrs./Miss……What business are you engaged in this area?
2. What are your major reasons for setting this type of business?
3. What benefits do the residents of this area gain from your business?
4. Are you aware that your business generate a lot of noise that affect some people, including your workers?
5. Do you know any effects and health problems that continuous noise, bring to human beings?
6. How would you like to balance your business interests with that of your community in terms of healthful environment especially that of school going children?
7. Would you suggest to the government some of the ways you should be helped to continue with your business while looking after the interest of healthful community

APPENDIX A6

THE UNIVERSITY OF ZAMBIA
SCHOOL OF HUMANITIES AND SOCIAL SCIENCES
DIRECTORATE OF POST GRADUATE STUDIES
DEPARTMENT OF PHILOSOPHY AND APPLIED ETHICS

Research Interview Schedule (For parents– semi standardized interview)
Name of Researcher: Mwamba Phillip
Topic of Study: *Problems of noise pollution in Lusaka schools: An Ethical case study of Mutendere and Woodlands school areas*
Supervisor: Prof George Spielthenner
Level of Study: Master's level.
Note of Assurance: The participants willingly engaged in providing data to this study are assured of anonymity if they so wish. But, they are also free to permit this researcher to be literally quoted.

1 Prof/ Dr/Mr./Mrs./Miss……, How is the noise situation in and around your residential area?

2. Are you aware of the effects and problems that continuous noise pollution bring on humanity?

3. How is the academic performance of your children?

4. How is the moral behaviour of children here?

5. Do your children speak with a high tone even when they are talking to a person who is near to them?

6. Are you and your family disturbed in your sleep by noise from the surroundings?

7 What help would you ask the Government to offer to protect you from such noise polluters so that you can enjoy peaceful night sleep and day?

8 What education would you offer to your neighbours about the dangers of noise pollution?

APPENDIX B

Division 6 about noise a part of The Environmental Management Act No. 12 of 2011 *Division 6 - Noise*

67. In this Division, unless the context otherwise requires—"noise level" means the level of noise, measured in decibels or other suitable units; and "noise emission standards" means the noise level emission standards established by the Agency pursuant to section *seventy.*

68. Subject to section *sixty-nine,* a person shall not emit noise in excess of the noise emission standards established pursuant to section *seventy.*

69. (1) Notwithstanding section *sixty-eight,* the inspectorate may grant a permit allowing excessive emission of noise under such terms and conditions as it may determine.

(2) Where an exemption is granted under subsection (1), workers exposed to excessive levels of noise shall be adequately protected in accordance with the directives of the Agency.

70. (1) The Agency shall, in consultation with the relevant appropriate authorities— *(a)* set up standard procedures for noise measurement; *(b)* establish noise level and noise emission standards for construction sites, plants, machinery, motor vehicles, aircrafts, including sonic booms and industrial and commercial activities; Interpretation Prohibition of noise emission exceeding established standards Exemption

144 No. 12 of 2011] *Environmental Management*

(c) apply appropriate measures to ensure the abatement and control of noise from the sources referred to in paragraph(b);

(d) measure the level of noise emanating from the sources referred to in paragraph (b), details of which measurement shall be given to the owner or occupier of the premises from which the measurement was taken; and

(e) advise on noise pollution abatement measures.

(2) The noise emission standards and guidelines as well as zones prescribed for the purposes of subsection (1) shall be published in the *Gazette* at least ninety days before the date upon which they come into effect.

APPENDIX C

Table 5.4 showing some schools and school areas were noise pollution is prone in Lusaka urban; hence indicating the seriousness of noise pollution in Lusaka schools.

School	Location	Source of noise pollution
1. Chawama basic	Chawama compound	Bars, taverns, bus-station &d market
2. Chimwemwe basic	Chawama compound	Bars, taverns, & Tuntembas
3. Chibolya basic	Chibolya compound	Comesa market, bars, Tuntembas & vehicles
4. Chitukuko basic	M'tendere compound	Bars, churches, taverns
5. Chitukuko basic	M'tendere community school	Bars, churches, taverns "nsolo game" & market
6. Chinika secondary	Kanyama compound	Bars, taverns, & Tuntembas
7. Disai basic	Lilanda compound	Bars, taverns, & Tuntembas
8. Flying Angels sec.	N'gombe compound	Bars, taverns, & Tuntembas
9. Justin Kabwe basic	Mandevu compound	Bars, taverns, & Tuntembas
10. Kamanga basic	Kamanga compound	Bars, taverns, & Tuntembas
11. Kaunda square basic	Kaunda square stage 1	Bars, taverns, & Tuntembas
12. Kizito basic	Kanyama compound	Bars, taverns, & Tuntembas
13. Lilanda basic	Lilanda compound	Bars, taverns, & Tuntembas
14. Mahatima Gandhi	M'tendere compound	Bars, taverns, & Tuntembas
15. Old M'tendere basic	M'tendere compound	Bars, taverns, & Tuntembas
16. Mutambe basic	Mandevu compound	Bars, taverns, bus-station &d Tuntemba markets
17. Ng'ombe P T A school	Ng'ombe compound	Bars, taverns, bus-station &d Tuntemba markets
18. Ngwerere basic	Garden compound	Bars, taverns, bus-station, night clubs & Tuntemba markets
19. Vera Chiluba basic	M'tendere compound	Bars, taverns, bus-station, night clubs & Tuntemba markets

APPENDIX D

Physical Properties of Sound

Before a detailed discussion of the ear structure, how it functions and how it is affected by noise pollution, a brief look at the physical properties of sound is important in order to gain a satisfactory understanding of such effects.

Suter (1991) explains that sound, as it is heard, is a result of pressure changes in a medium (usually in air), caused by vibrations or disturbances. The amplitude[9] of these pressure changes is stated in terms of sound levels occurring with frequency.[10] These sound intensity levels are measured in decibels (dB), while sound frequency is stated in terms of cycles per second or Hertz (Hz). Suter continues to explain that a small increase in decibels represents a large increase in sound energy. He says that sound in decibels is a logarithmic measure rather than a linear measure of the pressure changes. Bueche (1988), in line with Suter's explanation, defines 'sound' as any compression disturbance travelling through a material in such a way that it is capable of setting the human eardrum into motion thereby giving rise to the sensation of hearing. He pinpoints one of the peculiar properties of sound waves. He says that sound waves, being compression disturbance in the material, require a substance to travel. In other words, this energy cannot travel through a vacuum because there are no air particles to transmit or to disturb and propagate these sound waves.

The effects of noise pollution are determined mainly by the duration and the level of sound, but are influenced by the frequency. This means that long-lasting high levels of sounds are the most damaging to the hearing mechanism and generally the most annoying. According to Suter, high-frequency sounds are more hazardous to hearing and more annoying than low-frequency sounds. He argues that it has been shown that intermittent sounds are to some extent less damaging to the hearing than continuous sounds because of the ear's ability to regenerate during the intervening quiet periods. However, ***intermittent*** [11](sound that occurs at intervals) or ***impulsive***[12] sounds (sounds that are suddenly produced) tend to be more annoying because of their unpredictability (Pople, 1987; Suter, 1991).

Naturally, there are average limits of audibility for the human ear. The lower limit of just audible sound, and the upper limit, when sound is so intense that it hurts the ear. The ear is more sensitive to some frequencies than to others. For example, an intensity level of about 120 dB is painful and can cause permanent damage to the ear. However, Goines and Hagler (2007) say that long-term daily exposure to sound levels in excess of 85 dB is potentially hazardous, while Bueche (1988) says that long-term exposure to sound levels from 90 dB to 120 dB can cause impairment. The lowest sound level that is barely audible to the human ear is zero decibels (0 dB), while the normal sound intensity for ordinary conversation of people is 60 dB. Due to

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[9] **Amplitude** is the maximum distance the wave moves backward or forward from its rest position.
[10] **Frequency** is the number of vibration cycles completed by the wave per second (Bueche, 1988).
[11] **Intermittent** sound is sound occurring at intervals.
[12] **Impulsive** sounds are sounds that are suddenly produced (Suter, 1991).

such high sound levels intensity, noise pollution is found to have significant impact on the quality of life of both animals and human beings.

Detailed explanation of the Ear Structure and its Hearing function process
Hearing impairment

To understand how hearing impairment is caused by noise pollution in human beings, it is important that we know and understand the ear structure and how its hearing mechanism works. This will justify the need of the proposal made by this researcher to extend the awareness of the inner molecular-tissue environment of a human being to all the people.

The ear structure

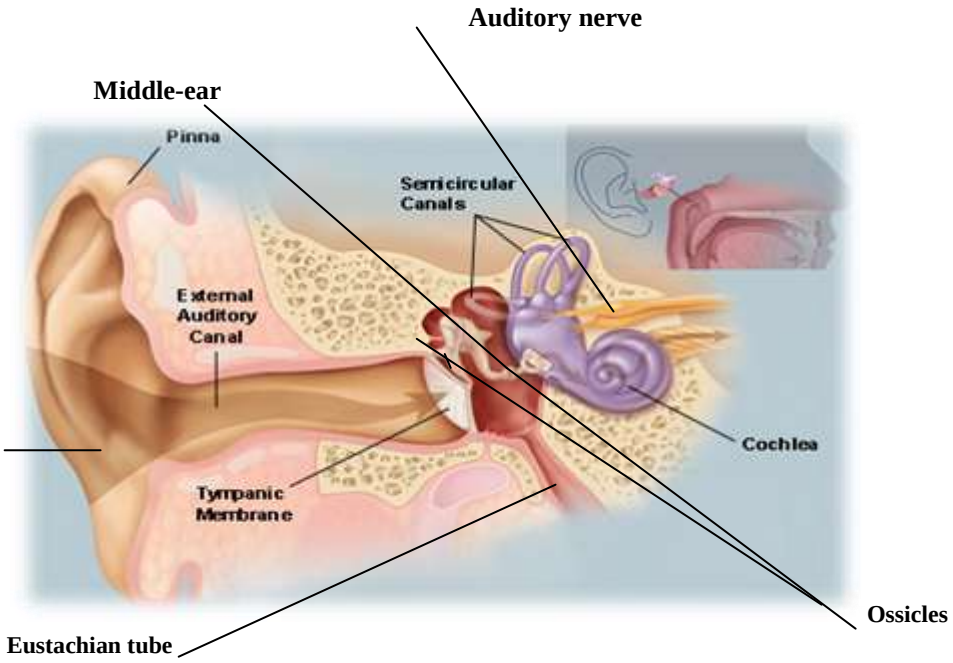
An explanation of the structure and function of the hearing apparatus and its sensing mechanism is necessary before a brief explanation of how noise pollution affects the human body in terms of hearing loss and permanent damage of the ear. This will enable us to understand the physiological connections of the effects and appreciate how the hearing may be affected or damaged due to noise pollution. In addition, this will help to justify an extension to an ethic that harmonizes the three man-relationships that Odum talked about that must include *man-to-his inner molecular-tissue environment relationships.*

The ear is a three-sectioned structure, partitioned as *outer ear*, the *middle ear* and the *inner ear.* This structure is one of the five sense organs and contains the *semi-circular canals* and the *cochlea.* The *semi-circular canals* contains receptors that are sensitive to gravitational movements of the body and help in the maintenance of the body balance while the *cochlea* consists of the o*rgan of corti* which enables the human being to hear all the sound impulses that are generated within its hearing-reach.

The outer ear consists of the *pinna*; a flap made of gristle cartilage that keeps it stiff to enable it catch sound waves and directs them into the hairy auditory canal, made of special cells that secrete waxy material which traps germs, dust particles and prevents them from getting into the ear. Stretched across the inner end of the ear channel, is a tough membrane known as *tympanum* or *eardrum*. Immediately behind the tympanum is an air-filled chamber, called the *middle ear*. This contains the three tiny bones, called *ear ossicles,* namely: *malleus* (hammer), *incus* (anvil), and *stapes* (stirrup). The *Eustachian tube* connects the air-filled chamber of the middle ear to the pharynx or the mouth cavity. Its major work is to balance the air pressure between the middle ear and the outside environment. The *oval window* is the boundary that separates the middle ear and the fluid-filled inner ear of the cochlea and the semi-circular canals. The ossicles make a lever system of three bones that oscillates and makes relative area contact on the tympanic membrane and later on the oval window. This amplifies the pressure so many times on the tympanic membrane, hence causing huge amplitudes of sound to move to the cochlea (Taylor et.al., 1998).

The chamber of the inner ear responsible for hearing is shaped like a snail shell and is known as *cochlea.* The *cochlea* is about 35 mm long, and is subdivided

longitudinally by a membranous triangle into three regions namely: *vestibular canal* (which is surrounded by Reissner's membrane and filled with perilymph)*; median canal*, (filled with the endolymph, bathing the tectorial membrane from which sensory hair cells are attached), and finally *the tympanic canal,* filled with the perilymph. The *organ of corti* consists of the tectorial membrane, the basilar membrane, the sensory hair cells and the auditory neurones. The organ of corti is the region where transduction of sound waves into electrical impulses occurs. The sound receptors within the *cochlea* are hair cells that rest on the basilar membrane that runs up and down the middle of the spiralling chamber, separating it into two halves.



The ear structure

Several neurons run from these hair cells to the brain, which together form the *auditory nerve* that transmits the electrical impulses to the auditory centres of the brain. Investigators have identified these sensory cells as *stereocilia* and the rootlets, which anchor them, as the auditory system's most vulnerable components with respect to noise response (Taylor et al., 1997; Johnson, 2006; Hughes and Ferrett, 2005; Suter, 1991).

Function of the hearing apparatus and sensing mechanism

Raven and Johnson (2002) and Johnson (2006) reveal the four category stages of how perceived sensory information, is conveyed to the Central Nervous System, and they list them as follows: *Stimulation, Transduction, Transmission* and *Interpretation.* ***Stimulation*** is a physical impingement of the stimulus on a sensory receptor or neurone or an accessory structure while ***Transduction*** is the sensory receptor process that initiates the opening and closing of the ion channels in the sensory neuron to allow transformation of sound energy impulses into electrical

impulses. ***Transmission*** is the process of the sensory neuron to conduct a nerve electrical impulse along an afferent pathway to the Central Nervous System while ***Interpretation***, according to Raven and Johnson, is a brain process that creates a sensory perception from the electro-chemical events produced by afferent stimulation. They clearly point out that, what is actually heard is done with the brain and "not with our sense organs" (Raven and Johnson, 1996, 1104).

Therefore, the process of hearing starts with the human ear receiving the sound waves that enter the outer ear, set oscillations in the eardrum and cause sympathetic movements of the *ossicles* that act as a lever system in the middle ear, behind the eardrum. The ossicles transfer the amplified vibrations of sound across the second membrane of the oval window. The oscillation of the oval window sets up pressure changes in the perilymph of the vestibular canal. These oscillations are then, transmitted to the endolymph in the median canal via Reissner's membrane. The vibrations are further transmitted to the basilar membrane where they cause ripples. These ripples are due to the relative movements of the basilar membrane, induced by pressure waves, pushing the sensory hair cells against the tectorial membrane and forcing the two membranes to slide past each other (Taylor et al., 1997).

The distortion produced in the sensory hairs due to shearing forces causes a depolarisation of the sensory cells and the production of generator potentials as well as the initiation of so-called action potentials in the axons of the auditory nerve. The generated electrical impulses at this point are then transmitted to the auditory nerve that relays them in an electrical and chemical fashion to the brain, where sounds are identified and interpreted accordingly. To reduce the pressure of sound waves and also to prepare for the next incoming sound waves in the inner ear after each transduction, these vibrations are dissipated into the air of the middle ear through the *round window* (Panneerselvam and Ramakrishnan, 2005; Taylor et al., 2001).

Hearing loss and permanent damage of the ear

It is proved that humans are not able to hear low-pitched sounds below 20 cycles per second, while children are capable of hearing high-pitched sounds up to 20, 000 cycles per second. However, this ability decreases with age (Miller and Harley, 1998). From this information, we can deduce that young people are more vulnerable to high intensity sounds than elderly people.

Exposure to continuous sound of certain intensity levels, particularly over a lifetime, can lead to a progressive loss of hearing, with a decrease in the threshold of hearing sensitivity. Hearing impairment due to noise pollution is a direct consequence of the effect of sound energy on the inner ear. In other words, hearing loss can be referred to as an auditory health effect. If sufficiently loud, and probably continuous, noise pollution dispersed in the environment can cause hearing impairment that includes temporary or permanent hearing loss. The permanent hearing loss is what is simply referred to as deafness. Any hearing loss can arise either from the damaged tympanic membrane (ear drum) due to high frequency sound pressure changes on it that may overcome the pressure balance of the

Eustachian tube, or may arise due to the extreme over sheared membranes in the organ of corti that may cause the hair cells to snap.

If the tympanic membrane is damaged, the lever-system of the ossicles may fail to coordinate the oscillations of sound waves through the oval window to the inner ear of the cochlea. On the other hand, if some hair cells get snapped or damaged due to over sheared membranes in the organ of corti, it would result into failure of transforming of sound impulses into electrical impulses. Lack of equilibrium in the sound wave distribution may cause uneven or uncoordinated transduction of sound waves that could result into unreadable electric sound impulses by the brain. These may cause some temporary or acute hearing loss.

According Hughes and Ferrett (2005), there are three principle acute effects that lead to this ill-health effect of noise. These three principle effects of temporary hearing loss are: ***temporary threshold shift***, ***tinnitus*** and ***cute acoustic trauma***.

Temporary threshold shift is caused by short excessive noise exposure that affects the cochlea by reducing the flow of nerve impulses to the brain. The result is a slight deafness, which is reversible when noise ceases or is removed.

Tinnitus is a physical condition caused by an intense and sustained high noise levels. This condition is experienced as a noise or ringing tone, buzzing in the ears or head when no such external physical noise is present. It is caused by the over-stimulation of the hair cells in the *organ of corti*, within the cochlea. However, the ringing sensation may continue for at least up to 24 hours or even more after the noise has ceased. Hughes and Ferrett confirm that a tinnitus is usually caused by a fault in the hearing system and is a symptom, not a disease in itself. They say that tinnitus can be made worse by loud noise especially exposure to sudden or long-term noise. Noise induced hearing impairment may be accompanied by abnormal loudness perception, distortion of frequency localization in the cochlea, and later tinnitus. Tinnitus may be temporal or may become permanent after prolonged exposure to noisy environments. Hughes and Ferrett (2006) give us a list of some eventual results of hearing losses, which include: loneliness, depression, impaired speech, impaired school and job performance, limited spectrum of opportunities, and a sense of isolation.

Acute acoustic trauma is caused by a very loud noise such as an explosion. It affects either the eardrum or the ossicles in the middle ear and Hughes and Ferrett say that this type is usually reversible. Permanent or chronic hearing loss may be due to the damage of the organ of corti in the inner ear of the cochlea. The damage results in the failure to perform transduction process effectively; a second step process in sensory information conveyance, according to Raven and Johnson (2002), so that sound waves are effectively changed into electrical impulses. Hughes and Ferrett conclude that severe explosive sounds can permanently damage the *tympanic membrane*. They conclude by saying that usually industrial workers or other people who are constantly subjected to high noise levels have a progressive and irreversible deterioration of hearing problems. Schwela et al., (2005) add that apart from the progressive hearing loss, there is also a danger of instant ear damage that is caused by very high intensity impulse sound like explosions.

Many researchers that have worked on the effects of noise pollution have expressed their view that the response to noise may depend on the characteristics of the sound including its intensity, frequency, complexity and duration and the meaning of the noise. Hearing is essential for well-being and safety. Hearing impairment is typically defined as an increase in the threshold of hearing as clinically assessed by audiometry (Schwela et al., 2005).

Schwela et al. acknowledge that apart from noise-induced hearing impairment, impaired hearing may also come from other causes such as ototoxic drugs and trauma. However, there is a general agreement among researchers that exposure to sound levels less than 70 dB does not produce hearing damage, regardless of the duration of exposure (Goines and Hagler, 2007). There is also another general agreement among researchers that exposure for more than eight hours to sound levels in excess of 85 dB (A) is potentially hazardous. In other words, 85 dB (A) is roughly equivalent to the noise of heavy truck traffic on a busy road (Hughes and Ferrett, 2005). Schwela et al. are supported by Bueche who expresses his arguments on this issue in the form of a table of *approximate sound intensity levels* as shown below (Bueche, 1988; 306).

Table of approximate sound intensities and intensity levels (Bueche, 1988; 306).

Type of Sound	**Intensity (W/M^2)**	**Intensity Level (dB)**
Pain producing	1	120
Jackhammer or riveter	10^{-2}	100
Busy street traffic	10^{-5}	70
Ordinary conversation	10^{-6}	60
Average whisper	10^{-10}	20
Rustle of leaves	10^{-11}	10
Barely audible sound	10^{-12}	0

The major cause of hearing loss is occupational noise exposure, although other sources of noise, particularly recreational noise, may produce significant deficits concerning noise-induced hearing loss. Studies suggest that children seem to be more vulnerable to noise induced hearing impairment than adults (Edworthy, 1997).

In support of the above argument, Edworthy reports that, in 2001, research estimated that 12.5% of American children between the ages of 6 to 19 years had impaired hearing in one or both ears. The research established that this was so because as many as 80% of elementary school children used personal music players for extended periods of time and played at potentially dangerous volume settings. The research established that there was little doubt that the uses of those consumer products which produce high levels of noise and were used with headsets or earphones were responsible for the hearing impairment that was seen with growing frequency in younger people. The researchers also showed a paternal concern in reference to regulatory authorities that left this form of noise pollution, largely

unregulated, despite the elaborate warnings placed on labels of these instruments by the manufacturers. Unfortunately, such concerns are worse-off in Africa and in Zambia in particular as individuals generally do not take time to read and understand label instructions.

Leisure-time noise exposure, was also generally unregulated, and was reported to be increasing as well, with resultant adverse effects. The report generally included people working in clubs, bars and other places of entertainment nature to be also at risk of hearing impairment. For this reason, the report says that rock musicians frequently have a problem of noise-induced hearing loss and usually experience tinnitus most of the times. Apart from the musicians themselves, employees of music clubs, where noise frequently exceeds safe levels, as recommended by World Health Organization (WHO), were also at risk of this effect. Schwela et al. (2005) continue to stress the significance of noise dose exposure and the risk of hearing impairment. They say that due to unwilling exposure to such noise levels, nearly a third of students who worked part time as bar staff or security staff in a university entertainment venue where research was done were found to have permanent hearing loss.