

AWARENESS OF EFFECTS OF LEAD CONTAMINATION IN ZAMBIA'S  
MAKULULU AND KASANDA MINE COMPOUNDS OF KABWE DISTRICT

by

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Dissertation submitted to the University of Zambia in partial fulfilment of the  
Requirement for the Award of Master of Education degree in Environmental  
Education.

The University of Zambia

Lusaka

2014

## **AUTHOR'S DECLARATION**

I, **Shankaya Christopher**, do hereby declare that this dissertation represents my own work and that it has not previously been submitted for a certificate, diploma, or degree at the University of Zambia or any other University.

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## CERTIFICATE OF APPROVAL

This dissertation of **Shankaya Christopher** is approved as partial fulfilment of the requirements for the award of Master of Education degree in Environmental Education by the University of Zambia.

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## ABSTRACT

The principal areas and causes of environmental degradation include land degradation through erosion, land, air and water pollution to mention only but a few. Many of these environmental issues emanate from mining activities in one way or the other. Although these environmental concerns are increasingly reflected in sectoral policies such as those of mining, tourism, agriculture, among others, the public awareness of environmental issues and individual responsibilities are poor in urban and rural communities. This, with other factors made the study sought to establish residents' awareness of the effects of environmental hazards in form of lead contamination in Makululu and Kasanda Mine Compounds of Kabwe district. To achieve the aim above, the objectives of the study were to establish the state of awareness by residents of Makululu and Kasanda Mine Compounds of Kabwe on the effects of lead contamination on their environment; to determine the nature of sensitisation that has been done concerning effects of lead contamination in their lives; to investigate residents' participation in different activities aimed at reducing the effects of lead contamination in the affected areas and to establish the contributions made by Environmental Education (EE) to address effects of lead contamination in the lives of Makululu and Kasanda Mine Compounds residents.

The study used the general research question to establish the state of awareness by residents of the study areas about effects of lead contamination on their environment. The general question was addressed through the following specific research questions: how aware are the residents of the study areas about the effects of lead contamination on their environment? What sensitisation programmes on effects of lead contamination have been conducted in the study areas? How involved were residents of Makululu and Kasanda Mine Compounds in activities aimed at reducing levels of lead contamination in the study areas? What contributions have been made by EE to address effects of lead contamination in the study areas?

The study used a survey design which was mainly qualitative though complemented by quantitative approaches to collect data using semi-structured questionnaires and interview guides. The sample size was 125 respondents and comprised 105 residents in Makululu and Kasanda Mine Compounds, 20 facilitators from NGOs and other government ministries.

The study established that most of the respondents from the category of residents were aware of effects of lead contamination. However, the knowledge has not been translated into behavioural and social change to influence residents' life style in regard to effects of lead contamination as attitude of residents towards the environment continue to be bad. This was due to lack of organised way of accessing information about effects of lead contamination in the study areas. Further revelations from the study were that the main ways in which residents were accessing information were through the clinic and neighbours. Among the major challenges faced in the awareness programme included lack of funds and few trained facilitators. Resulting from these challenges the study recommended that the Kabwe municipal council should fund awareness programmes and

train more environmental facilitators. The study also suggests that other possible ways EE could address environmental hazards included raising awareness programmes through localised curriculum, use of drama, theatre and television among others.

## **ACKNOWLEDGEMENTS**

First and foremost I would like to thank the Almighty God for His unfailing love to me; otherwise I am but a pencil in His hands.

My ever heartfelt thanks go to my supervisor Professor Charles Mwendabai Namafe, for his invaluable support, patience, generous assistance, inspiration and all constructive guidance that made it possible for me to come up with a sensible dissertation in the end.

Thanks to Kabwe Kasanda Mine and Makululu compound residents, Environmental Health Technologists in the areas of study, the two Members of Parliament for these areas, three area councillors for the same areas, Non Governmental Organisations, Kabwe Mine, and other stakeholders for assistance and cooperation during this study.

I also acknowledge the assistance and encouragement I received from my fellow Environmental Education students especially Hambulo Caesar, Yamba Maybin and Sitali Namakando Grace. My gratitude also goes to my friends Chilekwa Epilius, Katusi Joseph, Mwanabaleya Felix and Kaoma Chrispine for their unwavering support.

Finally I would like to thank my brother Dr. Shankaya M, wife Twaambo, children Luyando, Lushomo and Lumba, who desperately needed material and spiritual support, physical presence and persevered through hardships to enable me complete my study.

## **DEDICATION**

To my late mum and dad Sarah Chinyama Mbiiza and John Pombe Zimba Shankaya who have been a driving force in my life. M.T.S.R.I.P. Their support was unwavering.



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### **List of acronyms**

BC	Before Christ
B-Pb	Blood lead
CDC	Curriculum Development Centre
CEP	Copperbelt Environment Project
CSO	Central Statistics Office
DEBS	District Education Board Secretary
EA	Environmental Awareness
ECZ	Environmental Council of Zambia
EE	Environmental Education
EHTs	Environmental Health Technologists
EPICs	Environmental Public Information Centres
GRZ	Government of the Republic of Zambia
HIV/AIDS	Human Immune Virus/Acquired Immune Deficiency Syndrome
ILO	International Labour Organisation
KMC	Kabwe Municipal Council
MMSD	Mining, Minerals, and Sustainable Development
MoE	Ministry of Education
MoFNP	Ministry of Finance and National Planning
MoH	Ministry of Health
MPs	Members of Parliament
MTENR	Ministry of Tourism, Environment and Natural Resources
NGOs	Non-Governmental Organisations
PTA	Parent and Teachers Association
STIs	Sexually Transmitted Infections
TB	Tuberculosis
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
USA	United States of America
WHO	World Health Organisation
YMCA	Young Men Christian Association
ZCCM-IH	Zambia Consolidated Copper Mines-Investment Holdings
ZEMA	Zambia Environment Management Agency

## **CHAPTER ONE: BACKGROUND TO THE STUDY**

### **Overview**

This section presents the background that generated the need to conduct this study. The brief history of Kabwe: lead and zinc mine from inception to post closure. The statement of the problem, purpose, objectives, research questions and significance of the study were also brought out. Operational definition of terms used in the study and delimitation of the study were also presented.

### **1.1 Introduction**

The deterioration in the overall conditions of the environment has become a major concern in Zambia and the world over. The principal areas and causes of environmental degradation include land degradation through erosion, land, air and water pollution to mention only a few, (Kabwe Municipal Council (KMC), 2010). Many of these environmental issues emanate from mining activities in one way or the other. Although these environmental concerns are increasingly reflected in sectoral policies such as those of mining, tourism, agriculture, among others, public awareness of environmental issues and individual responsibilities are poor in urban and rural communities, (ECZ, 2000). This, together with other factors, necessitated the need to find out residents' awareness on effects of environmental hazards in form of lead contamination in Makululu and Kasanda Mine Compounds, following the long existence of Kabwe lead and zinc mine which has caused a lot of contamination in the town. However, perceptions of environmental impact vary significantly among different segments of Zambia, like elsewhere.

Kabwe town, is 130 km from Lusaka, and is one of the oldest mining towns of Zambia. It is located in Central Province where it shares boundaries with seven other provinces: Lusaka, Southern, Copperbelt, Western, North-Western, Northern and Eastern (GRZ, 1983). The town was the country's major producer of lead and zinc minerals. The major mineral discoveries were made in 1902 which led to the formation of Broken Hill Development Company in 1904 to exploit the resources (KMC, 2010). In the same year, 1904 the mine became fully operational in the production of lead and zinc in Kabwe. Soon after 1902 and until 1994, mining and smelting facilities ran almost continuously without addressing the potential dangers of lead contamination (<http://www.worstpolluted.org>). Within a minimal period of time, the town became the home to the largest and most prosperous lead mine and smelter on the continent. However, the government owned corporation, Zambia Consolidated Copper Mines (ZCCM), operated this mine without proper environmental pollution controls for most of its life (ECZ, 2004). This was because Kabwe's mining and mineral processing operations were undertaken during a period when statutory

environmental controls within the mining sector were non-existent (MTENR, 1994). Because of the mining sector's poor economic performance throughout the 1980s and 1990s and failure to adequately address the environmental issues, Kabwe mine was eventually closed in 1994 (CSO Report, 2011).

Until the closure of the mines in 1994, mining had been the major economic engagement for the population of Kabwe (ZCCM-IH PLC, 1995). As a direct consequence of the closure, many mine workers became unemployed and social support previously provided by ZCCM virtually ceased. This has resulted in increased poverty, poor sanitation, poor quality drinking water, malnutrition, dysentery, cholera, malaria, HIV/AIDs, tuberculosis, air pollution and other social problems related to mining activities (ZCCM-IH PLC, 2005).

The closure of Kabwe mine also raised social issues. Some of these include scavenging of metals on old dumpsites, trespassing within the caving areas; children bathing in the water ways, vandalism of the remaining structures of historical significance and illegal allocation of contaminated land near the mine area and along the Kabwe canal water way (ECZ, 2004).

There are several environmental problems arising from mining activities that Zambia faces. Notable ones of these are; dereliction of land through erosion, toxic dumps and redundant facilities; water pollution due to unmanaged waste water and sediment discharge; air pollution by blowing dust and refining processes, and failure to restore mined and quarried land (ECZ, 2008). Kabwe is not exempted from these issues being the oldest mining town in the country. Therefore, lead in Kabwe has always been recognised as an environmental toxin zone locally and internationally. WHO (2002), notes that the effects of lead toxins is thought to be everywhere around the mine area and the nearby compounds, including those along the water way.

The closure of the mine in 1994 consequently left substantial legacy of environmental hazards, some of which persist today (KMC, 2010). It was because of these activities in lead contaminated areas that the study aimed at finding out the state of awareness by residents of Makululu and Kasanda Mine Compounds of the effects of lead contamination on their lives and environment.

The effects of lead contamination could be aggravated by lack of environmental awareness among local residents, especially among adults and children with low literacy levels (ECZ, 2007). Most people with poor education standards, poor family income and large families focus their efforts on fulfilling the basic needs like food, shelter and decent income regardless of the danger they are exposed to (World Bank, 2002). In struggling to earn decent living, poverty stricken residents look for scrap metal in the highly lead polluted dumpsites which is a health hazard. Health in such cases



was not given a priority as they put emphasis on improving their livelihood (ECZ, 2004). Further, ECZ (2006) refers to inadequate human and financial resources, disposal facilities, and poor attitude of the general public and low state of awareness as standing barriers to sound health. This has resulted into lack of behavioural and social change as attitude of people towards the environment continue to be bad. Therefore, in order to tackle the environmental challenges of the 21<sup>st</sup> Century, people need to be aware of the adverse effects of environmental contamination in their residential areas. Well informed people would avoid activities that expose them to be vulnerable to lead contamination (ECZ, 2007). In view of that, EE plays a strategic role in raising people's awareness, disseminating environmental information and inspiring environmental action among residents. Engaging EE could foster awareness on the effects of lead contamination, if the residents were aware of such effects would desist from mining activities that expose them to the existing environmental hazards (ECZ, 2007). Furthermore, the residents could be encouraged to take care of their environment. The embracing of EE on the mining companies, policy makers and the local residents is important in raising good environmental management and sound health of the people. Therefore, this study sought to establish residents' awareness on the effects of lead contamination in Makululu and Kasanda Mine Compounds on themselves and their environment.

## **1.2 Statement of the Problem**

It is scientifically established that lead contamination has negative effects on human beings and environment (World Bank, 2002; National Academic of Sciences, 1993). The Zambian Copperbelt Environment Project (CEP) has been conducting various programmes intended to alert the residents of Kabwe, which was a lead and zinc mining town in Zambia, on effects of lead contamination (KMC, 2010; Water Management Consultants (WMC) Ltd UK, 2005). Despite all these sensitisation measures, there were a lot of activities happening at the time of conducting this study in the year 2014 in the highly lead polluted areas of Makululu and Kasanda Mine Compounds that made residents highly susceptible to the adverse effects of lead contamination. It was not known whether or not the people of these areas were aware of environmental effects of lead contamination in their residential areas. This was because, for individuals to express concern regarding environmental issues, they must first be aware that environmental problems existed. Without this awareness in place, society would not understand the need for change (Mweemba, 2013). In other words, lack of certainty on people's awareness of environmental hazards, and particularly lead contamination, has led to residents engaging in activities that exposed them to lead contamination. Such a situation constituted a problem for various reasons. Firstly, residents have built permanent structures for human habitation very close to the waterway and close to dumpsites within lead contaminated areas. They also use contaminated water for gardening, swimming and bathing from

the water canals. Even during the rainy season, most of the gardens are watered using water from the waterway. Taking into account that whatever came from these gardens was consumed daily by people near and far, and that the consumed vegetables could pose serious health problems, there was need to urgently address such a problem to stop rapid lead contamination spreading through ingestion. Secondly, residents also carried out economic activities such as stone crushing and scrap metal scavenging. In the process of conducting such activities, they exposed themselves to lead contaminated air dust. Thirdly, other residents used contaminated groundwater for domestic purposes. In view of such problems, and the vital role of awareness to address environmental issues, the researcher felt it necessary to investigate residents' awareness of the effects of lead contamination on themselves and their environment.

### **1.3 Purpose of the study**

The purpose of the study was to establish the awareness by residents of Makululu and Kasanda Mine Compounds of effects of lead contamination on their lives and environment.

### **1.4 Research Objectives**

The above aim was realised through the following research objectives:

- i. to establish the state of awareness by residents of Makululu and Kasanda Mine Compounds of Kabwe about the effects of lead contamination in their environment.
- ii. to determine the nature of sensitisation that has been done concerning effects of lead contamination in their lives.
- iii. to investigate residents' participation in different activities aimed at reducing the effects of lead contamination in the affected areas.
- iv. to establish the contributions made by environmental education to address effects of lead contamination in the lives of Makululu and Kasanda Mine Compounds residents.

### **1.5 General Research Question**

The study used the following general research question:

How aware are residents of Makululu and Kasanda Mine Compounds about effects of lead contamination in their environment?

#### **1.5.1 Specific Research Questions**

The general research question was addressed through the following specific research questions:

- i. how aware are the residents of Makululu and Kasanda Mine Compounds about the effects of lead contamination in their environment?
- ii. what sensitisation programmes on effects of lead contamination have been conducted in the study areas?
- iii. how involved were residents of Makululu and Kasanda Mine Compounds in activities aimed at reducing levels of lead contamination?
- iv. what contributions have been made by environmental education to address effects of lead contamination in Makululu and Kasanda Mine Compounds?

## **1.6 Significance of the Study**

Through this study, all stakeholders, such as the residents, government, donors, environmental NGOs and other cooperating partners involved in this programme may be made aware of the performance of environmental awareness programmes in Makululu and Kasanda Mine Compounds of Kabwe District.

The study could also reveal how environmental awareness programmes were administered and what challenges were faced in implementing the programmes to residents in these compounds. Further, the findings of this study may bring to light relevant information regarding strengths and shortcomings of implementing environmental awareness programmes in Makululu and Kasanda Mine Compounds. In this way, it might be possible to make necessary adjustments to the programme. Moreover, the study could help to integrate the participants' knowledge and the current knowledge of administering awareness programmes; and contribute in a Zambian perspective to the literature on the type of environmental awareness necessary for residents accessing this education. Besides, it was hoped that the study could also help stimulate further research on this subject.

These suggested EE activities could be important to residents of the study areas as they would help residents to manage their polluted land, air and water in order to reduce their suffering due to effects of lead contamination. Furthermore, the results of the study could be important to Government and environmental NGOs because EE activities suggested, would help in eradicating a number of bad vices such as: illegal settlements near the mine dumpsites and along the waterway, scavenging of metals and lead from the mine dumpsites and facilities of defunct mine. These vices could reduce because the Government and other stakeholders might use the results to increase awareness programmes through promotion of localised curriculum, improved water supply and sanitation. This would help to address effects of lead contamination in their lives in the study areas as well as other urban areas in the country such as Mufulira by relocating affected residents.

## **1.7 Delimitation**

The study was conducted in Kabwe District of Central Province. The location was chosen because it was easily accessible to the researcher. The sample comprised Mine Personnel Officer, head of Kabwe Municipal Council Health Department, Provincial Lands Officer, Members of Parliament, Ward Councillors, Principle Information and Communications Officer at ZEMA, Residents, Teachers and Pupils, Non-governmental Organisations (NGOs); such as Radio Reporters, CEP, Health Educators and Promoters were the main respondents. This research was confined to residents within the boundaries of Makululu and Kasanda Mine Compounds of Kabwe District except for some government and other stakeholder officials. These compounds are found on the south west of the town.

## **1.8 Limitations**

For a research of this magnitude, the researcher would have liked to interview as many residents of different compounds in the country as possible. This would have provided information on which to assess the performance of the programmes in various districts of Zambia and also for better generalisation of the findings. Mention must however be made of the fact, that although effects of mining are found in most parts of the country, constraints of financial and time resources confined the research to selected compounds of Kabwe District. Moreover, out of the 105 questionnaires produced for respondents, only 69 were utilised as 36 were returned unanswered. The other limitation was that a good number of residents were unable to read, write or understand English language, which was used in the questionnaires, two research assistants were engaged to help the researcher in interviewing the respondents. These asked respondents questions which were in the questionnaires, which they translated in vernacular and filled in the questionnaires on behalf of the respondents. The aspect of translating from one language to the other does not go without shortcomings as it is susceptible to errors. In addition, some participants were uncooperative, fearing that the researcher was not a student but one sent by government to spy on them.

There were 49,924 people in Makululu and Kasanda Mine Compounds in areas affected by lead poison and yet only 125 residents participated in this study. However, the results are generalisable to the residents and stakeholders sampled and give an insight of what the picture would be like if more participants and other sampling methods were used.

It was not easy to collect information of this nature of study from facilitators who belonged to government as they were not willing to give information especially on government's failure due to red tape. The other NGOs providing social services did not accept to give information of the study

topic citing previous researchers who tarnished the organisation's reputation. Besides, some respondents demanded to be paid in exchange with information. Patience was the only answer to this limitation.

### **1.9 Theoretical framework**

Theories help in guiding the process of delivering and bringing to fruition education programmes designed for any given group of learners. Therefore, this study was guided by theoretical frameworks based on Paulo Freire's theory of conscientisation and John Watson's theory of behaviourism. According to Mwamwenda (1995), if the consequences of action were unpleasant, the action would not be repeated. If, however, the consequences were pleasant, the behaviour would recur. In that regard, when teaching people to change behaviour, the behaviourists involved two important principles of reinforcement and conditioning which were important characteristics in behavioural change. This theory of behaviourists emphasised the inculcation of an awareness of the total environment and its problems, gaining of sound knowledge and understanding of how the environment function. Engleson (1991) stated that the aim of behaviourists was to help citizens become environmentally knowledgeable, skilled, willing to work individually and collectively toward achieving and maintaining a dynamic equilibrium between the quality of life and the environment. It further stressed the complexity of environmental problems and thus the need for critical thinking skills. It also utilised a broad array of educational approaches to teaching and learning and stressed each individual's responsibility towards the environment. The theory of Watson and others was found suitable for this study as a framework because the principles it applied to teach society could easily be evaluated and that might simply help the researcher establish the state of awareness of people on the effects of lead contamination in Makululu and Kasanda Mine Compounds. This theory was picked because it lays much emphasis on behavioural change of learners towards environmental issues.

Further, the theory enabled citizens to play a role in planning their environmental activities. In any case, if citizens were involved at some point in planning environmental activities, they would reveal that through behavioural change in the way residents interacted with their environment. The citizens would have also made decisions related to environmental sensitivity, knowledge, skills and value clarification to every stage when considering environmental issues in plans for development. It also considered the environment in totality; natural, social, economic and political, and that education should be a continuous lifelong process not to end after the facilitator had gone. In view of this, the theory was seen to be useful in order to find the state of awareness among residents of the aforesaid compounds.

The other theory which guided this study was that of Paulo Freire's conscientisation also called transformation learning. According to Paulo (1989), critical thinking, conscientisation and dialogue helped society to be transformed. At the time society had embraced the type of education which encouraged memorisation and remembering (Banking education), where the learner was viewed as a mere recipient of knowledge (container or a vessel) only, Paulo stood up to reject such type of education as it did not encourage learners to change behaviour. Paulo implemented his pedagogy of the oppressed, which was meant to conscientise the oppressed people to be changed completely, as critical thinkers.

In the Paulo type of education, the core aim was critical consciousness which included features such as power awareness, critical literacy, desocialisation and self education. Since this theory emphasised the importance of conscientisation in any society, the researcher used this concept of conscientisation to find out how much residents of Makululu and Kasanda Mine Compounds had been conscientised on the effects of lead contamination to their lives and environment and as a tool to interpret subsequent findings. The two theories were intended to find out how much people knew how to interact with their fellow humans and their environment. This was known through the interviews that were conducted to different stakeholders in the area. The study sought to establish if residents of Makululu and Kasanda Mine had been conscientised. Conscientisation is the type of education which made society become critical in whatever they did, not obtaining knowledge which was almost useless and end after passing the examination or upon the facilitator leaving. But we looked at the problem of lead contamination which was there to stay long with the residents of Makululu and Kasanda Mine Compounds. It was also argued that the environmental issues faced by Zambians today were as a result of mindset, values and practices in the social, economic as well as political and natural affairs of the environment (Nmafe, 2006). Therefore, the education people receive should be reflected in their lives even after many years of learning had passed.

What is critical in Paulo's theory to environmental education is the process of critical thinking and conscientisation reflecting back on previous experiences to determine whether or not what was learnt could still be justified under the prevailing circumstances. He strongly felt that such type of learning is very important as it leads into what he termed as conscientisation (transformation learning) as long as one engages oneself into critical reflection on his or her assumptions and presumptions. He further suggests that it is from reflective assessment that conscientisation starts and it is premised on validating the communicated ideas. In essence, when one is reflecting on the premises of interpretation, then such a person is engaged in content reflection, which is good. The most important learning point to environmental education of Paulo's theory is when learners begin

to re-evaluate their lives and transform their behaviours, which in fact represents reflecting on experience (Freire, 1989).

### **1.10 Operational Definition of Terms**

This section presents a brief description of the main concepts used in this study. The concepts had been defined differently by various scholars. However, in this study they mean as defined below:

**Environmental Education-** Permanent process in which individuals gain awareness of their environment and acquire the knowledge, values, skills, experiences and also the determination which enabled them to act individually and collectively to solve present and future problems.

**Environmental providers-** Institutions or individuals that were involved in providing EE activities.

**Environmental awareness-** means environmental knowledge for civil society, children, parents, village leaders, and government officials.

**Participation-** means a process that enabled the environmental provider of EE activities and the recipient to take more part in planning, implementation and evaluation of an education activity aimed at solving an environmental problem.

**Environmental Education activities-** lessons learnt on how to deal with impacts of mining and also how to care for the environment.

**Compound Square-** refers to the section of the compound where most public meetings are held from.

**Door to door campaign-** refers to community facilitators or any environmental educator who sensitise residents on effects of lead contamination moving from one household to another.

**Stakeholders-** refer to a person, group or institutions with a direct interest, involvement, or investment in helping to educate the residents of an area about environmental issues.

**Residents-** people living in the same compound or neighbourhood that are affected with common environmental problems such as vandalism, air pollution among others.

**Awareness lessons-** lessons or programmes creating environmental knowledge to residents about their environmental problems and solutions.

**Sensitisation-** this is awareness of environmental problems in a locality and solutions to a recipient of environmental education.

### **1.11 Structure of the Dissertation**

The study is divided into six chapters. Chapter one has introduction, statement of the problem, purpose of the study, objectives, research questions, significance of the study, delimitation, limitations, theoretical framework and structure of the study. Operational definitions of terms are also explained.

Chapter two addresses literature review related to the study topic. The third chapter describes the methodology used. It outlines how the research was conducted in terms of its design, target population, research sample, sampling procedure, research instruments, data collection and analysis procedures as well as ethical considerations. Chapter four embarks on the research findings using qualitative approach complemented by quantitative approach. Tables were used in quantitative presentation of data. The fifth chapter is discussion of the research findings presented in chapter four. The discussion is based on the themes upon which data gathering was collected. Finally, chapter six is conclusion and recommendations. The conclusion and recommendations are based on the findings of the study. The pages that follow are references and appendices.

### **1.12 Summary of the chapter**

This section focused on the background, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, delimitations of the study, limitations of the study, explanation of operational definition of terms and theoretical framework.

The next section shows the significance of the study in relation to literature from previous studies that were done responding to similar challenges arising from the need to establish residents' awareness of effects of lead contamination on the local communities and their environment.



## **CHAPTER TWO: LITERATURE REVIEW**

### **Overview**

This chapter reviewed literature using the thematic approach. The themes were derived from the literature read and also generated from the objectives of the study. The chapter also looks at the literature reviewed about the activities of EE globally and locally, and the negative effect of mining on people and environment. Finally, it looks at the use of EE globally and locally to address effects of mining in mining communities.

### **2.1 Introduction**

The usage of education by different organisations or institutions to end different environmental issues could be traced to ancient Egypt, Greece, India and China. A study by Loubser (2011) shows that, in Egypt, the Pharaoh Ikhnaton was reputed to have sent scribes to teach farmers not to plant their crops too close to the banks of the River Nile, as the natural vegetation was more likely to prevent erosion of the banks and the consequent loss of productive farmland. This was also a good way of preventing water from being contaminated from agro-chemicals. The weakness of Loubser's contribution was that it did not specify the role of farmers in the awareness programmes. Hence, education should help people to live in peace with their environment. Since the 1960s and 1970s EE was accepted by many countries globally that it could solve environmental problems. In this regard, a study by ECZ (2000) noted that the level of environmental awareness has improved although it is still low in certain specific areas. However, these have not been translated into behavioural and social change as attitude of residents towards the environment continue to be bad. Therefore, ZEMA should begin to prioritise the need to collaborate with other partners and stakeholders in order to contribute towards improving processes of EE in Zambia. EE should therefore constitute lifelong education which is responsive to changes in a rapidly changing world and equip society to play a productive role towards improving life and protecting the environment with regard to ethical values. In addition, a study by Namafe (2006) has shown that environmental issues faced by Zambia today are as a result of mindset, values and practices in the social, economic as well as political and natural affairs of the environment. Thus EE and public awareness activities are needed for change of mindset, values and practice.

### **2.2 Environmental Awareness and sensitisation**

It is documented by Mdluli (1977) that in the 4<sup>th</sup> century BC in Greece, Theophrastus, a student of Aristotle, regarded by many environmentalists as the first person to recognise basic principles of ecology, undertook a study which argued for a form of integrated environmental management,

included public education. This education for many years now has been playing an important role in trying to make people aware of certain environmental problems being faced at hand. Further, Lupele (2002) study contends that the communities needed to be empowered with relevant knowledge to help them preserve their natural resources and how to live in less conflict between human beings and nature. This kind of education is vital for residence of the study areas.

Awareness is to make people know what they did not know or what they had forgotten. It is also the state or ability to perceive, to feel, or to be conscious of events, objects or sensory patterns. In this level of consciousness, sense data could be confirmed by an observer without necessarily implying understanding. Ariasingam et al (1999) study reveals that environmental awareness is environmental knowledge for civil society, children, parents, village leaders and government officials. It is further shown as the state of being fully conscious of pertinent stimuli and real experience of a task or situation (LaBark and Distrehoft, 1998). In other words, awareness refers to having knowledge or cognizance of environmental issues and challenges surrounding the communities. Environmental awareness simply means having knowledge about the environment. The problem to LaBark and Distrehoft (1998) definition in this document was the absence of clarity on what people became conscious of and what kind of situation they experienced. This makes it difficult to apply this definition to a situation such as the case of Makululu and Kasanda Mine.

The awareness about the environment is a key aspect of society as it targets all individuals irrespective of different age groups. In a study by ILO (2011) argues that the goal of awareness is to change the norms of practice to prevent environmental contamination before medical treatment and costly cleanup operations are needed. This means that environmental awareness is to have knowledge about the environment which could help us to live in harmony in the environment and find solutions to existing environmental problems.

Public awareness programmes should enlighten public opinion on environment and promote community action in environmental management (ECZ, 2007). The document further revealed that human actions that lead to environmental degradation result from lack of knowledge. For example the absence of information about the nature and extent of pollution which was caused by emissions from industrial activities. These may result in communities being unaware of potential hazards and what could be done to reduce the risks. It is made clear that information and education could therefore be effective tools for mobilising affected communities, expanding knowledge about the environment and health conditions, and supporting environmental management decisions. This is as contained in a study by ECZ, 2007.

ZCCM-IH Plc (2002) study reveals that municipal and district authorities as well as other local authorities, including traditional leadership structure, play a useful role in the promotion of awareness and information dissemination concerning environmental issues as well as participation in the application of best practice methods in environmental mitigation. Further, it explained that the constraint was inadequate capacity for integrated environment and development planning, coupled with lack of environmental awareness at local government and community levels. This meant that there was need for a community sensitisation exercise (SE) as a key to facilitating activity for residence awareness of environmental hazards. Similarly, WMC Ltd (2005) shows that in order for such programmes to succeed, there is need to train identified representatives of a community as the SE were involving the use of a 'trickle down' process whereby relevant information was disseminated to few who would then train others. These trained representatives should be holding different influential positions in the community to easily help awareness programmes succeed.

The promotion of environmental awareness is usually at the heart of most NGOs. This is according to the study by Goulding et al, 2011. In addition, ECZ (2007) study states that NGOs are very important partners in environmental management, although their potential in this direction has not been fully utilised in Zambia. Many of these organisations have developed sufficient capacity in community mobilisation and advocacy. Therefore, it means that capacities and network infrastructure of some NGOs to implement some activities such as training and public awareness have been used. It is always appropriate to have a review and planning meetings and workshops in reference to projects, initiatives, implementation and challenges on environmental awareness and sensitisation programmes (ECZ, 2007) study. However, most NGOs in Zambia fail to yield results because they have not embraced environmental education to address environmental issues in their residences.

A study by Meyer (2005) indicated that, comprehensive educational programmes could be used to improve public and health practioners' awareness on the dangers of lead exposure and possible sources and mechanisms of exposure of lead environment. Further, Meyer reveals that testing the level of lead in children was key in the prevention strategy as many children with elevated blood lead levels (BLL) could not be displaying any symptoms allowing for preventative measures to be taken. The problem according to study by Meyer (2005) was the absence of clarity what screening of children with elevated blood lead levels played in increasing public awareness on the effects of mining.

Additionally, steps taken to reduce lead effects have been taken in many developed countries and have successfully resulted in decreased BLL in children in those countries. Meyer (2005) study revealed that in South Australia health institutions remain vigilant in monitoring levels in children and would continue to work with the smelter, local council and Port Pirie community to continue to improve those levels of low lead contamination.

Furthermore, these forms of awareness were just an expression of the mind by an individual or group of people. They considered their needs to be fully satisfied or insufficient when their expressions did not bear fruit, which made them to be called aware or unaware group of a certain society. Therefore, people could be called aware or unaware depending on what education they have on a certain issue. UNESCO (1978) study has shown that human action depends upon motivation and public awareness aroused concerning the essential links between environmental quality and continued satisfaction of human needs, which depended upon widespread understanding.

The literature has confirmed that environmental awareness is to have knowledge about the environment which could help people live in harmony with the environment. That could imply people to find solutions to existing environmental problems. The literature has also revealed that human activities that lead to environmental degradation result from lack of knowledge. The literature has revealed that awareness on effects of mining on people and environment had not improved; it was still a serious problem. Most people are still ignorant of their environmental challenges in residential areas. The sensitisation educational programmes on awareness of effects of mining are an imperative aspect in any given society. The sensitisation campaign educational programmes that raise awareness could be embraced in this study to help residents have widespread understanding of their environment. This literature highlights the need for establishing awareness to address effects of mining by residents. Therefore, this study would embrace some fundamental strategies highlighted by scholars at global level to address environmental issues at local level.

### **2.3 Community Participation**

Environmental Management Act (2011) has documented that community participation and involvement in natural resource management and sharing of benefits arising from the use of the resources shall be promoted and facilitated. Similarly, a study by ZCCM-IH (2003) has shown that among the many strategies that could be employed to resolve the lead contamination problem is community education, involvement of the community by making them aware of the lead hazard inherent and emanating from their surroundings and some of the ways that they could use to reduce

the risk of contamination. Further, it reveals that for awareness programmes to be successful, the messages developed must be compatible with the community's norms.

King County (2013) study has explained that childcare facilities in the areas most contaminated are being offered an opportunity to have their soils tested, receive educational information on how to reduce their exposure to contaminated soils, and access to curriculums geared toward teaching people how to work and play safe around contaminated soil. Similarly, a study by ECZ (2004) showed that community involvement and education seeks to address the issue of community ownership and thus diminish the extent of vandalism which could only be reduced by working with the community, also by promoting sustainable uses of rehabilitated sites. In addition, involvement of local authorities and interest groups in discussions on long term maintenance was important aspect to this issue.

## **2.4 Methods used in sensitisation**

A study conducted by Agency for Toxic Substances and Diseases Registry (ATSDR) (2007) has shown that to ensure that the place in which residents live and play are safe, there is need for staff with expertise in various areas of the environment to work closely with communities to identify concerns, provide updates on ongoing activities, and offer education as needed. Further, it reveals that experts and funded partners meet with individuals through community gatherings in open forums, and even at their homes to listen to their environmental health concerns, provide information, and conduct investigations. Consenting to this, [www.oregonstate.edu/wrlte](http://www.oregonstate.edu/wrlte) has shown that development of effective solutions to environmental programmes requires a well educated and trained, professional work force. ATSDR (2007) study reveals that health education specialists have created toolkits that explain exposures to lead, which are common in many areas. It is clear that education materials contribute to a body of information on chemical exposures that is valuable for employers, health care professionals, parents and communities. It is true people learn about effects of mining on people and environment, but at their own time they engage in activities that degrade the environment further. Thus, the knowledge may be imparted to residents, but attitudes and actions may not be evident. Knowledge is not always translated into action. This study would acknowledge encouraging the change of attitude in residents of contaminated areas. Thus EE and public awareness activities are needed for change of mindset, values and practices.

ATSDR (2007) study further has shown that this agency has educated hundreds of thousands of community members and health professionals by developing educational tools, training programmes, and outreach strategies. In the same line, a study by Patrick (2004) documented that children should be taught about the dangers of lead and their role in keeping themselves safe.

Further, it indicates that use of stories, role playing, and songs help children recognise sources of lead and learn prevention behaviours. It could be explained how good nutrition prevents lead poisoning and help them choose healthy foods (Rose, 2006). In addition, it could keep clothes free of lead dust by use of overalls over one's work clothes. Contrary to mere teaching children using various strategies, [www.afhh.org](http://www.afhh.org) has shown that the paediatricians should increase their efforts to screen children at risk for lead exposure to find those with elevated BLLs and continue providing anticipatory guidance to parents in an effort to prevent lead exposure.

There is need to improve on flow of information between stakeholders and community led committees and residents, where participants are encouraged to share experiences in groups in respective locations. The groups share progress of awareness programmes and challenges (ZCCM-IH Plc, 2005) study. Likewise, Loubser (2011) study has shown that different strategies and methods could be used in teaching, such as teaching by peers, group discussions, debates, stories, panel discussions, guest speakers, oral reports, demonstrations, cooperative group work and problem solving. In the same vein, a study by ECZ (2007) also revealed that knowledge could be shared through workshops, public meetings and hearings, panel discussion, brain storming, fact sheets, posters, facility tours, radio and television programmes. This explains that gatherings are useful information sharing platform in addition to making friendship. Equally formal meetings could be held for planning and publication of quarterly magazine as an effective way of communication. Public debate and radio or television interview are also useful. These methods, if well implemented, could raise the level of environmental awareness in affected areas with lead contamination such as Makululu and Kasanda Mine Compounds.

This study has acknowledged the importance of environmental education aims in promoting community participation to address effects of mining in the environment and communities at large. Literature has revealed that community participation should be encouraged as it makes residents aware of environmental hazards that surround them and find solutions. This was relevant to the study because the areas have environmental challenges which need solutions by the residents themselves since they understand their problems clearly. However, it is not always possible that when residents are aware of environmental issues then the problem of environment has been solved. This could require deeper environmental education activities to be fully understood by local residents to act positively in eradicating environmental challenges. The literature of community participation and creation of environmental awareness through various strategies is important to the study in order to increase environmental awareness in order to reduce activities that degrade the environment and endanger residents' lives.

## **2.5 Contributions made by EE to address effects of lead contamination in study areas**

This section discussed contribution made by EE to address lead poisoning in the study areas.

### **2.5.1 Environmental Education**

The Environment recently has been taken to mean four aspects of the holistic environment which are; the economic, the political, the cultural and finally the biophysical environment (Elsworth, 1990). Although these aspects of the environment are seen as separate from each other, they are all linked to one another and, for comprehensive environmental sustainability; the four aspects of the environment must work in harmony.

Environmental Education (EE) is the permanent process in which individuals gain awareness of their environment and acquire the knowledge, values, skills, experiences, and also determination which enables them to act individually and collectively to solve present and future problems as well as to meet their needs without compromising the needs of the future generations (Namafe, 2013). EE also refers to organized efforts to teach about how natural environments function, and particularly, how human beings could manage their behaviours and ecosystems in order to live sustainably.

In a study by Patrick (2004) has shown that, by 2003, United States of America was already using EE to address the effects of lead contamination among lead mine workers and their families. EE has been taught in communities and schools with the aim of ending mining problems in the environment. A study by ILO (2011) reveals that most countries had realised that EE could be used with less costs to reduce problems left or created by mining companies. However, in most African countries, EE does not exist to help them address environmental issues in their residential areas. To confirm this contrast, King County (2013) study has revealed that USA has been using appropriate methods and environmental education in their medical field through environmental health where it is attached to help end environmental problems created by mining activities.

At present EE, was adopted by the intergovernmental conference on EE at Tbilisi in 1977 and it was a basis for education module of Agenda 21. The study by UNCED (1992) indicated that the global framework for action adopted by UN Conference on Environment and Development (UNCEP) held in Rio de Janeiro, Brazil in 1992 which assured that EE, including formal education, public awareness and training should be recognised as a process by which human beings and societies could reach their full potentials of solving their problems. Since then, EE has been working to promote public awareness on a number of environmental issues faced by different countries globally through meetings and public hearings, among others.

Awareness about the environment was a key aspect of the society as it targeted all individuals irrespective of different age groups. In that regard, environmental education materials and information was disseminated through the use of print and electronic media in a consistent manner. To increase awareness, the government of the Republic of Zambia through the Ministry of Tourism, Environment and Natural Resources (MTENR), is working in liaison with Zambia Environmental Management Agency (ZEMA). In Zambia, it is ZEMA and other stakeholders that handle issues of Environmental Education (EE) and awareness (Environmental Management Act, 2011). It further stated that, ZEMA was the guide agency in the development of EE activities and enforcing laws and legislation on environmental Protection. It is an implementing arm of government for all projects and programmes that aim at protecting the environment. The MTENR is responsible for policy guidance, coordination and monitoring of environmental and natural resources management issues in the country. Similarly, ECZ (2007) indicated that in Zambia, ZEMA through the health sector promotes periodic public information campaigns on the successful awareness on environmental issues. However, these have not been translated into behavioural and social change as attitude of residents towards the environment continue to be bad. This implies that more need to be done concerning provision of environmental awareness to address effects of mining.

A study by ECZ (2000) has revealed that the level of environmental awareness has improved although it is still low in certain specific areas. The problem according to ECZ (2000) was lack of clarity on what areas still had low level of awareness and which ones had improved awareness. In view of this, ZEMA should prioritise the need to embark on coordinating and enhancing networking with stakeholders and partners, which should contribute towards strengthening of EE processes in Zambia. As evidenced above, EE in Zambia has not yet been used to a higher level to address impacts of mining and raising awareness among residents of mining communities. Therefore, studies by IUCN (1980) suggested that EE should target to produce citizens who are knowledgeable in problems associated with the biophysical environment and are aware of how to help solve these problems and motivated to work towards their solutions. This would help social groups and individuals develop skills for identifying and resolving environmental problems.

### **2.5.2 Environmental Education Activities in Zambia**

In Zambia, EE traces its active implementation through the strengthening of Wildlife Environmental Conservation Society of Zambia (WECSZ) in 1972 when it began to print and distribute conservation magazines with the help of the then MoE, World Wildlife Fund (WWF) and Roan Consolidated Mines (Aongola, 2009). Awareness about the environment and conservation is key aspect of society as it targeted all individuals irrespective of different age groups. In that regard, EE material and information was disseminated through the use of print and electronic medias.



Zambia's EE programmes were incorporated into the school curriculum in both formal and informal education which influenced the formal education system in 1994 when UNEP provided money for public information and environmental awareness under the Environmental Support Programme (ESP) as in Aongola et al, 2009 study. Following the suggestion of IUCN (1980), which had indicated that: School curricula should include EE both as an integrated subject in other subjects, and as a separate subject to be taught formally in a simpler language easy to be grasped by all. The school materials should be produced and effectiveness of teaching materials should be regularly evaluated against the stated objectives. However, EE has not been taught formally as teachers concentrate on subjects that are examinable. This has resulted in low levels of environmental awareness among many residents. Unless this attitude changes, the vision of EE implementation in Zambia would just be on paper.

However, EE processes are steadily gaining recognition from all sectors of the Zambian society, such as government, civil society, NGOs, religious institutions and the general public. Chipatu (2011) study has shown that, this is strongly evidenced in the growth in the number of institutions, NGOs, community groups and even individuals working to address environmental issues in local communities in one way or the other. The EE activities in Zambia have been performed in organisations such as wildlife and waste management to mention but a few.

### **2.5.3 Wildlife and Environmental Education Approaches used**

The wildlife and environmental society of Zambia is dedicated to conservation of natural resources, including land, forestry animals and bird life-flora and fauna, rivers and lakes (GRZ and IUCN, 1984). The institution creates and assists with educational projects, especially with the young in order to bring about a greater and deeper understanding of the importance of the environment in which we live. In order to deliver EE activities, the institution uses different methods and these are some of them:

The first is advocacy where wildlife and Environmental Conservation Society of Zambia engages in high level dialogue with policymakers and other influential leaders on broad policy issues and national policies relating to sustainable environmental management ([wescz@coppernet.zm](mailto:wescz@coppernet.zm)). Further, the site has shown that society has been very instrumental in the formulation of the national policy on environment, National Adaptation Programme (NAPA) and also advocated for the enactment of the Zambia wildlife act 12 of 1998 which ensures protection and conservation of wildlife and was formed with community participation being enhanced (Simasiku et al, 2008). The society also provides checks and balances on government initiatives and programmes to ensure successful implementation.

For example in 2013/2014 the WECSZ, had raised major concerns over the impact of opening a mining company (Kangaluwi) in Lower Zambezi National Park. The society has been making submissions to government outlining their objections and consequences of implementing such a project. The society was in agreement with the Environmental Impact Assessment (EIA) statement on the projects that they were not compatible with animal life as they would remove natural vegetation and that would be irreversible ecological damage ([wecsz@coppernet.zm](mailto:wecsz@coppernet.zm)).

The society has engaged in training local people in game management techniques such as, game cropping of elephants and other animals to ensure their sound management. Local people are also equipped with essential skills necessary to manage their local resources to ensure their sustainable utilisation (GRZ and IUCN, 1984). This has also been documented that in terms of capacity building, the society trained teachers in various schools that were members of the Chongololo club in order to implement the various activities under the Chongololo programme at school level.

The society also networked by initiating and maintaining contact with individuals and organisations that share or support common goals and agree to work together to achieve these goals. It is, therefore, worth noting that issues relating to wildlife conservation and sound environmental management require concerted efforts by different stakeholders. In this regard, the wecsz work in partnership with different stakeholders in order to realise their mandate. For example the society has been working in partnership with Radio 2 and MoE since 1970, in order to reach a wide section of society with regards to Chongololo programme on issues of nature conservation. This is as on [wecsz@coppernet.zm](mailto:wecsz@coppernet.zm).

The society also works with Munda-Wanga Environmental Park, Wild Wide Fund for nature (WWF) and African Wild Dog Conservation in programmes relating to wildlife and environmental conservation where the public learn of the importance of environmental protection (GRZ and IUCN, 1984).

The Chipembele radio programme is similar to Chongololo and uses similar content found in the magazines in an interactive way with interlude of music, drama, competitions and natural sound effects. Examples include stories such as the adventures of Mr. Chongololo (Millipede) and Mrs. Chipembele (Rhino). The programme has a new topic each week such as Lake Habitat, water pollution, ants and how birds fly to name but a few. Listeners could become members of the club by answering simple questions after which they are sent a membership card and brochure. There are about 80, 000 members and a large and varied number of unregistered listeners. The society is in the process of expanding its education activities through partnerships with other organisations and corporate bodies. This is available on [wecsz@coppernet.zm](mailto:wecsz@coppernet.zm).

Waste include garbage, refuse, sludge, and other discarded substances resulting from industrial, commercial, domestic and other community activities. Waste could be domestic, commercial, industrial, mine, hazardous and electronic waste. Waste generation and management is another challenge which the country is experiencing (ECZ, undated). Industries much more often produce liquid waste as compared to domestic users who generate solid waste. The municipal councils throughout the country handle issues of domestic waste management while industrial waste is handled by various generating companies. In both cases, ZEMA monitors the disposal of waste (GRZ and IUCN, 1984). While garbage generation does not seem to be a problem, a study by ECZ (2001), states that garbage collection and solid waste disposal is a major problem and more evident in urban areas due to lack of ability by the municipalities to handle the solid waste generated. In most cases, residents dig small pits in their backyards to throw in the garbage which in turn sinks down to the groundwater reserves and contaminate them.

ZEMA, local authorities and other private partners have involved EE activities in communities and company premises to mitigate the problem of waste management. Waste management therefore, is aimed at minimising waste generation and must provide for protection of both human health and the environment (ECZ, undated).

Though EE has grown to be steadily established in both formal and informal education systems, its biggest achievement has been increasing the environmental awareness. However, this still remains a big challenge for all the institutions and individuals involved in promoting EE to address the major environmental problems faced in the country. In other words, some human actions which lead to environmental degradation result from lack of information. Zambia is constrained by socio-economic problems which make EE unable to respond in an appropriate and successful manner to challenges of protecting the environment. Because of that, environmental degradation has persistently been the main setback the country is facing. Despite the major strides EE has done in wild life, conservation of forestry, there is much that EE has to achieve regarding lead contamination and impact of mining in general.

## **2.6 Environmental Education and mining**

Human civilisation has increased degradation of the natural ecosystems and eroding the life supporting systems which EE wants to bring mitigation for. EE encourages caring for the environment, society and the individual. EE also recognises values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture, and his biophysical surroundings. EE entails exercise in decision-making and self-formulating of a code of behaviour about issues relating to environmental quality. EE also deals with issues that affect all areas of our lives because of its nature; it presents environmental issues in a manner that will enable people to have this whole picture. This is as contained in UNESCO, 1976.

### **2.6.1 Negative impacts of mining**

Mineral mining is one of the most difficult, 'dirty and hazardous occupations which causes more fatalities than any other operational impact on the health of the local communities living around the mining areas at various levels (Stephens and Ahern, 2001). This is due to lack of knowledge by the residents resulting from irresponsible mining practices. The local communities get exposed to air, water, soil and land pollution which directly impacts on their health.

### **2.6.2 Impacts of mining on the quality of air**

Karpagam (1999) study has shown that air pollution is the modification of the natural characteristics of air by chemical, particulate matter or biological agent. Exposure to air pollution is the main environmental threat to human health. Similarly, Panneerselvam and Ramakrishnan (2009) has revealed that Smog, made up of soot, dust, sulphur dioxide and carbon monoxide has long been associated with disastrous consequences for human life. Pollution has impact on the local communities' health. On the other hand a study by Nakicenovic et al (1998) has noted that most affected areas have classical symptoms of common illnesses including asthma attacks, lung infections and respiratory complications such as coughs, eye irritations, and worry about the effects of these emissions on babies.

In Zambia the problem of air pollution is much concentrated in the cities which have the largest number of industries, mines and vehicular traffic. Panneerselvam and Ramakrishnan (2009) study has indicated that air pollution is reported in most industrial towns and metropolitan areas. The Copperbelt Province has the highest record of air pollution due to air pollutants such as sulphur dioxide pumped out into the atmosphere from smelters, acid plants and concentrators. ECZ (2008) observed that, smelters with emissions of sulphur dioxides contain an average of up to 70-g.m-3 annually; this has adversely affected vegetation and property in the prone areas.

However, a study by Schwela (1995) has shown that, emissions would decline in industrialised regions of the Northern hemisphere (Europe), the former Soviet Union, North America, and increase sharply in the developing regions of the Southern hemisphere and the far east (Latin America, Africa, Asia) by 1990 and 2020. In Western Europe, they have put strong national environmental policies, changes in national energy policies and implementation of environmental laws. The problem according to Schwela (1995) was that there was no definition of the actual reason which could lead to reduction of emissions in industrialised Europe and increase in developing countries. The reasons could have made it easier for this problem to be solved in developing nations as well.

### **2.6.3 Impacts of mining on land**

Mineral exploration and quarrying activities in mining areas have resulted in land degradation due to the presence of waste dumps and open pit which have excluded use of the affected areas for other useful purposes (ECZ, 2004). The presence of those dumps and open pits has also led to loss of aesthetic value of the area. Unsecured open pits dump sites and caving in areas posed health and safety hazards to members of the public in the area and could be of significant concern. World Bank (1991) study has revealed that mining temporary or permanently results into loss of land productivity and contamination of soils from mineral materials and toxic substances. Copper mining has also proved that it could destroy land to be none productive. Odum (1969) study has shown that fumes from copper smelters exterminated all the rooted plants over a wide area, once luxuriant vegetation covered Copperhill until fumes from the smelters killed all of vegetation. Little or no vegetation grows in affected areas because the soil has become acidic by acid rain.

### **2.6.4 Impacts of mining on water quality**

Mining and other industrial activities have caused air, land and water pollution. Water pollution is a result of any chemical, physical or biological change in the quality of water that has a harmful effect on any living thing that drinks or uses or lives in it (ECZ, undated). In line with this, a study by World Bank (1991) has revealed that air pollution from separation, fugitive dust and stacks emissions, noise from crushing and grinding the ore, contamination of local groundwater by leakage from tailings piles and shine ponds, waste disposal, visual intrusion and land use conflicts. Wamsley and Mazury (1999) add that, the overall effect of mine waste water is the deterioration in water quality in many surface water sources that could impact on the domestic, industrial and agricultural uses. World Bank (1991) study has also shown that, backfill material could alter the hydraulic characteristics and water quality.

Most of the urban and peri-urban draw their water requirement from unprotected, contaminated wells and ponds available locally (Panneerselvam and Ramakrishnan, 2009). This further states that wastes that are discharged into water contain pathogenic organisms that are capable of transmitting water-borne bacteria diseases such as cholera, typhoid, fever, dysentery and gastroenteritis. Water pollution also emanates from the discharge of agro-chemicals as run-off from fields where they have been used (ECZ, 2008).

Mining activities have also attracted unplanned squatter settlements usually without proper roads, drainages, clean drinking water, sanitation and health facilities just to mention but a few (MoFNP,

2006). It further observes that lack of such social amenities in turn causes water-borne diseases which are usually the plight of shanty compounds.

#### **2.6.5 Impact of mining on biodiversity**

A study by MMSD (2002) revealed that the most noticeable impact to biodiversity from mining is the elimination of vegetation, which in turn changes the availability of food and shelter for wildlife. It further elaborates that mining on a large scale could impact biodiversity by changing species composition and structure. For example, acid drainage and high metal concentrations in rivers generally result in an impoverished aquatic environment. This is as on [http://pdf.wri.org/mining\\_background\\_literature\\_review.pdf](http://pdf.wri.org/mining_background_literature_review.pdf). Kelly (1998) study has indicated that some species of algae and invertebrates are more tolerant of high metals and acid exposure and could, in fact, thrive in less competitive environments. Some wildlife species benefit from the modified habitat provided by mines.

#### **2.6.6 Mining and Health**

US Department of Health and Human Services (2005) has shown that exposure to copper has been associated with non-malignant respiratory disease; mortality rates in men, lung and thoracic mortality in persons living in copper mining regions had been noted.

Exploration and mining activities interfere to some degree with other activities that might be present or planned in the area; for example, vibrations from equipment operation and blasting, as well as noise and dust could be distracting and may well cause health problems to workers and nearby residents (World Bank (1991). WHO (2002) study has shown that women and children who spend most of their time in duties which expose them are the victims of the resulting lead pollution. In line with that <http://www.worstpolluted.org> states that Children who play in the soil and young men who scavenge the mines for scraps of metal are most susceptible to lead produced by the mine and smelter. On the other hand, <http://www.lusakatimes> has revealed that high levels of lead poisoning affect the entire population, but are particularly high in children of the area.

#### **2.6.7 Mining and local people**

Mineral development creates wealth, but it also causes considerable disruption on the environment. According to MMSD (2002) mining activities create jobs, roads, schools, and increase the demand of goods and services in remote and impoverished areas, but the benefits and costs usually are not evenly distributed and shared.

Mineral activities must ensure that the basic rights of the individual and communities affected are upheld and not infringed upon (ECZ, undated). It has further shown that basic rights include the

right to clean water, a safe environment, and livelihood, the right to be free from intimidation, violence and the right to be fairly compensated for loss.

In Zambia, during the days when the mines were operated by ZCCM, the company took care of all the public services in the neighbouring communities: hospitals, schools, maintenance of infrastructure activity centres for women, recreation for children, to mention but a few. After privatisation, the private mining companies discontinued most of those services, which have not been taken over by the state or the municipal authorities. This is available on County Balance: [http://www.postzambia.com/post-read\\_article.php?articleid=10898](http://www.postzambia.com/post-read_article.php?articleid=10898). However, despite some disparities in the manner countries handle mining companies and social responsibilities, there is immense contribution of the mining industry to the economy worldwide which has been appreciated. Different countries have come up with laws and regulations aimed at enhanced environmental management in the mining sector. Additionally, many countries have realised that laws and regulations have little or no concrete results without education to address those negative impacts. As a result, implementation of laws and regulations in these countries are accompanied by EE programmes focused at mining companies and mining community participation. In the same vein, ECZ (2007) study observed that when beginning the process of creating awareness in any given community, it is necessary first to assess the environment in which awareness creation would take place.

## **2.7 Impact of lead mining**

Haag (1978) study explains that mining operations have high impacts on environment and society, and could lead to deterioration of the health of the community and the environment. It further reveals that these mining activities are increasing in Africa, where mining is not always regulated and controlled by governments and international mining companies. In addition, mining is regarded as one of the most hazardous occupations that are inherently dangerous and its operations are almost, all the time, associated with the release of blown dust and other materials which are harmful to the health of human beings.

Lead is a useful and common metal that has been used by humans for thousands of years. This is according to [www.kingcounty.gov/healthservices/health.aspx](http://www.kingcounty.gov/healthservices/health.aspx). It has additionally shown that lead is very dangerous and poisonous particularly for children, when it is accidentally inhaled or ingested. ATSDR (2007) revealed that lead is a highly toxic substance, and exposure to lead could cause a range of adverse health effects. Children, as well as adults, could be sick from the effects of lead poisoning, but lead poisoning is much more frequent in children than in adults. In addition, it

revealed that in 2005, more than 300,000 children less than 6 years of age had too much lead in their blood in Northern USA.

According to [www.atsdr.cdc.gov/news/soilpica](http://www.atsdr.cdc.gov/news/soilpica) it has explained that children were most at risk for lead injuries because their bodies were still developing and because they tend to put things that could have lead dust on it in their mouths. It is suffice to say that until about age 6, young children do not have a fully developed 'blood brain barrier' that helps the body keeping harmful chemicals out of the brain. That means without the blood brain barrier, the effects of lead are even more devastating. [www.epa.gov/lead/pubs/leadinfo.htm](http://www.epa.gov/lead/pubs/leadinfo.htm) has shown that children that play in the soil and young men that scavenge the mines for scraps of metal are most susceptible to lead produced by the mine and smelter. Lead puts 189,725 kids at risk of diminished intelligence in 7 countries ([www.livemint.com/politics/5BtjsPFf7leGHmwbudMQoL/contours-of-contamination.html](http://www.livemint.com/politics/5BtjsPFf7leGHmwbudMQoL/contours-of-contamination.html)).

The people with pica which is a condition where a person craves and eats non food substances, including soil and dirt are also at high risk of lead poison. This is as on [www.atsdr.cdc.gov/news/soilpica](http://www.atsdr.cdc.gov/news/soilpica). Lead contamination is also associated with dust poisoning which contains lead dust fumes and all those dust diseases affect the alimentary canal, the blood stream, the brain or spinal system and the skin of human beings (Haag, 1978). Similarly, Rose (2006) has shown some of the signs of poisoning as fever, weakness, chest pains, cough, breathing difficulties, loss of appetite, abdominal problems, muscular weakness, tremor, joint pains, fatigue, anaemia, gradual loss of weight, reduced attention span, insomnia and constipation.

Rose (2006) provides new evidence in her study, that harmful effects could occur at even lower levels of exposure, even as low as 5 micrograms of lead contamination per decilitre of blood. For children even very low levels of exposure could result in reduced Intelligence Quotient (IQ), hearing disabilities, attention deficit disorders, behavioural problems, stunted growth, impaired hearing, and kidney damage (Patrick, 2004). However, <http://.gruterinstitute.org/news/v/s.html> has shown that lead poison has also been associated with juvenile delinquency and criminal behaviours. On the other hand, MMSD (2002) has added that mineral mining of heavy metal industries had significant impact on air, water, land and people. Therefore the pollution of these minerals endangered the lives of the people either through occupation or living around mining sites.

According to <http://www.FAO.org/docrep/x0178E/x01784.htm> the possible effects of exposure to chemicals range from infertility, miscarriage, malformation and neonatal death to growth retardation. Similarly, Vedantam (2007) has revealed that miscarriage and subtle abortions, declined fertility of men through sperm damage, diminished learning abilities of children, behavioural disruptions of children such as aggression, impulsive behaviour and hyper activity are associated to



lead poison. Cleveland et al (2008) added that women also had stillbirth, premature birth and low birth weight due to lead poison.

In adults, lead could increase high blood pressure and cause fertility problems, nerve disorders, irritability, and memory or concentration problems, result in vomiting and diarrhoea (<http://www.gruterinstitute.org/news/v/s.html>). It means that adults unlike children must be exposed too much higher levels of lead to experience adverse health effects. Nevertheless, [www.blacksmithinstitute.org/kabwe.shtml](http://www.blacksmithinstitute.org/kabwe.shtml) indicated that many people mistake the symptoms of lead poisoning for other common illnesses, such as a cold, flu or T.B. According to (Reuters, 2010) explains that about 15,000 people were relocated from Jiyuan in Central Henan province to other locations after 1000 children living around China's largest smelter plant were found to have excess lead in their blood.

## **2.8 Lead Exposure Routes**

Lead is a common environmental pollutant (Regan and Turner, 2007). (Heller et al, 2008; Tao He and Huang, 1992) have revealed that causes of environmental contamination include cottage industrial use of lead, such as is found in facilities that process lead acid batteries cells or produce lead wire or pipes, and metal recycling and foundries. Parents also bring lead home from work and these have caused lead exposure and lead contamination. Komex International (2001) indicated that the main lead (Pb) exposure pathways involve respiratory intake of airborne particulates derived from smelter emissions and fugitive dust from the waste dumpsites and consumption of crops grown on contaminated soil. In view of this, there are several industries that have continued to pollute the mining communities around them with the chemical used to produce batteries.

Sanborn (2002) has acknowledged that children living near facilities that process lead, such as lead smelters have unusually high blood lead levels. On the other hand, ILO (2011) has shown that even pets could come into contact with lead contaminated soil and cause human exposure to lead contamination when people, especially children, pet or play with the animals. Such everyday activities could cause elevated blood lead contamination levels. A young child's normal hand to mouth activity is a common pathway for exposure among children. Previous studies by Yu and Ye (1991) have shown that 83 percent of workers in a smelter wore their clothes home and 80 percent touched their children before changing out of their contaminated work clothes. They also argue that high lead levels are also found in products that are manufactured for children such as paint on coloured pencils, crayons, and note book covers.

In addition, Rossi (2008) has shown that lead exposure could occur from contact with lead in air, household dust, soil, water, commercial products, and dust created as people search the mine spoils for lead scraps. It is suffice to say that young children could not easily recognise or protect themselves from potential dangers. Therefore, parents, childcare providers, and those who interact with them everyday must take on the responsibility of keeping them out of harm's way EAD (2000). It could further be explained that since lead is found in homes, yards, day care centres, old buildings, playgrounds, drinking water, it becomes a tough job if adults do not recognise the potential hazards around them.

## **2.9 State of awareness and EE in Zambia**

The period of the 19<sup>th</sup> century came with marked increase in pollution due to industrial revolution which had caused an unprecedented alienation of man from nature and the disruption of (western) civilisation's formerly unified cultural milieu (Wheeler, 1975). It further states that the world was engulfed in mass production, widespread squalor, appalling health conditions, social ills and environmental destruction. This required a population which was well informed on the dangers that came with careless use of our environment due to ignorance of the resulting effects. It is clear that education for a long time now has been seen as a method that could help solve a number of environmental problems through teaching people to become aware of those environmental hazards. Loubser (2011) indicates that, a Scottish professor Patrick Geddes was dissatisfied with school and university learning and teaching methods. He dedicated himself to improvement of both the environment and education. This was a good idea to create better understanding of how man should relate himself to his environment. In this regard, to create the needed awareness, we do not just need the school methods of teaching the community, but far more than just university ways of teaching is required to bring lasting practical awareness appreciable.

Previous study by Dorcas (2003) has revealed that CEP has been implementing an intensive community outreach programme aimed at raising awareness as well as providing simple messages on how to avoid effects of mining. In addition, there must be continuous sensitisation or education in lead pollution since lead is naturally occurring. Sensitisation of the community on the general aspect of lead pollution must be on going. This is according to ZCCM-IH Plc (2005).

Environmental Management Act (2011) explains that the people should be involved in the development of policies, plans and programmes for environmental management. Further, it explains that ZEMA should undertake general educational programmes for the purpose of creating public awareness on the environment and facilitate public access to information on the environment. However, ZEMA has not created any awareness lessons in affected areas with impact of mining.

IRIN Africa (2005) adds that ZCCM-IH, ZEMA and KMC have launched a mitigation programme on lead exposure but community awareness remains low. In addition ECZ (2000) has shown that it is unfortunate that the level of environmental awareness has improved although it is still very low in certain specific areas. It is in this regard that ZEMA should prioritise the need to begin coordinating and enhancing networking among stakeholders and partners, which must contribute towards strengthening of awareness processes in Zambia. Improving community involvement in environmental management could enhance public participation through use of various channels of communication depending on the needs and availability of service in the district (ECZ, 2007). Further, it reveals that communication channels could include radio, television, newspapers and educational materials such as booklets, posters, brochures among others.

Individuals need to understand the full impact that personal or collective choices they make have adverse impact on our environment. Further, a well informed individual would be able to play a more meaningful role in the overall environmental decision making process. This is as contained in ECZ, 2007. Since the study shows that there is need to carry out more community sensitisation campaigns, it is important to include awareness activities which respond to and support local initiatives and take ownership of the project activities.

UNESCO (1977) study has shown that environmental awareness clearly constitutes a comprehensive lifelong education responsive to changes in a rapidly changing world. In addition, it should equip society to play a productive role towards improving life and protecting the environment with regard to given ethical values. Many people fail to interact with the environment in harmony because of lacking knowledge. Hence stringent measures need to be taken to create awareness among our citizens.

ECZ (2007) has shown that EE provides people with the awareness needed to build partnerships, understand NGO activities, develop participatory approaches to urban planning, and ensure future markets for eco-business. This could be done through enhanced critical thinking, problem solving, and effective decision-making skills. It teaches individuals to weigh various sides of environmental issues and make informed and responsible decisions. EE does not advocate a particular viewpoint or course of action (UNESCO, 1978). According to ECZ (2007) EE was included in the school curriculum in Zambia between 1990 and 1997 as seen to play a key role to solving environmental issues though it has not yet achieved a lot in Zambian situation. Nevertheless, all that ECZ (2007) has stated continue to be on paper as no EE subject is taught in Zambian schools as an independent subject except as an integrated one which creates apathy to its teaching.

With regard to awareness programmes in Zambia, there is dearth of literature on environmental awareness campaigns on effects of mining in Zambia. What exists on EMA (2011) is that educating

the public on environmental awareness on effects of mining is the responsibility of ZEMA in the country. Similarly, ECZ (2007) indicated that in Zambia, ZEMA, through the health sector, promotes periodic public information campaigns of the successful environmental awareness on effects of mining.

In view of the above, it is clear that more is needed to be done concerning provision of environmental awareness on effects of mining in Zambia. ZEMA education and communications department has not designed any educational awareness programmes to address effects of mining in mining communities.

## **2.10 Environmental Education and Mining in Developed Countries**

Because of the dearth in literature on environmental awareness using EE in Zambia, it was necessary that a review of literature from a developed country with a fully fledged EE awareness programmes was done. The choice of United States of America (USA) and Australia was as a consequence of the countries having well established EE programmes to address effects of mining which could be used as point of reference to the study areas. USA is one of the developed countries which have a comprehensive approach to address effects of lead contamination using EE. The approach includes the most important aspects to address effects of lead poisoning through public awareness, community participation and sensitisation among others. This section is based on review of literature on using EE to address effects of lead contamination in USA and Australia.

A study by King County (2013) has indicated that Elevated blood lead concentrations in people more especially children in US are still prevalent in many areas. It further states that major sources of lead contamination historically included mining and milling sites, primary and secondary smelters, battery manufacturing and recycling facilities. Many of the source facilities are located near residential areas or have had residential areas develop around them. Superfund (2003) has observed that fugitive emissions from the facilities have resulted in soil contamination in the yards of residences, which in turn might cause high blood lead levels in residents especially children. Many different clean-up methods have been implemented with varying degrees of success.

### **2.10.1 Community involvement**

In USA, community involvement to bring about sustainability of a residential cleanup project in many ways is constraining upon support from affected residents, elected officials, local public health agencies, municipal and public workers staff, state government personnel, and other stakeholders. It revealed that if residents recognised the risks posed to their community and felt involved in the decision-making process, they accepted the need for cleanup. It added that house to

house personal interaction with residents had been useful to learn their concerns and had also been an effective part of educating the public regarding risks posed by the site. The project manager always issued bulletins and fact sheets to help keep the community informed of the site activities and established a toll free number for residents to contact the manager for any questions about the site. The local governments were involved fully in spear heading such projects. This is according to Superfund, 2003.

### **2.10.2 Education activities**

Previous literature by Superfund (2003) has reviewed that in house education activities were normally combined with regular house cleaning in USA, one key to begin reduction of elevated blood lead concentrations in children was to initiate health education activities, and where appropriate, blood lead screening, as early as possible in the process. Those activities were started as soon as elevated blood lead levels or elevated soil levels were detected at the site. Education was sustained throughout the project. Further, the project manager educated community on the risks of lead exposure and encouraged lead education programmes which were coordinated with local programmes of health districts, schools and other community groups working with families and children (<http://www.epa.gov/suprefund/programs/lead/ieubk.htm>). The initial task was educating the community regarding their lead exposure and associated health risks. Education and cleanup activities were easier to implement, more effective, and more widely accepted by the community when the citizens understood the risks and believed that the community was really at risk. This is as contained in Superfund, 2003.

### **2.10.3 Community Advisory Groups (CAG)**

According to <http://www.epa.gov/superfund/tools/cag/index.htm> has shown that CAGs could contribute significantly to education activities in numerous ways. Programmes should be all inclusive to all affected neighbourhoods, as well as the minority leaders, bankers, school board members, health officials, selected officials, city public works staff, local environmental group members and other groups in the community should be involved to address the impact of mining on environment.

### **2.10.4 Informational meetings**

Dorcas (2003) has revealed that informational meetings were also important in USA where frequent public meetings were held to inform the community on current and planned Environmental Action Program [EAP] activities and collect feedback and concerns from citizens. Further it has shown that meetings were held at least every six months and that frequency helped ensure that the public stayed

informed of site progress and had an opportunity to provide meaningful input. The information gained from their constant contact with the local community to brief project staff on the environmental issues was important to the successful remediation of the site.

### **2.11 Environmental Education and mining in Australia**

Meyer, et al (2005) has shown that South Australian Health institutions remain vigilant in monitoring lead contamination levels in children and would continue to work with the smelter, the local council and port Pirie community to continue to improve these levels of low lead contamination. It further contends that South Australia Health comprehensive educational programmes are used to improve public and health practitioners' awareness of the dangers of lead contamination exposure and possible sources and mechanisms of exposure of environmental lead contamination. The government and the mine owners ensure environmental safety of the local people and environment.

In view of the above, the significance to address effects of mining using EE in USA and Australia is that it is holistic. The learners, the trainers, the environment and the venue are defined. The other significance is that all age groups of people such as the adults and children are catered for in the provision of the education. Generally, the review of literature from the two countries revealed that to address effects of lead poisoning using EE could cater for all age groups. The education is also culturally acceptable and also has linkage to other organisations. Rural communities are not left out in acquiring information of effects of mining on people and environment. Therefore, this study was necessary for it would ascertain the level of awareness in schools and the surrounding communities. This could be done by recognising prior knowledge of residents about environmental awareness. After assessing this prior knowledge, then necessary interventions could be taken to improve residents' knowledge, skills and values for successful environmental awareness programmes.

### **2.12 Environmental Education and mining in developing countries**

A review of literature in many African countries revealed that, most countries have started promoting the use of EE such as South Africa and Nigeria to address effects of mining. Despite its suitability and simplicity for developing countries, it is still lowly practiced.

In South Africa's Edenbale lead mining and Nigeria's Zamfara mine soils were tested frequently to help early detection of lead, the educational information received on how to reduce their exposure to contaminated soils, and access to curriculums geared toward teaching people how to work and play safe around contaminated soil (IRIN Africa, 2005).

South Africa has a slogan; ‘we share one environment and the better we share it and collectively care for it, the better quality future all of us are likely to have’. More successful EE initiatives and programmes on impacts of mining in some of the former homelands of pre-1994 South Africa, especially at grass root level has been recorded. This is according to Loubser, 2011. It further adds that, when environments become degraded, impoverished or polluted, it is invariably the poor and dispossessed who suffer disproportionately. The poor are usually least equipped to cope financially, materially, and in terms of skills with environmental stress and its consequences upon their lives.

South Africa introduced EE at all levels of education in 1985 to improve environmental issues on most residential areas (DoE, 1995). It further states that South Africa offers EE programmes or courses to a wider community; NGOs and political parties in government and opposition associated themselves very much to promoting EE in all faculties of learning such as law, journalism, economics other than the usual formal learning (DoE, 2002). NGOs have continued to lobby for education transformation to emphasise EE activities.

DoE (2002) has shown that EE processes are now integral to all the learning areas in the formal curriculum. Each learning area has a particular environmental focus embedded within it. In addition, community-based EE programmes have mushroomed. EE has become a new focus in industrial training, and public education.

IRIN Africa (2005) has observed that education for environmental awareness is essential for the younger and older generation. The beneficiaries at the grassroots level are as much a clientele for EE as the policy makers, the decision makers and the project implementers. Hence, EE needs to be conveyed to these different categories of people through formal education systems, non formal education systems and the use of mass media. This is shown in ILO, 2011.

Puyol (1999) has revealed that Communication, Education and Public Awareness [CEPA] play an important role in listening to how people feel about environmental issue by putting it on the agenda to raise awareness and identifying it to be dealt with by the project or policy. It also shows that during implementation CEPA is used to mobilise networks and stakeholders to explain benefits of participation and to build social responsibility. That has helped South Africa to succeed in her EE programmes country wide. Hesselink (2000) also records that CEPA involves information exchange, dialogue, education, and marketing. It adds that, to involve other sectors it should not only be by workshops or training but all residents to be involved in public meetings. Other target groups need to be driven by interventions such as street theatre, music or statements by television or sport celebrities.

However, in many African countries EE does not exist. Therefore, successful implementation of EE from the curriculum has greatly improved environmental management in most of the countries as shown above in the case of South Africa. Thus, this study has acknowledged the importance of effective implementation of EE in learning institutions and other relevant sectors of the society. This would enable people to value the importance of EE in sustaining the environment and mitigating the impending environmental mismanagement in Zambia. The study further placed emphasis on the provision of effective sensitisation programmes in order to improve awareness among residents. This would help people to acquire relevant knowledge, attitudes and skills for better environmental utilisation.

### **Key issues that arose from the literature review**

The literature reviewed above, for this study, showed that some gaps existed which needed filling. With regard to environmental awareness education in Zambia, there is a dearth of literature. One of the examples of the gaps identified included insufficient information on the use of environmental education activities to address effects of mining in Zambia. Since most of the studies have been concentrating on effects of mining on the environment and economic status of residents after mines had closed. Except for other countries such as U.S.A, Australia and South Africa, little attention has been paid to studies on using EE to address the negative effects of mining. The literature has not clearly indicated significant levels of environmental awareness in mining communities.

The other one was lack of information on the training programmes that are designed to provide socio-economic and biophysical education to residents on participation to address effects of mining. This is only present in other countries such as USA, Australia, Nigeria and South Africa.

The researcher strongly felt that these gaps needed to be filled in one way or another so as to ascertain whether there were EE activities taught to residents of the Zambian mining communities to fully understand the effects of mining in their areas.

### **2.13 Summary of the chapter**

This chapter has dealt with environmental awareness and sensitisation programmes. Then community participation was also reviewed. Methods used in sensitisation have been explained. Impact of mining to people and environment was highlighted. The contributions made by EE to address effects of lead contamination were also reviewed. Some of the relevant research works discussed were on USA and other selected countries with innovations and ways to address effects of mining using EE were also discussed. The next chapter presents the methodology of the study and gives reasons for the choice of a particular method selected.



## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **Overview**

This chapter discusses research methodology which is a very wide term that involves all strategies that describe where, how and when data is to be collected and analysed (Chilisa and Preece, 2005). In view of this, the chapter describes research design, target population, study sample, sampling and data collection procedure, research instruments that were used in data collection, data analysis and ethical considerations. It also gives a description of the study areas.

### **3.1 Introduction**

The study used a qualitative research approach which was supplemented by quantitative research approach. Interview guides were used to get views from the facilitators and government officials, while questionnaires were used to get information from residents and pupils of Makululu and Kasanda Mine Compounds. Observation was done during the distributions of the questionnaires and conducting interviews, viewing the physical environment in the study areas. Therefore, the collected data was analysed using qualitative and quantitative approaches.

### **3.2 Description of the study Areas**

This part of the report gives a description of the study areas in terms of geographical location and economic status of Kabwe.

#### **3.2.1 Geographical location of Kabwe District**

Kabwe District is located in Central Province of Zambia. It is surrounded by Kapiri Mposhi in the north and Chibombo district in the south respectively. It further lies in the mid veld with average altitude of 1207 metres, located between latitude 14° 27' South and longitude 28° 27' East on central plateau. It has an annual average temperature of 20.2° with the monthly average temperature of the hottest at 26.8° while the lowest monthly average temperature at 14.2°. The average total annual rainfall is 966 millimetres (KMC, 2010).

Kabwe District is found along the Great North Road 130 kilometres north of Lusaka and is a principal urban settlement of Central Province with a population of 202, 360 (CSO, 2012).

#### **3.2.2 Economic status of Kabwe**

Kabwe's growth and national economic importance was, for much of the 20<sup>th</sup> century, closely related to major producer of lead and zinc. Following the mining sector's poor economic

performance throughout the 1980s and 1990s and failure to adequately address the environmental issues, Kabwe mine was ultimately closed in 1994 (Water Management Consultants Ltd, 2005). Until the closure of the mine in 1994, mining had been the most important economic engagement for the population of Kabwe. There was also poor performance of the Mulungushi textile and railway industries, where most people were employed (Mankapi, 2001). It was further revealed that, as a direct consequence of the closure of the mine, textile and railway industries, workers became unemployed. The social support previously provided by ZCCM to mine workers and their family members in townships of Chowa and Kasanda mine was withdrawn. For instance, the provision of education, water supply, sanitation and medical facilities has reduced. Since 1994, responsibility for these services had been devolved to KMC. This is as contained in ZCCM-IH PLC, 2005. This document further reveals that KMC resources have not increased during the post-mine closure period to account for these incremental responsibilities.

This has resulted in increased poverty, poor sanitation and quality drinking water, malnutrition, dysentery, cholera, malaria, HIV/AIDS, tuberculosis, air pollution and other health problems related to mining activities. This is according to ECZ, 2008 documentation.

The closure of Kabwe mine also raises social issues. Some of these include the scavenging of metals on old mine dumpsites of lead and zinc. The trespassing within the caving area, vandalism of remaining structures of historical significance and illegal encroachment of the people without mining licenses, but who actually do mining and business there. There are also illegal mushrooming settlements along the waterway and main mine dumpsites (Water Management Consultants Ltd, 2005). The Scavenging on the mineral dumpsites poses a serious health risk to both scavengers and their families.

### **3.3 Research Design**

In this study, to ensure that there was an in-depth description and understanding of the area under study, a descriptive survey research design was employed. As opposed to other designs, a descriptive survey design was chosen because it involves describing the state of affairs as they exist. Moreover, Kombo and Tromp (2006), point out that descriptive studies are not restricted to fact findings, but may often result in the formulation of important principles of knowledge and solution to significant problems. However, Ghosh (1982) notes that descriptive survey is the investigation of social problems, the technique of collection of data through interview, questionnaire and library or book studies. Best (1970) defined descriptive survey research design as a relationship that exists, practices that prevail, beliefs, point of views, attitudes that are held, processes that are going on, efforts that are felt, or trends that are developing. This is a process by which facts are collected

about the social aspect of community's position which involves thoughts, opinions, attitudes, behaviour and feelings of the resident's awareness on the effects of lead contamination in Makululu and Kasanda Mine Compounds. Descriptive survey research design is more than just a collection of data. It involves measurement, classification, analysis, comparison and interpretation of data.

This study used mainly qualitative research approach which was complemented by quantitative research approach in data collection and analysis. Qualitative approach was used because it explores attitudes, experiences, behaviour and it attempts to get an in-depth opinion from respondents. Quantitative approach was used to generate statistical data which makes it easy to interpret and understand large amounts of data. To give full and clear explanations on the density of a given phenomenon, it is believed that combining qualitative and quantitative research approaches is the best way to achieve best results. It was because of the above submission that mainly qualitative research approach was used complemented by quantitative research approach in this study.

### **3.4 Target population**

Oliver and Abel (2003) state that, a target population is all members of any well defined class of people, events or objects who are designated as being the focus of an investigation. It could also be referred to as an entire group of persons or elements that have at least one thing in common. For the purpose of this study, the population included some residents and pupils of Makululu and Kasanda Mine Compounds respectively. Others included were government officials from Ministry of Lands, MoE (DEBS), headteacher and teachers from two schools in the study areas, EHTs from MoH, Public health officers KMC and communications and information officer ZEMA, the NGOs included were CEP, reporter from a radio station, MPs from study areas, councillors and Kabwe mine personnel officer.

### **3.5 Sample size and Sampling procedures**

Sample size is defined as a piece or segment which is representative of the whole. It is a subset of a population consisting of characteristics in which a researcher is interested (Ngoma, 2005). Sampling is the process of selecting a sample or small proportion that is representative of the population for observation and analysis (Sidhu, 2006). Sampling procedures may refer to the part of the research plan which shows how cases were to be selected for the purpose of observation. Sampling procedure is the procedure a researcher uses to gather people, places or things to study (Orodho and Kombo; 2002).

This research included 125 respondents. Out of this sample 20 were purposively selected including the members of parliament, councillors, Copperbelt Environment Project representatives, School

head teachers, teachers, public health workers (council), mine workers, lands officer, DEBS (MoE), ZEMA, radio reporter, Environmental Health Technologists (MoH) and community facilitators. These were selected because of the information they had due to their positions and professionalism in these compounds. CEP was the sole NGO involved in preparation, design and implementation of EA activities in Makululu and Kasanda Mine Compounds helped by the trained community facilitators, reporters, health workers, teachers and others in carrying out these EA activities in the compounds. For residents and pupils, those literate respondents were given the opportunity to write their own responses, while illiterate and semi literate were interviewed and the researcher wrote down their responses. Pupils were taken as residents coming from the affected communities.

The sample size was 125 respondents which composed of 105 of the 49,924 residents in the study areas and 20 officials from government ministries and NGOs. The residents were selected using random sampling strategy for this study.

This study used simple random sampling. Sidhu (2006: 260) states that, 'Simple random sampling means that every member of the sample is selected from the total population in such a manner that all members of the population have essentially the same probability of being selected.' Under this procedure, the residents of Makululu and Kasanda Mine Compounds, including pupils were selected at random. The participants from the two compounds were picked at random. Then the household numbers were written on small pieces of paper which were put in a bucket and then shuffled several times. The ward councillor helped to pick pieces of paper from the bucket with plot numbers written on them and those households picked made the sample. For the pupils, the same procedure was used where the headteacher picked names from the class registers provided, from small pieces of paper prepared and shuffled well before picking. The picked names made a sample for the pupils. Though time consuming, Simple Random Procedure is chosen because it provides each element in the population an equal chance to be selected as a study sample (Cohen et al, 2000; Kombo and Tromp, 2006). This reduced on biasness on selecting participants for the study.

### **3.6 Data Collection procedure**

Data collection is a systematic way of drawing information about objects of the target population who are represented by a sample (Ghosh, 1982). In order to obtain the needed data, an introductory letter from UNZA post graduate assistant dean school of education was sought for written permission, which was presented to all areas of study: DEBS permitted me to carry out my study in the schools within her jurisdiction in the study areas. Further, permission was sought from MoH District office for me to interview the EHTs at Makululu and Kasanda Mine Clinics respectively. In

short, the introductory letter was produced at any time of data collection when demanded for identity.

The study collected both secondary and primary data. Secondary data was obtained through library and information centres around Kabwe and also data from the internet were reviewed. Secondary data sources included both published and unpublished documents such as books, journals, modules and internet, magazines, newspapers, thesis, and seminar presentations. Primary data was obtained through administering of questionnaires and interview guides.

### **3.7 Research Instruments**

Two major research instruments were used during gathering of information for the research for qualitative data complemented by quantitative data. These were semi-structured questionnaires and an interview guide to produce primary data.

#### **3.7.1 Questionnaires**

A questionnaire was used to collect data where respondents filled in answers in written form and the researcher collected the forms with the completed information. It is a carefully designed instrument (written, typed or printed) for collecting data directly from people (Ogula, 1998). Therefore, a questionnaire was used to collect information from respondents who were residents in Makululu and Kasanda Mine Compounds of Kabwe District. The questionnaires were distributed to respondents by the researcher and research assistants and later collected on an agreed upon date ensuring 100% collection. They were administered to 105 residents of the study areas. The questionnaires were both closed and open ended as indicated by the sample questionnaire attached. The questionnaire was the appropriate method for collection of data from a large sample size. However, the questionnaires did not work as designed because some of the respondents were illiterate. Therefore, the researcher used questionnaire interviews to get information from the respondents.

#### **3.7.2 Interview**

An interview is a way of collecting data about a person by asking them rather than by watching their behaviour. It is an interaction or conversation that takes place between the researcher and a respondent in the process of data collection (Chilisa and Preece, 2005). Personal interview helps the researcher to measure what a person knows, thinks about a particular issue, and likes or dislikes. The researcher asked the respondents questions that were important to the study. To collect information for this study, interviews were conducted to stakeholders who are usually referred to as

providers or stakeholders. Nevertheless, the interview guide failed to fully obtain the required data as in some cases the respondents, especially government workers, avoided some of the questions diplomatically. Since the researcher could not force the respondents to give certain responses, the researcher accepted whatever response was given.

### **3.7.3 Observations**

The researcher was physically observing residents' activities and impacts of mining, where visible effects of lead contamination in Makululu and Kasanda Mine Compounds. Observation made it possible for the researcher to observe non verbal behaviour which is important in validating the residents' answer. Further, this method of data collection is flexible; meaning that the researcher's focus was easily shifted, as new data became known. This method provided an in depth understanding of the variables of the study.

### **3.8 Data Collection**

To obtain the needed data from the sampled participants, the researcher got permission from the University of Zambia authority which was presented to different departmental heads of Kabwe District where the research was conducted. The study used a combination of data collection techniques. It utilised a combination of both participatory and non participatory methods to gather data so as to increase reliability. Questionnaires were administered to key informants. Interviews with respondents who were not able to understand English were conducted in vernacular or local language to the respondents. Both non structured, semi and structured interview schedules were used depending on the theme. The study was more qualitative than quantitative in approach. The semi structured interview method was used to collect data from the sample. Informal interviews with key informants and other members of the mining communities, and none participant observations as well as document review was the other method employed as data collection technique. All data was collected by the researcher himself with the help of research assistants by use of a note book, pens and pencils where possible.

### **3.9 Data Analysis**

The process by which data is processed and converted into meaningful statement is referred to as data analysis and interpretation (Ghosh, 1992; Sarantakos, 1993). The purpose of data analysis was to process raw data for interpretation. In this research more qualitative approach was used in data analysis complemented by quantitative approach. To analyse quantitative data Statistical Package for Social Sciences (SPSS) was used to analyse data obtained from questionnaires served to the residents of Makululu and Kasanda Mine Compounds. From SPSS simple frequency tables with

percentages were generated for statistical presentation which helped in data analysis. The views from respondents collected in qualitative data were organised in common themes and analysed by way of narration while quantitative data was presented in simple frequency tables. Descriptive statistics was chosen for quantitative data because it helps to obtain frequencies and percentages in an accurate, precise, easier and fast way.

This study made use of the combination of methods to establish the accuracy of responses. According to (Chilisa and Preece, 2005; Kombo and Tromp, 2006) combination of methods allows the researcher to test one source of data against another. In this way, it proved the quality of data and accuracy of findings. In this study, data from interviews were compared with data from the questionnaires and relevant documents studied. The data from observation was also interpreted in the analysis. Then, a summary and conclusion was drawn.

### **3.10 Validity and Reliability**

Validity and reliability of data was enhanced using the process of combination of various methodologies. This study used the combination of methods of data collection and sources of data. The study used three data collection methods and four categories of sources of data. The combination of methods increases reliability and validity. Validity further examines the extent to which the results of the study can be generalised to the real world (Achola and Bless, 1997). The questionnaire was pilot tested on six (6) residents in the same areas where the study was conducted to obtain validation data and ensure that any anomalies and ambiguous questions were corrected before the questionnaire was finally administered to the sampled population. Interview guides and observations did not require pilot testing since the modification of questions could be made during the time of the study.

### **3.11 Ethical Considerations**

As regards to the issues of ethical consideration, the researcher obtained a letter from the assistant dean postgraduate in the school of education at the University of Zambia to the authorities in the study areas where the research was carried out. This was done in recognition of their authority and to gain their support and cooperation during the study. The written consent to different departmental heads was provided to allow the researcher to conduct a study in Kabwe community and in selected schools. The researcher was introducing himself and the purpose of the study was explained to the respondents. In addition, verbal permission was sought from each participant who was selected in the sample and confidentiality was indicated on the questionnaires. There was no participant who

was forced to give information when they were not willing to do so. The names of participants were not included in this study. All participants in this study, therefore, have remained anonymous.

### **3.12 Summary of the chapter**

The study gave geographical location and economic status of the study areas. Descriptive survey was the design methodology used as described in the methodology chapter. Target population, study sample and sampling procedures were discussed. In terms of data collection procedures, purposive sampling was used to select the environmental educators or providers who had been referred to as stakeholders. Then the simple random sampling method was also used to select the residents to be respondents including the pupils from selected schools in the study areas. This was done to reduce on biasness and increase level of generalisation of the findings to a larger population. On the research instruments, data was collected using two main instruments; questionnaire and interview guide. The data was analysed mainly by qualitative research approach complemented by quantitative approach. The next chapter displays the findings of the study.



## **CHAPTER FOUR: PRESENTATION OF RESEARCH FINDINGS**

### **4.0 Introduction**

This chapter presents findings of the research on residents' awareness of the effects of lead contamination in Zambia's Makululu and Kasanda Mine Compounds of Kabwe District. The presentation of findings is done under headings drawn from the research questions. The specific research questions which were used to answer the general research question were as follows:

- i. how aware are the residents of Makululu and Kasanda Mine Compounds about the effects of lead contamination in their environment?
- ii. what sensitisation programmes on effects of lead contamination have been conducted in the study areas?
- iii. how involved were residents of Makululu and Kasanda Mine Compounds in activities aimed at reducing levels of lead contamination?
- iv. what contributions have been made by environmental education to address effects of lead contamination in Makululu and Kasanda Mine Compounds?

The information presented in this chapter is organised in two parts. The first part dealt with findings from the questionnaires administered to 105 respondents (forming category of residents from Makululu and Kasanda Mine Compounds). The other part involved interviews conducted on 20 respondents who formed the group of facilitators (stakeholders) or environmental health providers. From these groups a total number of 125 respondents were involved in data generation.

### **4.1 Residents' awareness of Effects of Lead Contamination**

This section is a presentation of the research findings obtained using questionnaires from the pupils and residents of Makululu and Kasanda Mine Compounds on their awareness on the effects of lead contamination in these compounds of Kabwe District of Central Province. It is also based on the first research question which is focused on what people know about effects of lead contamination in Makululu and Kasanda Mine Compounds residents respectively. This research question is covering items from 4.1.1 to 4.1.10

#### **4.1.1 Social Background of Respondents**

This subsection discussed the social background of respondents which included: gender, age, educational level, employment status and period of stay of respondents of Makululu and Kasanda Mine Compounds.

#### 4.1.2 Gender of Respondents

From the questionnaires distributed to the respondents, they were asked to indicate their sexes showing their responses as in table 1. The data in table 1 showed that 60.0% of the respondents were males while 37.1% of respondents were females and only 2.9% of the respondents concealed their sex. The data collected showed that there were more males 60.0% who responded to the questionnaires against 37.1% of females. Gender was an important issue to this research question because it helped to understand if EE programmes were designed to cater for both genders without any sex discrimination to enable all learn about effects of lead regardless of their sex.

**Table 1: Respondent by Sex**

Sex	Frequency	Percentage
Male	63	60.0
Female	39	37.1
Sex concealed	3	2.9
Total	105	100.0

**Source: Field Data, 2014**

Having dealt with the gender of the respondents, the next point looked at their age.

#### 4.1.3 Age category of Respondents

The respondents were additionally asked to indicate their age and this was shown in table 2. The data given in table 2 showed that there were more youths 40.0% aged 15-30 and this was followed by 33.3% the age category of 31-40. The next was 14.3% age group of 51 and above. The remaining respondents were in the age group of 41-50 of the minority 12.4%. The data revealed that there were more youths 40.0% aged 15-30 against the minority 12.4% adults aged 41-50. This was very important to the study as it implied that EE programmes that were to be taken in the study areas should have more needs of youths and another to have more needs of adults as the two age groups have different needs in their learning experiences.

**Table 2: Age category of Residents**

Age	Frequency	Percentage
15-30	42	40.0
31-40	35	33.3
41-50	13	12.4
51 and above	15	14.3
Total	105	100.0

**Source: Field Data, 2014**

Having dealt with the age of respondents, the next item looked at their educational level.

#### 4.1.4 Educational Levels of Respondents

The respondents were further asked to indicate their education level attained as shown in table 3. Table 3 shows that 45.7% of the respondents had attained secondary education level. Those who had attained tertiary education were represented by 24.8%. Those who had attained primary education level were represented by 18.1%, while those without education were the minority 11.4% of the respondents. This information was important to the study as it helped to deduce that most of the respondents had basic education which could enable them to understand environmental issues affecting their localities.

**Table 3: Educational levels of the Respondents**

<b>Educational level</b>	<b>Frequency</b>	<b>Percentage</b>
Secondary	48	45.7
Tertiary	26	24.8
Primary	19	18.1
No Education	12	11.4
Total	105	100.0

**Source: Field Data, 2014**

Having established the educational level of the respondents, the next item tackled their employment status.

#### 4.1.5 Employment status of Respondents

The respondents in table 4 were asked to indicate the type of occupation they did. From the data given in table 4, the majority of the respondents 30.5% belonged to the business sector while 23.8% of the respondents belonged to the non working category. The data has shown that the majority of the respondents 30.5% were in business, those not employed were represented by 23.8% and the minority 11.4% of the respondents were those in public sector. This meant that a large number of respondents were not employed in formal jobs. The findings from respondents revealed that some of those out of formal employment dealt in illegal business as they tried to put food on their table. This was due to their source of daily income which was unknown. The information was helpful to establish economic status of residents of the study areas. This information could help to ascertain what residents did for their daily living and know how to incorporate them in the new EE programmes.

**Table 4: Occupation of Respondents**

<b>Occupation</b>	<b>Frequency</b>	<b>Percentages</b>
Business category	32	30.5
Non working	25	23.8
Students	21	20.0
Private sector	15	14.3
Public sector	12	11.4
Total	105	100.0

**Source: Field Data, 2014**

After establishing the occupation status of the respondents, the next item tackled was their period of stay in Makululu and Kasanda Mine Compounds.

#### **4.1.6 Period of stay in Makululu and Kasanda Mine Compounds**

The respondents were further asked to signify the period of their stay in Makululu and Kasanda Mine Compounds respectively. Table 5 shows that 53.5% of the respondents had lived in the study areas for over 5 years. This was followed by 27.6% of the respondents who had lived in the study areas for 3-5 years. The remaining of the respondents 21.9% were the minority who had lived in Makululu and Kasanda Mine Compounds from 0-2 years. The responses on this question were important to the study because it would show whether the activities exposing residents to lead contamination were done by new members in the study areas who did not understand the environmental issues of the areas or because of bad attitude to change. It could also mean that residents despite the long stay had not yet acquired environmental awareness on the effects of lead contamination.

**Table 5: Period of stay in Makululu and Kasanda Mine Compounds area**

<b>Period of stay</b>	<b>Frequency</b>	<b>Percentage</b>
0-2 years	23	21.9
3-5 years	29	27.6
Over 5 years	53	53.5
Total	105	100.0

**Source: field data, 2014**

A summary of the respondent's period of stay in Makululu and Kasanda Mine Compounds led to a presentation on respondents' understanding of the term Environmental Awareness.

In view of Respondents' understanding of the term environmental awareness is shown in table 6. The table shows that majority of the respondents 62.9% understood environmental awareness as having environmental knowledge. The other 22.9% of the respondents knew it as being aware of dangerous substance. The least of the respondents 6.6% said that environmental awareness was environmental change due to human activities. It was important to the study because if respondents

understood environmental awareness, it could be easy to know what still needed to be covered in terms of filling the gaps related to the phrase EA in the study areas.

**Table 6: Respondents' Understanding of the term Environmental Awareness (EA)**

<b>Environmental Awareness</b>	<b>Frequency</b>	<b>Percentage</b>
Environmental knowledge	66	62.9
Awareness of dangerous substance	24	22.9
Environmental management problem	8	7.6
Environmental change due to human activities	7	6.6
Total	105	100.0

**Source: Field Data, 2014**

Having looked at the respondents' understanding of the term 'EA', the next section looked at the state of awareness among the respondents.

#### **4.1.7 State of Awareness among Respondents**

Respondents were further asked to point out level of awareness on the effects of lead contamination as shown in table 7. The table shows that 89.5% of the respondents indicated that they were aware of the presence of lead contamination, while 10.5% of the respondents denoted that they were not aware of the effects of lead contamination in Makululu and Kasanda Mine Compounds respectively. This entails that most of the respondents 89.5% were aware of the presence of lead contamination and they had stayed long time in the study areas. Those who were not aware, 10.5% of the respondents meant that there were no deliberate follow up programmes in the study areas intended to educate residents of lead contamination. Hence, the new comers in these areas were ignorant of the presence of lead contamination. The information was essential for establishing the starting point for EE programmes to the study areas.

**Table 7: State of Awareness among Respondents**

<b>State of awareness</b>	<b>Frequency</b>	<b>Percentage</b>
Aware	94	89.5
Not aware	11	10.5
Total	105	100.0

**Source: field data, 2014**

Having established the state of awareness among the respondents, the next item examined was the source of information for the residents.

For the respondents who answered in the affirmative were asked a further question to indicate the sources of their information and in that respect, table 8 shows their responses. According to the data shown in table 8, most of the respondents 33.3% became aware of the effects of lead contamination through neighbours. The other 18.1% of the respondents became aware through community

facilitators. While 5.7% of the respondents stated that they had not heard anything about lead contamination. The state of awareness was important to the study as it would reveal the actual source of information concerning lead contamination in the study areas. However, the data has revealed that the majority of the respondents 33.3% became aware through neighbours. This could entail that there were no organised EE programmes in the study areas.

**Table 8: How Respondents became Aware of the Effects of Lead Contamination in Makululu and Kasanda Mine Compounds?**

<b>How people became aware</b>	<b>Frequency</b>	<b>Percentage</b>
Through neighbours	35	33.3
When children tested positive	30	28.6
Through community facilitators	19	18.1
Literature/ZCCM-IH/ECZ/KMC	9	8.6
Through former miners	6	5.7
Have not heard anything	6	5.7
Total	105	100.0

**Source: Field Data, 2014**

Having looked at how residents became aware of the effects of lead contamination, the next section looked at methods used to teach awareness.

#### **4.1.8 Methods used to teach Awareness**

The respondents were asked to state methods used to teach residents on effects of lead contamination in Makululu and Kasanda Mine Compounds. The varying responses given were, general meetings, radio programmes, television presentations, observations, door to door, mobile announcements, drama, school gathering (open day and PTA), one to one contact, ladies talk at the market places, school presentations during assembly, health talk at church, youth community meetings, clinic workshops, posters, songs and others expressed themselves in Cibemba said (teti twishibe imisango bafundila mo kabili tatusambilila ifili fyoonse pa lwa cela ca mutofwe) we cannot know the methods used to teach since we do not learn anything concerning lead contamination. The information was important to the study to know which methods would be ideal to use in the suggested EE activities to address effects of lead contamination and to attract more residents' attention to the programme.

Having presented methods used to teach awareness programmes to residents, the respondents were also asked another question to state common health problems experienced in Makululu and Kasanda Mine Compounds. In response to this question some respondents used phrases in Cibemba, English and Cilenje to describe the health problems faced in these compounds.

The following were common phrases that were used:

(Kwaliba ukonaula kwa mwela uku kalamba sana munchende twikalilamo) there is a lot of air pollution in our residential areas. (Mwebakalamba, tuleilishanya pa mulandu wa lukungu ulwima pamulandu wa mwela uu fuma kumigodi ne misebo iyi shapwa) sir, in our area we are complaining of dust blown by wind from the mine dumpsites and unfinished roads. There are also problems of HIV/AIDs and other related STIs and TB. (Tuto chiswa bulwashi bwamu shamba alimwi aku chiswa kwa mwita na mumala mu misena shesu nshotu kala) we are suffering from respiratory infections and abdominal pains in our areas. (Bukale bula lensha bunya nkambo kabuyamba buli mu manda esu alimwi a mu mishika na mumaliketeki maka maka kuchatoka sha kulya) hygiene is pathetic in our homes and market places especially poor food handling. (Kwaliba ukulwishanya munchende twikala pa mulandu wa bwalwa no kukana bomfya bwino imiti iikola kubekala mushi aba shibomba) there is violence in our compounds because of alcohol and drug abuse among unemployed residents.

The common phrases in English to describe health problems faced in these areas were:

There are high poverty levels in these compounds and residents are willing to do anything in order to survive. In addition, some respondents said that there was erratic water supply from Lukanga water and Sewerage Company (LWSC). Some respondents explained that there was also a problem of fumes from chlorine powder. They further claimed that, the councillors and area MPs were aware of their problem concerning poor sanitation and drainage. The other respondents complained of high mosquito bites resulting into increased malaria cases in their areas. Respondents also complained over high lead pollution in water and land, also poor sewer system in the areas. Some respondents criticised poor leadership representation which was not taking the plight of their people at heart. The information was vital to the study because it would help identify the common problems residents faced and incorporate remedies in the suggested EE programmes.

In view of the common health problems, the participants were asked another question to identify the common causes of the stated health problems above. Their responses were in both vernacular and English to describe identified health problems. The following were some of the responses:

(Mwebakalamba, chimoneka kwati amalwele ayengi yaletwa na menshi ayekalila munchende twikala) sir, it seems that most of the illnesses are caused by stagnant water in our compound. (Kwaliba ukukoweshiwa kwa mwela no mushili. Ici kuti twashininkisha muluchelo ilyo umwela umoneka nga fubefube kumigodi icho icileta ubwafya kuli ifwe tuli kumasamba wa migodi) there is lead pollution in both land and air. This is evident in the morning where air pollution appears in

form of fog at the mine plant and affects us on the wind ward of the mine. (Twapenga lusuko nkambo ka mi kwakwa itana kumana kubambwa alimwi a lusuko luswa ku shilongoma shamu migodi) we have suffered a lot from blowing dust from unfinished roads and dust from mine dumpsites. (Abekala mushi abaya ku fimbotela mu kutola ifyela no kwimba cela ca mutofwe munchende bafibika balalunda ku bwafya bwa ukukowela kwa cela ca mutofwe) residents who scavenge metals and lead from the mine dumpsites contribute to the problems of lead contamination. (Abekala mushi bamo babomfya amenshi ayafuma mumigodi ukupanga kwa injelwa. Bamo nabo bekala mululamba lwatumana twa migodi leelo tamwabatamfya) some residents use water from the mine canal to finish their jobs of brick moulding. Some residents are settled near the dumpsites and along the mine canal but you have not chased them. (Twamipapata mwebakalamba, tusoseleniko nokutwafwa pa mulandu wakukoweshiwa kwa cela ca mutofwe munchende shesu. Twali lufya ifibusa ifingi no lupwa pa mulandu wakukoweshiwa kwa cela ca mutofwe. Utufipatala tu nono tatusokolola fye ifi umulandu waku bombela ubuteko ubo ubwafilwa ukutufuta pa mulandu wafitumbuka ukwimba cela ca mutofwe) we plead with you sir, please help speak for us concerning lead poison in our compounds. We have lost many friends and relatives because of lead poison related deaths. The clinic does not just reveal this information because they work for the same government which has failed to compensate us due to effects of lead mining.

Others said the causes of health problems were because of trespassing in the mine area and mine dumpsites where they carry the dust to their residential areas. Many pregnant ladies have the habit of eating soils. The other health problem is the carrying of slag from the mine dumpsites to residential areas and children who play in dust and bare ground are victims.

There was a concern raised on poor sanitation in unplanned settlements hence you find a lot of contaminated food stuff. The respondents also lamented on uncontrolled kachasu brewing and drinking making most people unproductive. They added that this was due to lack of health information on the effects of kachasu and wine drinking. Some respondents revealed that poverty levels were very high resulting into serious prostitution especially among the youths. The other respondents said that facilitators (leaders) were selfish and greedy for they just wanted allowances from the sponsors of the programmes and not interested in serving their communities. There was also a complaint on lead poison, though people continued to eat food stuff grown from lead contaminated areas. The information was important to the study as it would help the environmental facilitators to know what to include in the EE lessons to bring solution to environmental problems faced in the study areas.



#### 4.1.9 Most Vulnerable Groups to Lead Contamination

The researcher further enquired from the respondents to identify the groups of people most likely to be affected by lead contamination as shown in table 9. The table shows that majority of the respondents 61.0% indicated that children were most vulnerable while 25.7% of the respondents reported that all the groups of people were vulnerable. The least 3.8% of the respondents showed that men were more vulnerable to effects of lead contamination than any other group. The responses to this question were important to the study because it would help in planning lessons in EE designed to address problems of a specific group.

**Table 9: Most Vulnerable Groups to Lead Contamination**

<b>Most Vulnerable people</b>	<b>Frequency</b>	<b>Percentage</b>
Children	64	61.0
All groups	27	25.7
Women	10	9.5
Men	4	3.4
Total	105	100.0

**Source: Field Data, 2014**

After considering the most vulnerable groups to lead contamination, the next item looked at why they felt those groups were the most vulnerable.

The respondents were asked a further question to justify their responses given in table 9. There were varied responses and expressions. The following were common responses and expressions. It was revealed that children were most likely to be vulnerable since their immune system was still weak. Children also sleep on muddy floors which are dust. Some research participants denoted that children eat food without washing their hands. The other respondents further revealed that children like playing in dust and eat soil. The children are ignorant of lead contamination. Some respondents elaborated that children play and bath in contaminated rainwater.

In terms of all groups to be vulnerable to effects of lead contamination, the common response was that blown dust does not choose as it affects all, hence all the residents are vulnerable to dust exposure. The respondents also submitted that all residents ate vegetables grown in contaminated areas and frequently drunk contaminated water from shallow wells.

Generally, women are vulnerable because they like to eat unsafe food stuff at the market which is usually poorly handled and blown by dust. Most women also practice Geophagia (desire to eat soil). The other response showed that women are more exposed to dust inhaling because of sweeping the grounds and houses as they also work in their gardens and backyards.

A number of the respondents who said men were most vulnerable indicated that men were miners and scavenge metals and lead from mine dumpsites. Some of the respondents said that men wore dirty and dust clothes daily. They also do cheap business of moulding bricks using canal water in the dambo areas of Makululu Compound. The information was vital to the study as it would help the facilitators to include in their suggested EE lessons pertinent issues to help address effects of lead contamination in the study areas.

The research participants were asked a further question to indicate on how lead contamination affected children, women, men and generally all the age groups of residents of Makululu and Kasanda Mine Compounds. The following were the common phrases in vernacular which came out from respondents: (Twaleumfwa uko abantu baleilishanya pa mulandu wa buchintomfwa bwa bana ba bashimaini) we were just hearing people complaining about the naughtiness of miners' children. (Abantu batila, abana baakuuma kuli sumu ya cela ca mutofwe tababomba bwino mu ma sukulu) people say that, children who have been affected by lead poison do not perform well at school. (Tulechula sana, maka maka abana balailishanya noku kalipwa kwa Mutwe no kubaba mumenso) we suffering a lot, especially children often complain of headaches and eye irritation. (Bana besu bali tyompetwe mu shikolo nkambo kaba mai babo batongoka ayi bana besu nshikopo mu ma classi) our children are discouraged at school since teachers are always complaining that our children are very dull in school. (Batweba ukuti, abana baakuuma kuli sumu ya cela ca mutofwe tabakwata kwibukisha bwino) they tell us that, children affected by lead poison have loss of memory.

The other revelations were that the effects of lead on people and vegetation were that children affected have low brain growth rate resulting into mental retardation. Additionally, some of the respondents stated that children affected have stunted growth and low IQ which result into their low class performance. Other respondents submitted that children affected usually have respiratory infections such as continuous coughs and flu. A number of participants revealed that some children affected by lead poison have convulsions and serious stomachache.

On the part of women, respondents indicated in vernacular that the common effects were: (Banamayo bali pa bukulu balaposa) pregnant women have miscarriages. (Munshita banamayo bali ku mwenshi, ulufumo lulafimba no kukalipwa sana) during menstrual, women have swollen and painful stomach. (Banamayo bala fyala abana abashilakosa no kukana fina bwino bwino) women give birth to premature and under weight babies.

The other responses were specified in English to describe effects of lead contamination on women. Common responses were that there is poor growth of unborn babies and this causes brain damage

and hypertension to the mother. Some said that women usually have breast and cervical cancer, anaemia, abnormal labour pains and headaches. Other participants also stated that women have kidney failures, sometimes deliver abnormal babies or still births.

In terms of effects of lead contamination on men, respondents revealed that men become impotent and they become less active sexually. A number of participants signified that affected men produce weak sperms and small sperm count (quantity). Other research participants further highlighted that affected men suffer from various diseases such as high blood pressure, kidney damage, anaemia and tuberculosis. In addition, some of the respondents said that affected men had stomachache, headache, damaged liver, respiratory infections and poor health.

On the natural vegetation, the common responses were that vegetation leaves and stems turn yellow and brown causing stunted growth to vegetation in these areas. The importance of this question on the effects of lead contamination on people and environment is that it suggested EE lessons would reveal to residents that effects do not only affect crops but people as well.

## **4.2 Sensitisation Programmes Concerning Effects of Lead Contamination in the Study Areas**

This section focuses on the second research question which is based on what sensitisation programmes on effects of lead contamination have been carried out in Makululu and Kasanda Mine Compounds respectively. This research question is important because it helps understand what has been done in terms of sensitisation and what still need to be done. It addresses items 4.2.1 to 4.2.3.

### **4.2.1 Awareness of Sensitisation Programmes**

The respondents were then asked to state if there were sensitisation campaign programmes to address lead contamination in Makululu and Kasanda Mine Compounds respectively as in table 10. According to the table, most of the respondents 63.8% had said that there were no sensitisation campaign programmes while 36.2% of the respondents indicated that there were sensitisation campaign programmes. The information was important to the study because it would help facilitators know what programmes to include in the EE suggested programmes.

**Table 10: Awareness of Sensitisation Programmes**

<b>Awareness of Sensitisation</b>	<b>Frequency</b>	<b>Percentage</b>
No sensitisation	67	63.8
Sensitisation	38	36.2
Total	105	100.0

**Source: field data, 2014**

Having looked at awareness of sensitisation programmes, the next section looked at the institutions conducting awareness programmes.

With regard to institutions teaching awareness programmes, the participants were requested to identify names of institutions or groups of people involved in lead contamination sensitisation campaigns as shown in table 11. From the findings given has shown that 32.4% of the respondents had said that they did not know of any institution involved in sensitisation programmes, while 16.2% of the respondents indicated MoH-Clinic. The minority of respondents 7.6% said that the media (local radio stations) was sensitising residents. This information was vital to the study because it would help to know which other facilitators left out of the programmes could be incorporated in EE lessons to sensitise residents.

**Table 11: Institutions teaching Awareness Lessons**

<b>Institutions in Sensitisation Programmes</b>	<b>Frequency</b>	<b>Percentage</b>
Do not know any	34	32.4
KMC MoH-Clinic	17	16.2
KMC	14	13.3
ZCCM/Mines/World Bank	13	12.4
Inshindo Foundation	10	9.5
YMCA in schools	9	8.6
Media (local radio stations)	8	7.6
Total	105	100.0

**Source: Field Data, 2014**

After dealing with institutions conducting awareness programmes, the next item examined the accessibility of information by residents.

#### **4.2.2 Accessibility of Information by Residents**

The respondents were required to state whether or not it was easy to access information on the effects of lead contamination as illustrated in table 12. The table shows that responses on the question of whether or not respondents easily accessed information. The majority of the respondents 53.3% stated that it was not easy to access information on effects of lead contamination while the minority of the participants 46.7% indicated that it was easy to access information on effects of lead contamination. This was important to the study because it could help facilitators to put in place facilities where EE programmes could be held easily and accessed to increase awareness by all residents of the study areas.

**Table 12: Accessibility of Information by Residents**

Accessibility of Information	Frequency	Percentage
Not accessible	56	53.3
Accessible	49	46.7
Total	105	100.0

**Source: field data, 2014**

Having dealt with accessibility of information by residents, it led to sources of information by respondents on effects of lead contamination.

#### **4.2.3 Sources of Information by Respondents on Effects of Lead Contamination**

The respondents were further asked to state the source of information in their compounds on effects of lead contamination as obtained in table 13. The table indicated that most of the respondents 21.9% showed that residents got information from neighbours. Then 11.4% of the respondents stated that they obtained information during community meetings with community facilitators. The minority of the respondents 6.7% indicated that they were ignorant of any source of information. Knowing the source of information was vital to the study because it could help residents be sure of the reliable sources to obtain information from.

**Table 13: Sources of Information on Effects of Lead Contamination**

Sources of Information	Frequency	Percentage
From Neighbours	23	21.9
MoH-clinic	22	20.9
Library (books)	13	13.4
Community facilitators	12	11.4
Media (local radio stations)	11	10.5
KMC	9	8.6
ZCCM-IH/CEP/Mines	7	6.7
Total	105	100.0

**Source: Field Data, 2014**

Following the discussion on sources of information by respondents, the next item looked at the centres of sensitisation.

The participants were asked a further question to state where they received awareness instructions from. This is shown in table 14. Findings revealed that 22.9% of the respondents indicated that they received sensitisation at the clinic. The other 11.4% of the respondents reported that they received it at the church premises. The least of the respondents 7.6% showed that they were taught from market places. This was important to the study because it could help facilitators of EE programmes outline clearly where awareness would take place from in the study areas.

**Table 14: Centres of Sensitisation**

<b>Centres of Sensitisation</b>	<b>Frequency</b>	<b>Percentage</b>
Clinic	24	22.9
Homes	21	20.0
Not taught (ignorant)	19	18.1
Compound square	12	11.4
Church premises	12	11.4
School premises	9	8.6
Market place	8	7.6
Total	105	100.0

**Source: Field Data, 2014**

Having dealt with centres of sensitisation, the next section examined the community participation of respondents in awareness programmes in the study areas.

### **4.3 Community Participation in Awareness Programmes in the Study Areas**

This section presents the third research question based on investigating residents' participation in awareness lessons on effects of lead contamination in Makululu and Kasanda Mine Compounds. This is covered in items 4.3.1 to 4.3.3.

#### **4.3.1 State of Participation in Awareness Programmes**

The research participants were further asked a question to whether or not they participated in any awareness lessons as shown in table 15. It showed that majority of the respondents 58.1% showed that they did not participate in awareness lessons. The other 41.9% of the respondents indicated that they had participated in awareness lessons in the study areas. This information was important to the study because it indicated that more EE programmes needed to be organised to enable residents participate in awareness programmes so that they could solve their environmental problems.

**Table 15: Participation in Awareness Programmes**

<b>Participation in Awareness</b>	<b>Frequency</b>	<b>Percentage</b>
Not participated	61	58.1
Participated	44	41.9
Total	105	100.0

**Source: Field Data, 2014**

The participants, who responded in the affirmative, were asked a further question to state how often they participated in awareness lessons on the effects of lead contamination as shown in table 16. It is clear that most of the respondents 45.7% affirmed that there was no time of the year they had participated in any awareness lessons. The other 24.8% of the respondents indicated that they had participated in awareness lessons annually. The least of the respondents 7.6% showed that they had

participated in awareness lessons weekly. This was significant to the study because it could show how frequent the residents participated in awareness programmes. This could help facilitators design awareness programmes in EE lessons taught regularly to residents to increase awareness.

**Table 16: Frequency of Participation in Awareness Lessons**

<b>Frequency of Participation in Awareness</b>	<b>Frequency</b>	<b>Percentage</b>
Weekly	8	7.6
Monthly	10	9.5
Every 6 months	13	12.4
Annually	26	24.8
No time	48	45.7
Total	105	100.0

**Source: field data, 2014**

Following the successful tackling of the item frequency of participation in awareness programmes, the next item dealt with was the reasons why some respondents did not participate in awareness programmes.

The participants were asked another question to give reasons why some residents did not participate in awareness programmes in Makululu and Kasanda Mine Compounds on effects of lead contamination as tabulated in table 17. The data showed that 22.0% of the respondents had not heard of awareness programmes. Then 12.4% of the respondents indicated that meetings were held far away from their residential homes. The minority of the participants 7.6% submitted that only relatives and friends to those in leadership were invited to the meetings. This was helpful to the study because it could help in designing EE lessons which could be interesting and all inclusive to benefit every resident.

**Table 17: Reasons for not participating in Awareness Lessons**

<b>Reasons for not participating</b>	<b>Frequency</b>	<b>Percentage</b>
Not heard of awareness programmes	23	22.0
Few trained facilitators	21	20.0
Failure of leaders to organise meetings	18	17.1
Meetings held far from home	13	12.4
Not invited to the meetings	12	11.4
Busy during the week	10	9.5
Only friends and relatives are invited to meetings	8	7.6
Total	105	100.0

**Source: Field Data, 2014**

Next after dealing with why respondents did not participate in awareness programmes, then dealt with involvement in planning awareness.

### 4.3.2 Involvement in Planning Awareness

The respondents were asked to state how they were involved in planning of awareness lessons on effects of lead contamination as shown in table 18. The table shows that 40.0% of the respondents indicated that residents were not involved in planning of meetings. Then 12.4% of the respondents said that they were involved in greening and spreading of uncontaminated soil around their homes. Finally, the minority of the respondents 10.5% stated that they were involved in community meetings in the study areas. This information was vital to the study to include residents in all stages of executing EE programmes in the study areas.

**Table 18: Involvement of Respondents in Planning Lessons of Awareness**

<b>Involvement in Planning Meetings</b>	<b>Frequency</b>	<b>Percentage</b>
Not involved in planning meetings	42	40.0
No idea of any planning meetings held	39	37.1
Involved in greening and soil spreading around homes	13	12.4
Involved in community meetings	11	10.5
Total	105	100.0

**Source: Field Data, 2014**

Having established respondents' involvement in planning awareness programmes, the following item dealt with respondents' need for sensitisation programmes.

### 4.3.3 Need for Sensitisation Programmes

Then respondents were asked a further question as to whether or not they still wanted to receive more sensitisation lessons. This question was important to help the study proceed to the next phase of content covered. The information was also significant to the study because it could help facilitators evaluate the progress of EE lessons offered. This information was summarised in table 19. The table showed that 59.0% of the respondents still needed sensitisation programmes. The other 41.0% of the respondents said that they did not need any sensitisation programmes.

**Table 19: Need for Sensitisation Lessons**

<b>Need for Sensitisation Programmes</b>	<b>Frequency</b>	<b>Percentage</b>
Need sensitisation	62	59.0
Do not need sensitisation	43	41.0
Total	105	100.0

**Source: field data, 2014**

After tackling the need for sensitisation programmes, the next section examined the contributions made by EE to address effects of lead contamination in the study areas.

## 4.4 Contributions made by EE to Address Effects of Lead Contamination



This section presents the research findings based on the fourth research question which focused on contributions made by EE to address effects of lead contamination on people and environment. This is shown in the description and tables below for open ended questions. This section is covered in items 4.4.1 to 4.4.3.

#### 4.4.1 Topics taught in Awareness of Lead Contamination

To start with, respondents were required to state what topics were covered in awareness campaign programmes on the effects of lead contamination on people and their environment in Makululu and Kasanda Mine Compounds respectively. This was presented in varying common responses in Cilamba and Cilenje from respondents on the content of lessons which Makululu and Kasanda Mine Communities received. Respondents said that (pa mpindi ilya, balya abantu balitusambilishe ifyakubyala ifiti ne fyani pa ma ng'anda yesu) at that time those people taught us how to plant trees and grass around homes. Respondents also said that (baka tuisha bukale bubotu bwa mu manda esu ngotu kala) they taught us home hygiene. Some respondents said that (twalisambile nefya kuwamyako umushili ukupitila muku bomfya Umushili u-uweme pa mayanda yesu) we were also taught how to improve the soil around homes. Other respondents also stated that (lyonse intungulushi shilafisa ichishinka, tashifwayapo ukweba ati abapeshi baishiba ifyo abaya bafwilishako balabila) always the leaders concealed the truth and they did not want the poor to know what the sponsors of the programmes said. The information on topics covered was vital in deciding what topics to include in the new EE programmes in order to address the problems of lead contamination.

The respondents were asked a further question to indicate if the lessons were dealt with adequately as shown in table 20. It was indicated that 29.5% of the respondents showed that lessons received had been dealt with adequately while 70.5% of the respondents revealed that lessons were not adequately covered. This information was important to the study because it could help to design new topics to meet the needs of residents in the study areas to enable them solve environmental issues.

**Table 20: Were Lead Contamination lessons dealt with adequately?**

Were Lead Contamination lessons dealt with adequately	Frequency	Percentage
Adequately dealt with	31	29.5
Not adequately dealt with	74	70.5
Total	105	100.0

**Source: field data, 2014**

For those respondents who answered affirmatively, a follow up question was asked to explain why they thought that the lessons were adequately dealt with. From table 21, it was clear that 45.7% of

the respondents gave no response to support that lessons were dealt with adequately, while 18.1% of the respondents stated that greening the yards was taught. The least of the respondents 8.6% pointed out that it was by adding black soil around homes. This information was helpful because it could assist facilitators to understand what lessons were covered and those still needed to be covered.

**Table 21: Reasons for Lessons taught**

<b>Reasons of Lessons taught</b>	<b>Frequency</b>	<b>Percentage</b>
No reasons given in support	48	45.7
Greening yards	19	18.1
Screening of children and food supplement	15	14.3
Reduction on illegal collection of slag	14	13.3
Spreading of soil around homes	9	8.6
Total	105	100.0

**Source: Field Data, 2014**

Having examined the reasons of lessons taught to respondents, the following issue to deal with was the suggested topics for inclusion in awareness programmes.

#### **4.4.2 Suggested topics for inclusion in Awareness Programmes**

The respondents were asked another question to suggest topics they would like to be included in awareness lessons as shown in table 22. The majority of the respondents 27.6% suggested environmental health. The other 21.9% of the respondents indicated that they wanted topics on effects of mining. The minority of the respondents 12.4% suggested topics on pollution in general. The information was vital on suggested topics to decide which topics were to be included in EE programmes.

**Table 22: Suggested topics for Inclusion in Awareness Programmes**

<b>Suggested topics for Inclusion</b>	<b>Frequency</b>	<b>Percentage</b>
Environmental health	29	27.6
Water supply improvement	24	22.9
Effects of mining	23	21.9
Removal of slag from residential areas	16	15.2
Pollution in general	13	12.9
Total	105	100.0

**Source: field data, 2014**

Having dealt with suggested topics for inclusion in awareness programmes, the next subsection examined the behavioural change in targeted areas.

In view of the behavioural change in targeted areas, the respondents were asked to indicate how lessons learnt impacted on the behaviour of people as shown in table 23. The majority of the

respondents 31.4% showed that people had not changed in behaviour as there were no new traits of behaviour that were seen. The other 14.3% of the respondents revealed that change was seen in behaviour of residents through greening of the surroundings of their homes. The least of the respondents 6.7% stated that change was seen in people's behaviour by minimising collection of slag from mine dumpsites to residential areas. This information was essential because it could help in deciding how to evaluate and monitor the awareness programmes in the study areas.

**Table 23: Behavioural change in targeted Areas**

<b>Behavioural change in targeted Areas</b>	<b>Frequency</b>	<b>Percentage</b>
No change in behaviour	33	31.4
Greening homes	15	14.3
Spreading of soil around homes	13	12.4
Children screening and food supplements	11	10.5
Putting up cement slabs or pavements	10	9.5
Women stopped selling and eating soil	8	7.6
Use alternatives (mats, Lexine)	8	7.6
Illegal slag collection has minimised	7	6.7
Total	105	100.0

**Source: Field Data, 2014**

After establishing the behavioural change in targeted areas, the following section dealt with how far awareness programmes had achieved intended results.

In case of how far awareness programmes gained ground, the research participants were asked to indicate whether awareness had gained ground as revealed in table 24. The results revealed from the study were that, the majority of the respondents 67.6% said that awareness programmes had not gained ground, while 32.4% of the respondents believed that the programmes had gained ground. This was essential to help decide new methods to employ in awareness lessons in the study areas.

**Table 24: Has Awareness Programmes Gained Ground**

<b>Has Awareness Programmes Gained Ground</b>	<b>Frequency</b>	<b>Percentage</b>
Not gained ground	71	67.6
Gained ground	34	32.4
Total	105	100.0

**Source: field data, 2014**

For those who believed that the programmes had not gained ground they were asked another question to outline the barriers to the failure of the awareness campaign as shown in table 25. The table highlights responses on barriers to the successful delivery of awareness programmes to residents. The majority of the respondents 19.0% said that they did not learn problems of effects of lead contamination well because facilitators were few to cover the whole compound. The other 14.3% of the respondents explained that the money from World Bank given to appreciate residents

who applied what they had learnt was misused. In due course, funds for the programme ran out. Then 12.4% of the respondents believed that the leaders were selfish and greedy and they did not teach others what they had learnt in lodges and hotels. The least of the respondents 6.7% stated that there was lack of schedule of planned activities for routine teaching. This information was important to establish how to plan successful awareness programmes to achieve good results.

**Table 25: Barriers to the Successful Implementation of Awareness Lessons**

<b>Barriers to Successful Programmes</b>	<b>Frequency</b>	<b>Percentage</b>
Lack of proper lessons on lead	20	19.0
Leaders misused funds	15	14.3
Leaders selfish and greedy	13	12.4
Lack of commitment to serve	13	12.4
Erratic water supply and high water bills	11	10.5
Vandalisms of infrastructure	10	9.5
Poor trained facilitators	8	7.6
Poor information transfer	8	7.6
Lack of schedule and planned activities	7	6.7
Total	105	100.0

**Source: Field Data, 2014**

Having examined barriers to successful implementation of awareness programmes, the next subsection looked at how EE could be used to address effects of lead contamination.

#### **4.4.3 Responses on how EE could be used to Address Effects of Lead Contamination**

The researcher wanted to establish possible contributions that EE could make on the lives of Makululu and Kasanda Mine Compounds residents respectively.

There was a question asked to the respondents focusing on the possible contributions EE could make to address effects of lead contamination among the residents of these compounds as presented in the following paragraphs.

##### **(a) Need to train more Community Facilitators**

The respondents believed that there were very few field workers to manage to cover all the compounds. They suggested that more community facilitators should be trained to enable them to explain environmental issues to the residents. They were of the view that incumbent community facilitators should be equipped with adequate field skills to deliver correct information to the residents. They also thought that if this was done, more residents would be reached. They also said that topics offered should vary on content since qualified facilitators were deployed.

#### **(b) Monitoring of Community Facilitators**

A number of respondents suggested that there was need to supervise community facilitators and monitor how they explained lessons to residents. Respondents also thought that facilitators did not do the right thing because the work was voluntary. Therefore, respondents believed that field workers needed to be motivated by paying them according to the number of households each visited per month, and given bicycles for easy movements. This could help reach more residents in the study areas.

#### **(c) Promote Door to Door Campaigns**

Some respondents were of the view that door to door campaigns would be the best way to communicate to different families than just calling for general meetings which were usually poorly attended. In a door to door campaign, if no family member was found during visit, the facilitator would reschedule when to visit that household again until the message was delivered. The respondents suggested that an identity mark was supposed to be put on the door post the same way Central Statistics Office (CSO) does it for easy evaluation on which households were visited in a given quarter.

#### **(d) Continuation of Awareness Campaigns**

Participants also suggested that what ZCCM-IH/CEP had started should be revamped because the problem of lead was still real. The respondents also believed that there was need to continue informing people of what was happening in their environment since people easily forget and needed constant reminders. The respondents thought that visiting each household four times in a year would capture even new migrants.

#### **(e) Group Shared Experiences**

It was revealed that there was need for community members to come together at least twice in a year to share their life experiences concerning life in their compounds. Respondents said that during this time of meeting, community members would narrate how they faced and solved environmental challenges at their homes. The experience would include children screening, testing for B-Pb and how they received help. The respondents believed that such meetings would encourage those who still had a second thought whether to take their children or not for screening. Other environmental challenges would be shared such as poor sanitation and hygiene.

#### **(f) Community Land Use**

The participants were of the view that community land needed to be used to the benefit of all community members. Therefore, there should be no one member allowed to settle in an area which would risk their own lives and that of other members of the community. In view of this, respondents thought that slag from the mine dumpsites were not to be brought to residential areas as they were a danger not only to the culprit but neighbours as well. The respondents were of the view point that

KMC should restrict settlements in unplanned areas. They thought that this was going to reduce on the transfer of lead contamination to residential areas.

**(g) Communities to Learn Project Ownership**

Respondents were of the view that communities should learn to respect the projects set up in their areas by avoiding vandalism. The participants felt that if people were not taught about the importance of project ownership, even other projects put up would still be vandalised.

**(h) Environmental Education Centres (EEC)**

The participants suggested that there should be EEC set up in strategic public points such as markets, schools, churches and clinic for easy access of information to all at any time. The respondents also submitted that if this was followed very well, it would be an effective way of reaching different groups of people to give them environmental information.

**(i) Community Youth Groups**

The respondents recommended that there was need to form up youth groups and assign them with environmental projects to accomplish in the community such as greening on an organised day when there was community sports. The participants believed that as community members were coming for entertainment, environmental issues should be shared. The respondents thought that in such activities drama could be used to entertain educative pieces of sketches to residents on the common environmental challenges faced in the areas.

**(j) Encourage Community Radio Programmes**

The participants felt that the local radio stations could be used to air debate, quiz, and question and answer time on environmental challenges of Kabwe District on effects of lead, water supply concerns and hygiene. The participants also suggested that focus group discussions and mobile announcements could be effective ways of informing residents on environmental issues faced in these areas if regularly conducted.

**(k) Expert Presentations**

The respondents also suggested that those people who know more about effects of lead contamination should not just attend workshops and seminars to present to a small group of people and collect huge allowances, instead they should talk to a big gathering in compounds. The respondents felt that was going to benefit all the residents since some facilitators who went to learn from organised workshops in hotels failed to disseminate information to others.

#### **4.5 Findings from the Facilitators**

This section discussed the facilitators' responses from interviews on awareness of effects of lead contamination in Makululu and Kasanda Mine Compounds.

#### **4.5.1 Facilitators' Awareness of Effects of Lead Contamination**

This section is based on the first research question which focused on establishing how aware the residents of Makululu and Kasanda Mine Compounds of Kabwe are on the effects of lead contamination on their environment. This is addressed in items 4.5.1 to 4.5.4. Each government official, health provider and selected NGOs (environmental awareness facilitators) were asked individually, rather independently regarding residents' awareness that were offered in the sensitisation programmes in Makululu and Kasanda Mine Compounds of Kabwe District.

In terms of facilitators' understanding of Environmental Awareness (EA), facilitators were required to explain what they understood by the term 'Environmental Awareness'. The facilitators had varying understanding of the term as evidenced in multiple responses presented below.

Most of the facilitators defined EA as making people to know about environmental problems in their surroundings. Some respondents believed that it was being aware of their surroundings and the fact that their activities could change the state of the environment. Other responses suggested that it was a person's environment, while some revealed that it was the condition of the good or bad surrounding. Respondents also thought that it was important to know how dangerous some substances were to the soil, air, water and living things. Some pointed out that it was having information about the surroundings. However, some respondents had said they did not understand the term well. The researcher helped to explain the term that it was an organised teaching received by people from a facilitator on how they could manage their environment. It is important to have such a study because if facilitators understood environmental awareness, they would know what to teach these communities.

#### **4.5.2 Facilitators' Awareness of Lead Contamination in Makululu and Kasanda Mine Compounds**

The facilitators of environmental awareness programmes were asked whether or not they were aware of lead contamination in Makululu and Kasanda Mine Compounds. All of the respondents 100% had said that they were aware of lead contamination in the said compounds. This information was important because it could create confidence in the residents that the facilitators had the knowledge to deliver right information on awareness programmes.

A follow up question was asked to state how they became aware of the presence of lead contamination in these compounds. The common responses were that it was part of their course work at college or university for the work they do. Others said it was through measuring of lead levels in the soil and water using a machine called XFR. Respondents also stated that former miners talked about it, while some became aware when they subjected themselves or a member of their family to screening for B-Pb levels at the clinic. Respondents also revealed that they became aware

through workshops, trainings and seminars conducted by ZCCM-IH in 2004. In addition, others said that ZEMA had introduced topics on environmental risks of mining lead to miners. Some respondents used both print and electronic media of radio, television, internet, magazines, posters, text books, brochures and newspapers. Other respondents said that it was through research institutions like the 'Black Water' and some said they just knew that lead pollutes the environment from school knowledge. Some respondents pointed out that it was through mining companies' reports and when they obtain mining licences. Responses also suggested that it was through a radio programme which was presented entitled 'environment and you'. This was essential because it could help train facilitators in a way they would deliver well awareness to residents.

#### **4.5.3 Methods used to teach Awareness Lessons**

Concerning the methods used by facilitators to teach awareness lessons, the common responses were that group meetings and home visitation (door to door) were organised according to zones of Makululu and sections of Kasanda. Some respondents said that they used information gotten from library books, brochures, magazines, posters, newspapers, film slides and games on lead poisoning. Some responses indicated that it was through use of drama, poetry, mobile announcements, and improved water supply sources. Other responses revealed that it was through focus group discussions, community information and communication, workshops, seminars and teaching children at school who in turn went to share with their parents at home. On the contrary, there were two respondents who said that they did not know of any methods used by different institutions charged with that responsibility to teach others. This was vital in helping to devise EE programmes that could use a variety of approaches to make awareness interesting and attractive to residents.

In view of common health problems faced, the government officials and other stakeholders were asked to state common health problems experienced in these compounds, the common responses were that erratic water supply, blown dust from unfinished roads, mine dumpsites, lead poisoning, poor sanitation, poor sewer system, air pollution, alcohol abuse, HIV/AIDs, TB and STIs were the major causes of these problems. Other respondents also stated that there were improper rubbish sites, water pollution, poor hygiene, stagnant water, malaria, contaminated food, high poverty levels, respiratory infections like coughs and flu. The other responses indicated that there was noise pollution, abdominal problems such as cholera and dysentery, high B-Pb levels in children and mental retardation. However, two of the respondents said that they had no information from ZCCM-IH/CEP or ZEMA on the effects of lead contamination. The significance of this information was for facilitators of EE programmes to know how to address needs of residents.

On the question of common causes of health problems, the common responses were that high poverty levels, high lead poison levels, unprotected play grounds and mine dumpsites, illegal land allocation by politicians, prostitution, flooding, blowing dust from mine dumpsites and unfinished



roads contributed. Other respondents also showed that there was lack of social services such as sanitation, drainage and water supply. Trespassing on the mine area, scavenging for lead and metal from the mine dumpsites, illegal collection of slag to residential areas, selling and eating of soil, lead poison, air, water and soil contamination, low knowledge levels and stubbornness of residents, intake of vegetables that were grown in polluted areas with lead were the main causes. The importance of this was that facilitators would deal with causes of health problems among residents in their designed EE programmes.

#### **4.5.4 Most Vulnerable people to Effects of Lead Contamination**

Environmental awareness facilitators were asked to identify most vulnerable groups of people to effects of lead contamination. Most respondents thought that all the groups; children, women and men were vulnerable. Some of the respondents believed that children were more vulnerable to effects of lead contamination. However, one response indicated that did not have an idea which group was more vulnerable than the other. This information was vital in designing EE programmes that could address the category of residents most affected by effects of lead contamination.

The respondents were asked a further question to give reasons to support their response given in 4.5.4 above and the following were the common responses. Children like playing in contaminated soil and eat soil. They like to play with contaminated water during rainy season as it was difficult to monitor their movements. Other respondents also believed that children had weak immune system and lacked protected play grounds. In terms of women, the common responses were that they eat soil during pregnancy. When doing daily activities of sweeping the yards and house and gardening, they are exposed to lead contamination. Some of the respondents stated that lead was found in soil and that all were exposed to blowing dust from unfinished roads and mine dumpsites, while other respondents believed that men were more exposed to effects of lead contamination because they scavenged lead and metal from the dumpsites. The respondents added that men trespass in the mine dumpsites transferring the lead blown dust to homes. This information was important because facilitators would include in EE programmes the safety measures to help residents live in harmony in their environment.

With regards to effects of lead contamination on people and vegetation, the respondents were asked to explain what they taught on the effects of lead contamination on children, women, men and natural environment. Some of the responses were that children were dull in school or very intelligent. It was also reported that they would be slow growth rate, low IQ, naughtiness, loss of memory (anaemia), severe abdominal pains, and kidney failure. They would also be high blood pressure, brain damage and mental retardation.

On women, the common responses were that they give birth to abnormal babies, under weight babies, miscarriages and still births. Women experienced labour complications, anaemic and

unborn babies were affected. They have terminal respiratory infections which could be suspected to be TB.

When asked how lead affects men, common responses were that they have low sperm production and count, heart problems, anaemic, reduced blood circulation, hence low erection and fertility.

Concerning natural vegetation, the responses given were that crops become stunted in growth, leaves and stems turn brown and yellow, crop failure common, vegetation was difficult to maintain, hence, not easy to notice the effects of lead as they were long term. The importance of this question on effects of lead contamination on people and environment was that it would establish ways to protect residents in the polluted areas.

#### **4.6 Sensitisation Programmes Concerning Effects of Lead Contamination**

This section is based on the second research question focused to establish what sensitisation programmes have been done on the effects of lead contamination on residents' lives and vegetation in Makululu and Kasanda Mine Compounds. This is addressed in items 4.6.1 to 4.6.4.

##### **4.6.1 Facilitators' Awareness of Sensitisation Programmes**

The respondents were asked a question as to whether or not they were aware of sensitisation programmes aimed to address lead contamination in Makululu and Kasanda Mine Compounds. Most of the respondents 55.0% said that they were aware of the sensitisation programmes conducted in Makululu and Kasanda Mine Compounds, while 45.0% of the responses indicated that they were not aware of any awareness programmes in these compounds mentioned above. The significance of this information was that it could help facilitators initiate EE programmes in the study areas to sensitise residents about effects of lead contamination.

##### **4.6.2 Institutions involved in Awareness Lessons**

The government officials and environmental awareness providers were asked to identify the institutions involved in awareness teaching programmes. The respondents gave names of institutions which were there in 2004 at the start of the awareness programme by CEP and respondents clearly revealed that there were presently no institutions sensitising residents. The respondents indicated the following as some of the institutions which were there during the programme inception. They were NGOs (CEP) and government wing of ZCCM-IH/World Bank as sponsors. The other responses showed that MoH-health centres, KMC through local councillors of affected areas, institutions mandated to look into environmental problems such as ZEMA and others. Some respondents pointed out that schools, churches, peer groups and community facilitators sensitised the residents. This information was vital as it could help facilitators include other important institutions which were previously left out in EE programmes provision.

##### **4.6.3 Accessibility of Information by Residents**

The stakeholders were asked as to whether or not it was easy for residents to access information on effects of lead contamination. The majority of the respondents 45.0% said that it was easy to access information, while the other 40.0% of the responses indicated that it was not easy to access information on effects of lead contamination. The minority of the respondents 15.0% showed two responses yes and no. This information was significant to the study as it could improve on the dissemination of EE programmes to residents by setting information centres easily accessible to all.

#### **4.6.4 Sources of Information**

The respondents were further asked a question to name the sources of information on the effects of lead contamination and the common responses were that information was provided for to people by volunteers called Lead Treatment Supporters (LTS). Some of the respondents said information was found in EPICs where books, magazines, brochures provided free information. The respondents also mentioned of health centres and trained community facilitators as sources of information. Others were Churches, schools, community radio stations, peer educators, information education and communication. Some of the responses indicated that information was gotten through drama, sketches and group sensitisation. However, some of the respondents believed that it was difficult to access information since EPICs were vandalised and people decide not to go there anymore. Knowing the source of information was important to the study because it could help residents to be sure of reliable sources to obtain awareness information from.

On centres of sensitisation, the respondents were required to state where residents were taught awareness from. The responses were homes, churches, markets and schools. Other areas were Compound Square like Kakungu square for Makululu central compound, lodges and hotel conference rooms. This was central to the study because it could help facilitators of EE programmes outline clearly where awareness would take place from in the study areas.

### **4.7 Community Participation in Awareness Programmes in the Study Areas**

This section is based on the third research question focused on how residents of Makululu and Kasanda Mine Compounds were involved in activities aimed at reducing levels of effects of lead contamination on the lives of people and the environment at large. This was addressed in items 4.7.1 to 4.7.4.

#### **4.7.1 Facilitators' Participation in Awareness Programmes**

The stakeholders were asked to whether or not residents participated in awareness programmes in Makululu and Kasanda Mine Compounds. Majority of the respondents 65.0% said that residents participated in awareness programmes while the other 35.0% of the respondents said that residents did not participate in awareness programmes. The participation of facilitators in awareness

programmes was crucial in establishing the existence of the sensitisation programmes in the study areas.

#### **4.7.2 State of Residents' Participation in Awareness Programmes**

Then the stakeholders were asked a further question on how often residents of Makululu and Kasanda Compounds participated in awareness lessons. The majority of the respondents 40.0% indicated that they were not sure of how often those charged with that responsibility involved the residents as it were not their responsibility while the other 25.0% of the responses showed that residents participated annually. The minority of the respondents 5.0% said that residents participated weekly. The state of residents' participation in awareness programmes was crucial in establishing where to start from when providing EE programmes to residents.

#### **4.7.3 Involvement in Planning Awareness**

The respondents were further asked if they involved the residents in planning of sensitisation lessons. The responses indicated that residents were not involved in planning because already planned activities were taken to residents to implement. Other respondents said that even fellow stakeholders in the provision of awareness programmes were not involved in planning. Respondents further pointed out that even though residents were not involved in planning but were required to participate in the implementation of the programmes. In addition, respondents observed that with the closure of ZCCM-IH (CEP) office in Kabwe, the sensitisation programmes were almost dying out if not completely dead. Other respondents thought that it was the duty of the local council to plan and execute awareness activities, how they did it, was not their business but council's. Their interest was to see that environmental sensitisation programmes were done. However, some respondents believed that residents were involved in planning through community members who were trained to facilitate. Other respondents observed that residents were involved at implementation level not at planning. The significance of this information was that it could help decide to include residents at all levels of programmes implementation for EE to succeed.

On the responses as to why some residents did not participate in awareness programmes, the stakeholders said that they were aware that the compounds were so big for few trained facilitators to cover them well. The environmental providers also revealed that the residents deliberately did not choose to attend awareness meetings. Some respondents observed that since meetings were held during the work days of the week, most residents were busy with their chores elsewhere. The other respondents complained lack of cooperation between the provincial and local leadership for failing to publicise and organise meetings properly. There was communication breakdown. This information was crucial in designing EE programmes which could be interesting and all inclusive to benefit every resident.

#### **4.7.4 Are Sensitisation Programmes needed or not?**

When providers were asked on whether the residents still needed to receive awareness programmes, all of the respondents 100% said that since lead contamination was still an issue in these compounds, also the awareness programmes needed to be revamped with immediate effect. The information was significant because it could help facilitators evaluate progress of EE lessons.

#### **4.8 Contributions made by EE to Address Effects of Lead Contamination in the Study Areas**

This section is based on the fourth research question which sought to find out possible contributions EE could make to address environmental challenges on residents and the environment at large. This was addressed in items 4.8.1 to 4.8.9.

##### **4.8.1 Topics Facilitators taught in Awareness of Lead Contamination**

The researcher sought to establish what topics the facilitators taught the residents on the effects of lead contamination in Makululu and Kasanda Mine Compounds. Respondents said that the residents were taught on greening, soil remediation (spreading of uncontaminated black soil on yards), good hygiene and how to get public information through the use of the EPICs. The information on topics included was crucial in deciding what topics to include in EE programmes in the study areas.

When asked how lead contamination lessons were dealt, about 75.0% of the respondents believed that the lessons were not well covered, while the other 15.0% of the respondents thought that the lessons were adequately covered. This information was crucial in helping to design new topics to meet the needs of residents in study areas to enable them solve environmental issues.

For those respondents that had said they were adequately covered, a further question was asked to give reasons why they felt that lessons on effects of lead contamination were adequately covered. It was brought out by respondents that residents were well reached in communication as vernacular was used in teaching. Only those residents were stubborn to change. Respondents further stated that ZCCM-IH had to import uncontaminated soil from Lukanga swamps and gravel for residents to see the gravity of the problem. Responses further indicated that residents were taught on greening and that ZCCM-IH had built EPICs for residents to get information on lead contamination. Respondents further observed that ZCCM-IH had built pavements on few households to show to those who had the capacity in future and wanted to put pavements at their yards. Other respondents said that the impact of lessons is still seen to date as residents still receive food supplements such as soya, beans, milk and medication to those found with high B-Pb levels.

Respondents reported that trained facilitators worked hand in hand with KMC to teach residents, though this had been derailed due to council's lack of funds to support the programmes. In addition, respondents said that there had been noticeable reduction in the selling and eating of soil at markets. One stakeholder emphasised that according to CSO reports had shown that residents were aware

and discouraged not to follow untrue versions of literature more especially those written by a named international NGO as it stood to discredit the Zambian government.

However, some of the respondents stated that the problem of lead contamination still existed but very few residents were sensitised hence the programme was not well dealt with. Other responses observed that there has been few sensitisation meetings conducted and little literature on lead issues were made available to residents in those EPICs. Some stakeholders showed concern despite giving council a huge amount of money by World Bank to help solve a number of environmental challenges faced in these compounds. All play parks and compound EPICs were in a deplorable state except for Clayton Park and town centre library. This was significant because it could establish lessons covered and not.

#### **4.8.2 Suggested topics for Inclusion in Awareness Programmes**

In terms of the suggested topics to be included in awareness programmes, most of the stakeholders unanimously said that safe water supply sources must be improved. Efficient removal of slag from residential areas was another. Easy accessibility to public information by the poor of the poorest, and devise a system that would easily monitor facilitators' activities and keep information of activities undertaken. Some of the stakeholders suggested that teachings of effects of mine dumpsites as dangerous sources of lead poisoning. The effects of mining in the surrounding residential areas were also not adequately taught as outlined under environmental health and pollution in general. This therefore, entailed that more awareness programmes were needed to be emphasised in EE programmes.

With regards to behavioural change in targeted areas, the revelations from the stakeholders were that parents told their children to avoid playing on unfinished roads, (mwebana twapapata, mwila yangalila mu misebo iishapwa na mufibansa umushaba ichani pantu mukakwata ubwafya bwa sumu ya cela ca mutofwe) please children, do not play on unfinished roads and bare grounds, you will be contaminated by lead poison. In addition, women have minimised selling and eating of soil in market places. Some of the respondents stated that residents wetted the ground before sweeping and digging gardens to stop dust from rising. They also practiced greening and soil remediation around their homes. The respondents revealed that vendors cover food stuff and no longer spread food stuff on the ground when displaying for sale.

Responses also indicated that households use natural manure in gardens. Other respondents said that residents had minimised on illegal collection of slag from mine dumpsites to residential areas. Respondents also said that residents went to clinics for screening, received food supplements and medication. Further, respondents said that parents wash their children's clothes after playing in dust and bath them before they went to sleep. A further explanation was that pregnant women had

reduced on miscarriages due to information learnt in clinics. The providers also explained that teachers in schools had known how to handle pupils from these areas.

On the issue of behavioural change, contrary responses were recorded that there was no noticeable change in behaviour as residents still worked and settled in polluted areas on the canal banks. The KMC and even the minister of Local government and housing had failed to address the problem in question. As not all people are the same, other residents were stubborn to accept change. It was business as usual. This information was significant to establish evaluation and monitoring mechanism in awareness programmes in the study areas.

#### **4.8.3 Has Awareness Programmes Gained Ground**

Some of the providers expressed that in schools individual teachers were free to incorporate environmental awareness during the normal class teaching if they wished to. Other providers said that residents had become aware and avoided exposing themselves to lead contamination. Responses also stated that many parents were not allowing their children to play in bare grounds. Some respondents pointed out that residents mop floors regularly, use mats instead of carpets, lexine sofas in place of velvet ones. Responses also noted that residents green yards, soil remediation and clean water supply. A further point was added that residents were taught on dangers of allowing children bath in waterway and using that water for brick moulding and gardening in the dambos of Makululu compound. Respondents stated that ZCCM-IH and CEP built EPICs and play parks to provide information and safe play grounds for children. Nevertheless, some respondents revealed that the programme did not seem to have helped in changing residents' old way of life. Some parents were hesitant to take their children for screening at the clinic because of blood which was involved. Other respondents said that residents were still ignorant of good health living.

Respondents said that in the absence of ZCCM-IH and CEP residents easily forgot what they had learnt and needed constant reminder. Other respondents explained that ZCCM-IH stopped funding the programmes before they could gain ground and since then residents no longer showed interest on learning about effects of lead contamination. Most responses suggested that the programmes needed to be encouraged. This was helpful to establish variety of methods to employ in awareness programmes in the study areas so that the programmes were acceptable to residents.

A follow up question was asked about the possible barriers to the successful running of awareness campaign programmes. Some respondents felt that ZCCM-IH and CEP were not transparent in calling for meetings and workshops since money was involved. They left out a number of technocrats such as health workers and EHTs in planning. This meant that more residents who were trained were less educated and failed to interpret environmental issues to the residents. Respondents believed that most literature was in English and no books were printed in local languages. Some

respondents said that the EPICs were vandalised in communities and all books, computers, game discs, film slides on lead were removed to town information centre. Some of the community centres had been turned into counselling centres for youths. Other responses suggested that after pulling out, ZCCM-IH and CEP funds could no longer be available to appreciate those who were greening and that discouraged many from continuing in the programmes. Lack of funds resulted into the natural death of the programmes, more especially that the programmes were handed over to KMC which had no financial muscle to continue such activities.

Respondents also revealed that KMC had weak by-laws on settlements planning as they still have failed to relocate residents settled on canal banks especially in Kasanda East and Chowa West. These settlements resulted into constant flooding during rainy season in Makululu, Chowa and Katondo Compounds. Respondents further lamented over KMC inability to employ qualified librarians who knew how to help readers with correct information and books. Respondents also complained that KMC had failed Kabwe residents administratively by allowing a lot of wrong things to continue happening such as illegal settlements. The respondents observed that there were lack of sensitisation on local Medias (radio and television stations), lack of local language brochures, magazines and local newspapers.

Respondents said that programmes were not fully explained to the residents for them to appreciate the projects before implementation. This was the reason why all the EPICs and play parks in community location for an exception of Clayton Park have been vandalised. This made the programmes unsustainable and short lived without much success.

Respondents reported that more households still lacked clean water, making greening very secondary. The providers revealed that most residents in Kabwe were not formally employed hence failed to get good nutrition which was good for those in lead contaminated places. Those made most residents view such programmes as time wasters and decided not to attend meetings especially after withdraw of ZCCM-IH. The funds became difficult to access to appreciate residents for attending meetings. Respondents further observed that residents were more concerned about their food and not about things that seemed remote. Responses revealed that such bad attitude left many residents ignorant of effects of lead contamination in the communities. The providers also reported that government had not done much mitigation on lead contamination eradication after benefiting from abundant mineral wealth that was mined in Kabwe, but did less to protect the lives of the residents around the mining area. The information was important because it could help improve successful planning of awareness programmes.

#### **4.8.4 Responses on Contributions that could be made by EE to Address Effects of Lead Contamination**



The researcher sought to establish the best way EE could possibly be used to contribute to address the effects of lead contamination in Makululu and Kasanda Mine Compounds. The respondents said that the best possible way EE could contribute to address the effects of lead contamination in awareness programmes were:

**(a) Localised Curriculum**

It was established that EE should be put in the local curriculum for all Kabwe schools and be examinable to all pupils in Kabwe District concerning the local environment and its challenges. This would help children grow into adulthood able to respect and appreciate the environment. Other respondents said that this information could be incorporated in the local schools curriculum through DEBS' office. That idea had died prematurely after World Bank withdrew its funding to the project. It was further suggested that such programmes could work well if it was incorporated through school health activities which required governments' will power to help MoE through CDC plan and implement workable localised curriculum for Kabwe schools and incorporate topics of local curriculum into the syllabus. That initiative could increase sensitisation levels in the communities where there were children. If taught of effects of lead contamination, children could share with their parents at home. In addition, children easily adopt to change and could grow up into adulthood with the knowledge of environmental awareness.

**(b) Involve more Technocrats in Awareness Programmes**

In the light of best ways of executing EE activities, respondents thought that more technocrats should be incorporated and consulted to find help on how the programme could yield intended results. These technocrats could be involved starting from planning meetings to the implementation stage. They could as well be used in training of facilitators as they were key resource persons in information dissemination and that different stakeholders reached different classes of society. Respondents suggested that nurses, nutritionists, midwifery and EHTs should be fully involved in workshops, seminars and general meetings discussing how environmental awareness programmes could be conducted.

**(c) Improve Literacy Levels of Residents to Reduce Language Barriers**

The respondents were of the view point that formal education should be encouraged to help improve on literacy levels for residents to acquire information about lead poison. It was further noted that introduction of literacy classes to residents could help reduce communication barriers.

**(d) Improve on Presentation of EE Activities**

Respondents said that these activities would enormously improve the lives of residents through drama, poetry and videos from other countries with similar problems. Other activities included would be pictorial flaps to children showing dangers of lead contamination, one to one sensitisation, and group discussions in public meetings to increase awareness and skills about caring for their

environment. It was further suggested that EE activities should be used to teach residents through clinics, churches, schools and market places. Further still that residents should continue to receive food supplements and medication for those with high B-Pb levels. A further observation was that independent institutions and NGOs should help in environmental awareness needed in training. Some responses suggested that more environmental teachers should be trained and a separate department to be opened looking at how EE activities were run in the country just as it was obtainable in other countries. The other respondents accounted that EE lessons should be on going as residents forgot, others shifted into other compounds and new ones came in.

**(e) EPICs to be Active in the Communities as Public Information Centres**

On the vandalised information centres, respondents stated that centres in Makululu and Kasanda needed to be revamped to their original ideals as active information centres where residents could get environmental education information at any time a resident visited the centre. It was believed that council had the human resource to provide EE activities in those information centres through the department of public health and settlements in urban and peri urban. The centres should therefore be made into permanent places which were reservoir of information.

The other responses suggested that residents needed to be sensitised on the EPICs and play parks as their own projects. In such a manner, residents could be contributing a small amount for maintenance purposes. Vandalism of community projects came because the community was not involved and consulted. No wonder, the projects were targets of vandalism by the community. Other respondents said that government should construct more clinics in the areas with full involvement of the community in order to completely address the problem of lead contamination.

**(f) Emphasis on Attitude change towards EE Programmes**

The respondents said that in order for EE activities to be successful, residents need to be taught on attitude change. The civic leaders need to be involved to encourage residents to learn and respect programmes taught on environmental care.

The respondents also added that, the trained facilitators on environmental awareness needed to be given an incentive to make them spend more hours intensifying on conducting awareness lessons to residents in the compounds. A further thought was given that business houses in Kabwe and outside could be requested to fund environmental awareness programmes as it had already started. In addition, respondents were of the view that government needed to be fully involved in trying to address the problem of lead contamination as it bordered on lives of the future leaders of mother Zambia.

Concerning dust, it was said that government through the local authorities in Kabwe needed to tar all the compound roads to help suppress rising dust in these areas due to over speeding cars. It was also suggested that EE activities should encourage the teaching of good nutrition to residents such

as local munkoyo, mazoe, milk and soya which help neutralise lead contamination. It was further stated that radio programmes should be encouraged where quiz and debates were aired especially using local language to discuss effects of lead contamination in Kabwe.

#### **4.9 Summary of Chapter four**

The chapter presented findings of the study on the residents' awareness on the effects of lead contamination in the study areas. It was established that most residents knew about lead contamination. Though, they had little knowledge of the presence of environmental degradation and poor access to information concerning lead poison. About 70.6% of the respondents said affirmatively that they were not aware of programmes operating in their compounds. The main education received was on greening, home and general hygiene, soil remediation and water supply source improvements. The methods that were used were mobile announcements, door to door sensitisation, general meetings, and focus group discussions. The respondents also complained challenges on accessing information among which was few trained facilitators, lack of funding and residents' involvement in consultative meetings before implementation.

The study suggested that the government should help MoE through CDC to localise the curriculum to enhance awareness activities in the areas. In addition, EE activities should be presented in more interesting and educative manner such as through drama, poetry, radio quiz and debate. More technocrats should be incorporated into the programmes in order to add dynamism. The next chapter presents discussions of findings on the study.

## **CHAPTER FIVE: DISCUSSION OF FINDINGS**

### **5.0 Introduction**

This chapter presents the discussions of the findings of residents' awareness of the effects of lead contamination in Zambia's Makululu and Kasanda Mine Compounds of Kabwe District, Central Province. The discussion is based on the four objectives, which were:

- (a) to establish the state of awareness of residents of Makululu and Kasanda Mine Compounds of Kabwe about the effects of lead contamination on their environment.
- (b) to determine how much sensitisation has been done concerning effects of lead contamination in their lives.
- (c) to investigate the nature of residents' participation in different activities aimed at reducing the effects of lead contamination in the affected areas.
- (d) to establish the contributions made by EE to address the effects of lead contamination on the lives of people in Makululu and Kasanda Mine compounds of Kabwe District.

### **5.1 Residents' Awareness of Effects of Lead Contamination**

The first objective was aimed at establishing how much residents of Makululu and Kasanda Mine Compounds know about the presence of lead contamination and its effects in their environment. This is addressed in items 5.1.1 to 5.1.8

#### **5.1.1 Social Background of the Respondents**

This subsection discussed the social background of respondents which included: gender, age, educational level, employment status and period of stay of respondents in Makululu and Kasanda.

#### **5.1.2 Gender of Respondents**

In this study, there were more males, 60.0% than females 37.1% and 2.9% had not shown their sex. The distribution of gender would entail coming up with awareness programmes that should consider roles, needs and participation of both men and women. In this case, it was easy to deduce that men dominated even in meetings. Culturally, in most Zambian traditional, women are considered second class citizens who should remain quiet in the presence of men. Therefore, their participation was greatly marginalised as evidenced above where more men took part in most compound activities. This meant that most women in such cases may remain ignorant of impacts of mining especially on effects of lead contamination. It was also clear that, certain methods in communities clinging to traditional beliefs could not be used to present EE programmes. For example in focus group discussion, it could imply that women would not contribute no matter how varied their points could

be on solutions to effects of lead contamination. This could affect the progress of awareness programmes in the study areas. In agreement to this assertion, Rosenberg et al (2008) has shown that sometimes people's situations do not allow them to act in line with the values they hold. For example, a female facilitator grown up in a society that considers men's superiority could fail to deliver awareness lessons to male clientele. However, in this modern era, gender matters are being promoted by all sectors. Hence, EE programmes should be designed to use variety of methods that cater for both genders without sex discrimination.

The same is true for age as a variable. In this study, age of respondents had an influence on the outcome of awareness programmes that would be suggested. As shown in 4.1.2 of chapter 4, most of the respondents 40.0% were youths aged 15-30, while adults constituted 33.3% from the age of 31-40. The information collected on age distribution in the study areas focused to meet the needs of youths and another needs of adults as the two age groups have different needs in their learning experiences. The idea is acknowledged by Rosenberg et al (2008), who indicated that it is important to take learners individually as they have different learning styles. In addition, a broader range of different kinds of methods generally helps people to address a broader spectrum of environmental learning outcomes. This could be through use of variety of methods to increase chances for everyone to learn.

### **5.1.3 Educational Levels of Respondents**

The frequency table 3 of chapter 4 item 4.1.3 indicated that most respondents 45.7% had completed secondary education. The respondents with tertiary education were represented by 24.8%. The minority responses 11.4% were those without education. This, therefore, was enough information to deduce that most of the respondents had basic education which enabled them to understand environmental issues affecting their localities than those uneducated. However, basic education alone could not be adequate enough to enable residents understand environmental issues and appreciate the environment itself without EE and education awareness programmes in the areas. It could also be stated that though educated, respondents had poor source of environmental awareness on effects of lead contamination as shown from data collected in item 4.2.3, of chapter 4, table 13, and showing source of information given by neighbours 21.9%. This source of information was not reliable as it could not cover in the same way facilitators could do. In line with this assertion, ATSDR (2007) indicates that quality EE could only be provided by experts in environmental training where they provide information about the environment. Lack of good source of information entails that residents could continue to scavenge metals and lead from dumpsites and pregnant women continue to eat soil.

Acknowledging the above assertion, ECZ (2007) indicated that well informed people would avoid activities that expose them to be vulnerable to lead contamination. It further elucidates that the effects of lead contamination could be aggravated by lack of EE and environmental awareness among residents, especially among adults and children with low literacy levels. In the same vein Loubser (2011) has also shown that good education helps people to live in harmony with their environment.

There was more need for EE activities or programmes to teach people skills, attitudes, and code of behaviour. Additionally, there should be values of identifying and appreciating environmental problems and how to solve those environmental issues more efficiently without causing damage to the other part of the environment.

However, it was also clear that the levels of illiteracy are still high as indicated by the findings represented by 11.4% of the respondents who were uneducated. This is in line with the survey report of CSO (2004) which has shown that in the survey conducted in 2004, more people were illiterate than those who were literate. The same results were repeated in the survey of 2006. ECZ (2006) in line with this statement had shown that the percentage of Zambians who had not attended school was still high especially among the old age groups. This could be the reason residents engage in activities exposing them to lead contamination in the study areas.

#### **5.1.4 Employment Status of Respondents**

Frequency table 4 in chapter 4 items 4.1.5 showed that majority of the respondents 30.5% were in business, while 23.8% of respondents were unemployed. The minority of the respondents 11.4% were the only ones in public sector (formal employment). This meant that a large number of respondents were not in formal jobs. The findings revealed that although majority of the respondents were in business, it may be possible that some of them could be dealing in illegal business since the type of business for the source of their daily income was unknown. In case of high unemployment in the study areas was that the unemployed could be involved in activities such as scavenging metals that would increase effects of lead contamination in homes of residents of Makululu and Kasanda Mine Compounds as they looked forward to better their living standards.

In agreement with this ECZ (2004) has revealed that unemployed people in struggling to earn decent living, poverty stricken residents scavenge on scrap metal in the highly contaminated dumpsites which pose health hazard. Health in such cases was not given a priority as they put emphasis on improving their livelihood. In line with that ECZ (2008) has observed that, unemployment has resulted in increased poverty, poor sanitation, poor quality drinking water,

malnutrition, dysentery, cholera, malaria, HIV/AIDS, tuberculosis, air pollution and other health problems related to mining activities. Lack of education implied that it was the beginning of all unacceptable activities which could cause harm to individuals and the entire community. The situation demands for EE activities that may not only respond to the environmental problems but to economic and social problems to improve lives of residents in the study areas who are not in employment but engage into stone crushing and slag collection to beautify residential areas and for sale.

### **5.1.5 Period of stay in Makululu and Kasanda Mine Compounds**

Table 5 of chapter 4 items 4.1.6, has shown that most of the respondents 53.5% had stayed in Makululu and Kasanda Mine Compounds for over 5 years, while 27.6% of the respondents had stayed in the study areas for 3-5 years. Then 21.9% of the respondents revealed that they had only stayed in the study areas for less than 2 years.

This revealed that though there were a good number of residents who had stayed in the study areas for long, the number of incoming migrants was also increasing. This meant that if EE programmes were not regularly conducted there was a possibility that most new comers in the study areas could be ignorant of environmental problems of the areas. In line with that Dorcas (2003) mentioned that, there must be continuous sensitisation or education in lead pollution since lead is naturally occurring. This was evidenced by the data given above. Furthermore, for those who had stayed long enough, the implication would mean that such respondents could have had enough environmental information about the nature of environmental issues which had affected the community but had not translated that into behavioural and social change to influence their life style regarding lead poison. These residents would have lacked attitude change towards the environment which continues to be bad. The responses on this question were important to the study because it would show whether the activities exposing residents to lead contamination were caused by new members in the study areas who did not understand the environmental issues of the areas, or that despite the long stay residents had not yet acquired environmental awareness on the effects of lead contamination.

The same is true to respondents' understanding of the phrase environmental awareness; respondents understood environmental awareness (EA) differently. The majority of the respondents 62.9% understood it as having knowledge about the environment. The other 22.9% of the respondents understood it as being aware of dangerous substances in the environment such as pollution, for example lead and zinc materials. The minority of the respondents 6.6% understood it as environmental change due to human activities such as agriculture, mining, disposal of waste and charcoal burning. The same was true for the environmental facilitators who had also different

understanding of EA. The fragmented responses on the understanding of the phrase EA from both the residents and facilitators entails that there was still much needed to be done in terms of filling in gaps related to the concept of EA and EE activities in the study areas.

However, in acknowledging the above understanding, Ariasingam et al (1999) showed that EA was environmental knowledge for civil society, children, parents, village leaders and government officials. In agreement to this thought of EA, ILO (2011) indicated that EA is to have knowledge about the environment which could help people live in harmony in the environment and find solutions to existing environmental problems. Therefore, EA should not only be understood as having knowledge about the surroundings. It should go beyond mere surroundings. It should include understanding of the physical surroundings, socio-economical and political aspect that organise people in the context of these surroundings. Agreeing to this statement, Lupele (2002) mentioned that the communities need to be empowered with relevant knowledge to help them able to preserve their natural resources and how to live in less conflict between human beings and nature. This is supported by Namafe, 2013 and UNCED, 1992 who agree that EA is multidimensional in nature; hence it should be understood in interrelatedness to cultural values, skills, norms, awareness, attitudes and knowledge.

This situation shows a mismatch between the EE providers and residents of the study areas. The implication of the difference in understanding the phrase shows that there were no designed and coordinated EE programmes on awareness between facilitators and residents. This therefore, brings a lot of questions whether the facilitators conducted EE programmes in the study areas. It could also imply that EE programmes were on paper for execution and did not expand in the study areas due to lack of funds to coordinate them well.

#### **5.1.6 Residents' Awareness of Lead Contamination**

On the awareness of lead contamination, the study revealed that 89.5% of respondents were aware of lead contamination while 10.5% of responses said they were not aware. This situation implied that there was awareness programmes conducted in the study areas. However, the knowledge has not been translated into behavioural and social change to influence residents' life style regarding effects of lead contamination as attitude of residents towards the environment continue to be bad. In acknowledgement to this idea ECZ (2006) notes that the level of environmental awareness among residents of the mining communities has not improved on the negative impacts of mining, to the extent of influencing enforcement of environmental awareness programmes in the areas.

On the other hand, it could entail that incoming migrants were the ones who were ignorant of lead



contamination. It could also imply that, the incoming migrants who were ignorant of effects of lead contamination were involved in illegal activities which could harm them and other community members. This could be due to lack of environmental knowledge about their localities. Consenting to this, IUCN (1980) mentioned that EE targeted to produce citizens who were knowledgeable of problems associated with the biophysical environment and were aware of how to help solve those problems and motivated to work towards their solution. This would imply that EE activities should help social groups and individuals develop skills for identifying and resolving environmental problems. Although, the scenario suggested that there was less provision of EE to help address most environmental issues in the study areas. This therefore, calls for EE activities to address the negative impacts of mining.

Further, the findings on sources of information revealed that environmental facilitators, stakeholders and residents of the study areas had varying responses on this matter. Despite the varying responses, they all identified sources of information among which were neighbours and course work for those who were professional health workers. These would not be reliable sources of information because they could not give information as EE would. The responses indeed confirmed that there was need to have reliable sources of information concerning effects of lead contamination. Agreeing to this idea, ECZ (2007) acknowledges that communication channels need to be reliable which could include radio, television, newspapers and educational materials such as booklets, posters and brochures.

This situation of varying responses in their source of information concerning effects of lead contamination entails that there were no organised awareness programmes specifically designed to target residents' education on effects of lead contamination in their communities. This case also implies that there was casual approach of the programmes in the manner they were conducted. It could also mean that there was lack of communication and absence of education meant to empower the residents.

#### **5.1.7 Methods used in Awareness Programmes**

As regards the methods used, findings revealed a lot of similarities between the residents' and facilitators' responses. The respondents identified use of seminars, workshops, focus group discussions, general meetings, radio programmes and door to door. The other methods identified were posters, brochures and books. The responses indeed confirmed that there was need to vary methods of delivering EE to local residents. ATSDR (2007) agrees to that assertion by indicating that experts and funded partners met with individuals through community gatherings in open forums, and even at their homes to listen to their environmental health concerns provide

information and conduct investigations. In addition, Loubser (2011) has mentioned that different strategies and methods could be used in teaching awareness, such as peers, group discussions, debates, panel discussions, guest speakers, oral reports, demonstrations, cooperative group work and problem solving. The implication was that there could have been lessons provided to make residents aware of lead contamination in their localities, but lacked follow ups, monitoring and evaluation of the performance of awareness programmes for the purpose of making improvements.

The facilitators mentioned that EPICs were methods used for easy access of free books, video games, film slides, cameras about lead contamination in other countries. They also mentioned strategies through provision of free supply of tap and kiosk water to residents of the study areas. On the contrary, residents complained lacking books and equipments in those EPICs as all materials about lead contamination were transferred to town information centre. Accessing information through town information centre was difficult for poor residents of Makululu who were required to pay a daily subscription fee of k3.00 or an annual membership fee of k30.00. This information revealed how facilitators had little or no physical contact with the grassroots but based their information on books they read. That could imply that facilitators did not know exact problems their clientele were facing on the ground.

In case of improved water supply, it was true that CEP put up water tanks in Makululu and Kasanda Mine to improve water reticulation. Initially, tap and kiosk water was supplied freely to residents of the study areas before these facilities were handed to Lukanga water and Sewerage who commercialised them. Residents now pay k47.00 per month for tap water and k4.00 per month for kiosk water. This explained why residents in the shanty compounds still used shallow wells for drinking water even though contaminated but was accessible. Mweemba (2013) has complemented this statement by mentioning that without awareness in place, society would not understand the need for change. Therefore, EE activities should be designed to change residents' behaviour and attitude towards new strategies and methods of awareness of lead contamination.

However, residents with great dismay expressed ignorance of methods used since they did not learn anything. Respondents expressed themselves in Bemba saying in common phrase such as; (Teti twishibe inshila shibomfeshiwa mukufunda ukwishiba palwa bwafya bwa cela ca mutofwe pantu Tatusambililapo icili conse) we cannot know the methods used to teach awareness since we do not learn anything concerning lead contamination. This may entail that residents could not have learnt anything to make them aware of effects of lead contamination in their communities except hearing from their neighbours. This could have been the reason residents were putting up permanent structures in contaminated areas due to the ignorance on effects of lead contamination. Supporting

this idea, ECZ (2006) mentioned that poor attitude of the general public and low awareness were the standing barriers to sound health. Thus EE and public awareness activities are needed for change of attitude and mindset of residents.

The same is true for common health problems faced by residents of the study areas. Makululu and Kasanda Mine residents were able to state general environmental problems in these areas related to lead mining. The most highlighted environmental problems were lack of vegetation growth, water, dust, and air and land pollution. The other environmental problems mentioned included respiratory infection, abdominal pains, erratic water supply, poor sanitation and drainage, HIV/AIDS, TB, violence and alcohol abuse. This information agreed with CSO (2011) which identified respiratory infections, abdominal pains, malaria, poor sanitation and drainage as prevalent environmental problems to the residents of the study areas. Stephens and Ahern (2001) acknowledged that local communities get exposed through air, water, soil and land pollution which directly impacts on their health.

On the contrary, some residents explained that during the days of ZCCM these diseases did not bother them as they had free medical services at mine hospital. These services were paid for by the mine through ZCCM. This claim was in agreement with Mankapi (2001) which has shown that before the closure of the mine, ZCCM used to provide social services for mine workers and their family members in townships of Chowa and Kasanda Mine. The services included education, water supply, sanitation and medical facilities.

In Kabwe, it is evidenced by the level of unemployment currently that most people depended on the mining companies and after their closure that could have affected residents' income flow. This has made most households unable to access services they used to before the closure of the mines. This implies that more deaths take place since most residents have poor diets and fail to pay for their medical bills when they become sick from lead related illnesses. The implication also is that such residents lived a frustrated life, no longer cared what happens to them in looking for food. Alternatively, they even engage themselves in activities exposing them to effects of lead contamination. In line with the idea above World Bank (2002) has indicated that most people with poor education standards, poor family income and large families focus their efforts on fulfilling the basic needs like food, shelter and decent income.

As already indicated, most poverty stricken residents were the ones who scavenged lead and scrap metals in trying to raise their standard of living for their families. Therefore, poverty drives them to do anything.

On the type of common causes of environmental health problems, both the residents and facilitators were able to underscore the causes of health problems in these communities. The most highlighted problem causes included stagnant water, lead contamination and polluted air, blowing dust from unfinished roads and mine dumpsites. Other causes mentioned included scavenging metals and lead from mine dumpsites, geophagia, trespassing in the mine areas and mine dumpsites. The residents' claims on causes of environmental health problems to Kasanda Mine and Makululu Community was supported by ECZ (2004), which acknowledged that in struggling to earn decent living, poverty stricken residents scavenge on scrap metal in highly lead polluted dumpsites which is a health hazard. To such people, health in these situations is not given a priority as they put emphasis on improving their livelihood.

Therefore, this is clear evidence that in these areas mining related activities are the main causes of environmental health problems. This also entails that in doing activities which expose them to lead contamination, even their health is compromised. This idea is complemented by ECZ (2007), which identifies that well informed residents avoid activities that expose them to be vulnerable to lead contamination. That could result from lack of adequate environmental knowledge by residents. Therefore, it is important to design environmental awareness programmes which could help residents avoid engaging in activities exposing them to lead contamination. The other implication is that people have no other formal jobs to do, hence engage in illegal mining which paid them little and left their health deteriorating due to lead contamination. This is aggravated by the absence of good nutrition in many households.

#### **5.1.8 Most Vulnerable Groups to Lead Contamination**

Responses on which category was most vulnerable to effects of lead contamination showed that environmental facilitators and residents affirmed that children and women are the most vulnerable to effects of lead contamination. The women and children are both most vulnerable because of geophagy and like to play in contaminated soils respectively. This data agrees with ATSDR (2007) which has explained that children, as well as adults, could be sick from the effects of lead contamination, but lead contamination is much frequent in children than in adults. This meant that there is need to create safe good play parks for children and nutritious food for pregnant mothers to replace contaminated soil. This situation also could imply that it is necessary to promote inclusive EE that could offer more learning points focused on children and their guardians if there should be a generation that could live sustainably throughout their lives in these areas.

The data collected agree with [www.atsdr.cdc.gov/news/soilpica](http://www.atsdr.cdc.gov/news/soilpica) which stated that, children were

most at risk for lead injuries because their bodies were still developing and because they tend to put things that could have lead dust on it in their mouth. Further, children that play in the soil, women that crave for pica and young men that scavenge the mine scraps of metal are most susceptible to lead produced by the mine and smelter. The situation implied that there was need for lessons of integrated content in the normal learning of children and all issues that affect them across disciplines and curricula which is the only way lives of children could be saved from eternal deterioration. This data is agreeing with IUCN (1980) which has shown that school curricula should include EE both as an integrated subject in other subjects, and as a separate subject to be taught formally in a simpler language easy to be grasped by all. Hence, school materials should be produced and effectiveness of teaching materials regularly evaluated against the stated objective.

Therefore, this entails that children and women need to be taught long life skills about environmental appreciation. They need to be taught good values, motivation, commitment and attitudes to grow up into adulthood understanding their environment well and respecting it. That could help affected groups to avoid all activities leaving them exposed to environmental hazards such as lead contamination and scavenging scrap metals.

The same is true with the effects of lead contamination on people and environment. The respondents revealed that residents and facilitators are aware of the effects of lead contamination. The respondents disclosed that the most common effects in people as naughtiness, dullness, loss of memory, severe headaches and eyes irritation. The other effects mentioned were mental retardation, stunted growth, low IQ, respiratory infections, weak sperm count among men and still births and miscarriages among women. This idea is acknowledged by Rose (2006) which stated that effects of lead contamination include fever, weakness, chest pains, cough, breathing problems, loss of appetite, abdominal problems, muscular weakness, tremor, joint pains, fatigue, anaemia, gradual loss of weight, reduced attention span, trouble sleeping and constipation. In the same vein Haag (1978) has shown that lead contamination is also associated with dust poisoning which contains lead dust fumes and all those dust diseases affected the alimentary canal, the blood stream, the brain or spinal system and the skin of human beings. In line with this data (Vedantam, 2007 and Cleveland et al, 2008) which indicated that women had miscarriage and subtle abortions, declined fertility of men through sperm damage, impulsive behaviour and aggression, women also had still birth, premature birth and low birth weight.

Once residents are affected by lead, especially children could drop out of school due to short concentration span in school. That could imply having children who would grow up into adulthood unable to solve their own socio-economic and biophysical environment. That would increase the

levels of land degradation because residents could only do unclassified jobs of quarrying, stone crushing and metal scavenging. This would further deteriorate the standard of living from current levels to a bunch of adults who could not learn.

The findings above could make it difficult for residents to know the exact problem they are faced with. This could be due to the fact that the symptoms of lead are closely related to HIV/AIDS, TB and flu. This could also make residents fail to distinguish when someone died of lead related illness or HIV/AIDS. This is due to similar symptoms. This assertion agrees with <http://www.blacksmithinstitute.org/kabwe.shtml> which mentioned that many people mistake the symptoms of lead poisoning for other common illnesses, such as cold, flu or TB and HIV/AIDS. This could be the reason most people did not fear the effects of lead, as they thought lead is not real because its effects are similar to other illnesses of HIV/AIDS and TB.

The above situation would entail that future generation could fail to regenerate due to low sperm count and high infertility among women and men respectively. In that case, birth statistics could stagnate and population count would be marginal. The social trend would lead to a lot of unfaithfulness among couples. That may result into a lot of broken homes and increase in children without parental care turning into street kids and robbers. The situation also explains the reason there are a lot of abandoned and dumped babies nearly on monthly basis in the study areas.

## **5.2 Sensitisation Programmes on the Effects of Lead Contamination**

The second objective of the study was aimed at determining how much sensitisation has been done on effects of lead contamination on people and the environment at large. This is addressed in items 5.2.1 to 5.2.4

### **5.2.1 Awareness of Sensitisation Programmes**

Responses on awareness of sensitisation programmes in the research area revealed that, majority of the respondents 63.8% said that they were not aware of sensitisation programmes taking place in the study areas. The minority of respondents, 36.2% said that there was awareness of sensitisation programmes taking place in the study areas. The situation implies that there are no awareness programmes in the study areas. This was because most of the residents 63.8% in the study areas were not aware of EE activities taking place. On the contrary, Dorcas (2003) indicated that CEP had been implementing an intensive community outreach programme aimed at raising awareness as well as providing simple messages on how to avoid lead exposure which has not been a complete success due to residents' poor attitude towards change. This situation explains that there are no well coordinated and managed awareness programmes in the study areas.

The implication is that there are no follow-up, continuity, monitoring and evaluation for the purpose of improvements to awareness programmes. Therefore, it is important that sensitisation involves EE activities for holistic teaching of individuals and society to enable them avoid lead contamination in their daily activities. In line with this idea, Chipatu (2011) mentioned that EE activities could help community groups and even individuals working to address environmental issues in local communities in one way or the other.

### **5.2.2 Institutions teaching Sensitisation Lessons**

The institutions teaching sensitisation lessons in the study areas according to the data collected from the residents was the clinic at 16.2%. The others were KMC at 13.3% and the minority 7.6% were the media houses. However, 32.4% represented respondents who did not know any institution involved in awareness programmes because such programmes were not there. Nevertheless, the data collected suggested that there were many uncredible players offering awareness programmes in the study areas. Furthermore, this revelation called for introduction of a permanent institution to coordinate, monitor and evaluate other institutions' activities on sensitisation of educational programmes. The situation also implies that if several credible institutions were involved in raising awareness, positive results could be yielded in the programmes because various approaches to teach residents on environmental issues would be used. Agreeing to that claim, ZCCM-IH plc (2002) identified municipal and district authorities as well as other local authorities, such as traditional leadership structure, as playing a useful role in the promotion of information dissemination concerning environmental issues as well as participation in the application of the best practice methods in environmental mitigation. The case of respondents who did not know would also mean that awareness programmes could have been there but poorly coordinated, managed and conducted inconsistently.

### **5.2.3 Accessibility of Information by Residents**

The data collected on the accessibility of information by residents showed that 53.3% of the respondents had agreed that it was not easy to access information on lead contamination. The minority of the respondents 46.7% said that it was easy to access information of lead contamination in the study areas. The data could mean that, if EE programmes were there, they were not consistently conducted. This was evident by majority of the respondents 53.3% who stated that it was difficult to access information on lead contamination. This meant that information concerning lead contamination was not easily accessible hence it was difficult to carry out sensitisation campaigns to residents who had difficulties in accessing information on environmental issues. What is important was to use EE to sensitise residents because it helped them easily understand the nature

of environment and consequently learn to conserve it. Furthermore, EE provides solutions to all environmental issues. This could help to address effects of lead contamination and promote a clean environment. This would also mean that teaching awareness programmes could be easy since there was accessibility of information as indicated by 46.7% of the respondents.

The same was true for sources of information on effects of lead contamination in the study areas. The research findings showed that 21.9% of the respondents who were the majority got information through their neighbours. The other 11.4% of the respondents said that they got information through community facilitators opposed to minority 6.7% who said that they got information through ZCCM-IH/CEP/Mines. These research findings confirmed that there were several sources of information for the residents of the study areas on effects of lead contamination. In support to this view, ECZ (2004) acknowledged that involvement of local authorities and interest groups in discussions of long-term maintenance and education was an important aspect to solve environmental concerns. The implication of this situation was that when there were several sources of information, it could be easy to educate more residents on effects of lead contamination. This would also help mitigate and avoid environmental problems associated with lead contamination. The situation called for networking among the various players offering environmental information to the residents of the study areas. This would result into meaningful sensitisation to residents of these areas on issues affecting their environment.

However, depending on information from neighbours may not be reliable. This was because neighbours who were not specialists in EE could misrepresent facts and cause information transfer gap. Above all, since neighbours were not environmentalists, could not know how to explain environmental issues correctly to their friends. In line with this, <http://www.epa.gov/superfund/programs/lead/ieubk.htm> has shown that project manager educated community on the risks of lead exposure and established lead exposure programmes. Furthermore, lead education programmes were coordinated with local programmes of health districts, schools and other community groups who worked with families and children. This meant that specialists were to educate others on environmental problems. This calls for enforcement of EE activities in the study areas to help residents understand their environment better.

After identifying the sources of information on the effects of lead contamination in the study areas, respondents further gave the centres of sensitisation as clinic 22.9% and Compound Square 11.4%, while 7.6% said that they learnt from the market. On the contrary, 18.1% said that they had not learnt anything. This implies that sensitisation could take place wherever it was appropriate. In support of that view, Chibale (2013) pointed out that, ideally all training and educational



programmes should be given in suitable places such as fields, homes, churches and places set aside by specialists for demonstrations. This also meant that awareness of effects of lead contamination were better taught to residents in homes or where people gathered so that there could be easy demonstration especially during planting grass, trees and spreading uncontaminated soil. It further entails that taking advantage of patients who visit the clinic for medication into hours of lecture would not be in conformity with most residents' norms. Visitors at the clinic specifically go there for medication and not to be switched to long hours of lecture. In line with this claim, ZCCM-IH (2003) explained that if awareness programmes were to be successful, the messages that were developed should be compatible with the community's norms. Therefore, such programmes should be organised through good planning and executed at appropriate time and place to learn how to avoid environmental hazards. It could also imply that lessons were not monitored and evaluated to see the progress. This is evidenced by 18.1% of the respondents who said that they had not been sensitised in these residential areas. EE programmes should target to reach all citizens affected by environmental issues.

### **5.3 Community Participation in Awareness Programmes in the Study Areas**

The third objective of the study was to investigate the nature of residents' participation in different activities aimed at reducing the effects of lead contamination in the affected areas. This is addressed in items 5.3.1 to 5.3.3

#### **5.3.1 Participation in Awareness Programmes**

In view of participation of awareness programmes, 41.9% of the respondents confirmed participation in awareness programmes, while 58.1% of the respondents mentioned lack of participation in awareness programmes. The implication of this situation is that residents did not participate in awareness programmes because there were no EE activities designed to educate residents on their environments. This entails that environmental awareness programmes were not organised well to include all residents. The situation also entails that there was no continuous interaction between facilitators and residents. Agreeing to that assertion, ZCCM-IH Plc (2005) acknowledged that there must be continuous sensitisation in lead pollution areas since lead is naturally occurring. Furthermore, it has shown that sensitisation on the general aspect of lead pollution must be on going. This calls for both providers and residents to identify environmental problems in their localities and find lasting solutions to such problems. In addition, Dorcas (2003) substantiates that information gained from constant contact between facilitators and local community to brief project staff on the environmental issues was important to the successful remediation of the site. This situation calls for new strategies which could increase active

participation of the residents of the study areas. This claim is in line with ZCCM-IH (2003) which indicated that to resolve lead contamination problem, community education and involvement, should make residents aware of lead hazard emanating from their surroundings.

### **5.3.2 Frequency of Participation in Awareness Lessons**

The study revealed that majority of the respondents 45.7% did not participate in awareness programmes. The other responses were fragmented. Some of the respondents 24.8% said that they participated annually, while 12.4% indicated that they participated every six months. The other respondents 9.5% said that they participated monthly and the least 7.6% of the respondents said that they participated weekly. This revelation implies that there could be no awareness programmes taking place in the study areas. These responses for this question were very important for the study because it revealed whether or not respondents participated frequently in environmental education processes taking place in their localities. Frequency of participation in environmental awareness programmes was vital because it made the respondents to be aware of their environment. It also showed problems and how to solve environmental hazards such as lead contamination. This idea was supported by Dorcas (2003) which indicated that community holding meetings every six months and that frequency would help ensure the public stayed informed of the site progress and had an opportunity to provide meaningful input. This situation could enhance public participation through use of channels of communication depending on needs and availability of service in the area.

In view of the reasons for not participating in awareness programmes, the findings from the field study revealed that some respondents had never heard of such meetings. This was attributed to vastness of compounds, for example Makululu, which could not be covered with few trained facilitators who did voluntary work. This entails that there was lack of commitment from such officers towards work. IRIN Africa (2005) which has noted that the level of awareness has remained low due to lack of committed environmentalists to conduct environmental educational campaigns. It was also revealed that sometimes meetings were just held at the clinic and Kakungu square. These places were too far for some residents such as those from Chililalila and Magandanyama especially that Makululu had five zones. This meant that there is need to spread the venues for meetings to enable all residents attend meetings to learn about environmental issues of their areas. This agrees with EMA (2011) which mentioned that people should be involved in the development of policies, plans and programmes for environmental management.

Further, the study established that some respondents were not invited for the meetings. The leaders only invited their friends and relatives. The idea behind was to bribe them. The allowances which

were meant to be given to participating candidates were corruptly obtained by the same leaders. Revelations of this nature added to the low turnout of residents to community meetings. In certain circumstances, it was revealed that leaders would fabricate a register of those in attendance at the meetings and yet they were not there. This could be as a result of the education type we receive which did not help citizens to ask the 'why' questions, but accept everything they were told as truth. Paulo (1989) described such type of education as banking type, dehumanising, domineering, the best methods that foster awareness should be utilitarian, learner centred and should take into account the real needs of the community. In addition, ECZ (2007) identified that EE was included in the school curriculum in Zambia between 1990 and 1997 as seen to play a key role to solving environmental issues though it had not yet achieved a lot in the Zambian situation. In line with this view, the MoE (1996) which indicated that to enable and provide an education system that would meet the needs of Zambia and its people such a syllabus is key to achieving results. Hence need them to involve residents starting from planning to the last stage of the programme if results must be achieved of finding solutions to environmental problems. Participatory approaches must encompass a range of different methods, tools and attitudes, which range from the more attractive to the more empowering stance.

The same was true with the involvement of residents in planning of awareness programmes in the study areas. The findings revealed that most of the respondents 40.0% did not participate in planning meetings and the other 37.1% of the respondents did not hear any planning meetings held. This therefore entails that the majority of residents did not participate in planning of environmental activities taking place in their localities. On the contrary, DoE (2002) which explained that learning of environmental issues should incorporate stakeholders who were the actual locals with the full knowledge of their locality. Hence, this entails that if the local people were involved in planning of awareness programmes, they would ensure that the programmes included environmental problems affecting residents directly and requiring immediate address. In addition, EMA (2011) has acknowledged that residents should be involved in the development of policies, plans and programmes for environmental management. Residents should be involved at all levels of EE activities intended to solve environmental issues in their localities.

#### **5.3.4 Need for Sensitisation Programmes**

The findings revealed that majority of respondents 50.0% said that there was need for more environmental awareness programmes to be conducted in the study areas. This entails that most of the respondents in the study areas had not adequately been sensitised on the environmental problems of their areas. Therefore, it meant that groups or individuals who were not well sensitised

had not developed skills of identifying and resolving environmental problems of their areas. In line with this idea, UNCED (1992) identified public environmental awareness and training as a process by which human beings and societies could reach their full potential of solving their environmental problems. This was the importance of emphasising environmental awareness to be continuous in the study areas. It was only through proper implementation of EE activities that could help residents solve their environmental issues in these localities as EE targets to transform citizens' attitudes towards their environment. It is also the way the programme was implemented that determines its effectiveness. The use of inappropriate methods in implementing awareness programmes in many countries worldwide has led to failure of such programmes. Consenting to this Paulo (1989) described that when inappropriate methods are employed, the picture portrayed about the effectiveness of the awareness programmes is negative.

#### **5.4 Contributions made by EE to Address Effects of Lead Contamination in the Study Areas**

The fourth objective aimed at establishing possible contributions made by EE to address effects of lead contamination in awareness campaign programmes in affected areas. This is addressed in items 5.4.1 to 5.4.4

##### **5.4.1 Content of Lessons Learnt in Awareness Programmes**

The researcher wanted to find out from the respondents the content of lessons learnt in awareness programmes. This would help assess if the content was bringing solutions to the impact of mining on people. As observed from the facilitators' responses in items 4.8.1 of chapter 4, that content of lessons taught in environmental awareness included greening, soil spreading, good hygiene and how to access public information through the use of EPICs. The responses of facilitators on content of the programme lessons were similar to residents'. This entails that the content covered was related to the general solutions to address negative impact of lead contamination in affected areas. The important issue was close monitoring of awareness programmes conducted in the study areas.

The findings also revealed that there were no review meetings to evaluate the results of the programme. On the contrary, ECZ (2007) mentioned that it is always appropriate to have review and planning meetings or workshops in reference to projects, initiatives, implementation and challenges on environmental awareness and satisfaction programmes. It further acknowledges that formal meetings could be held for planning and publication of quarterly magazines as an effective way of communication concerning the implementation of the project.

On the other hand, 19.0% of the respondents revealed that facilitators did not teach them in detail

what they learnt in hotels and lodges about the importance of greening. In addition, UNESCO (1978) has identified that human action depended upon motivation and public awareness being aroused concerning the essential links between environmental quality and continued sensitisation of human needs, which depended upon widespread understanding of the environment. That situation gives reasons as to why residents had taken the awareness programmes casually resulting into residents not treasuring and caring for their own environment. The residents no longer appreciate EE awareness programmes anymore. This entails that if a programme after implementation could not produce results, that type of education is unsatisfactory and was not conscientisation type of learning which aim at changing the behaviour of the learners.

The same is true to how lead contamination lessons were dealt with, responses showed that both facilitators and residents revealed that the lessons were not adequately covered. This explains the failure of sensitisation programmes to achieve intended purpose of conscientising affected communities. This was in the light of residents who were not aware of lead contamination in these localities. However, the content given to residents conformed to the problem of lead contamination. This was evidenced through responses which gave various topics covered ranging from greening, soil remediation and others. The education was meant to increase public awareness and knowledge about environmental issues. [www.epa.gov/education](http://www.epa.gov/education) mentioned that if EE is promoted in teaching lead contamination, it would provide the public with the necessary skills to make informed decisions and take responsible action. The point of contention here is that programmes could have been organised in a hurry and failed to address the felt needs of residents concerning lead contamination. In line with this idea, ECZ (2007) has indicated that if awareness programmes are well implemented they could raise the level of environmental awareness in affected areas with lead contamination. This is evident in line to lack of behavioural and social change among the residents of the study areas. This created doubts as to whether what is taught was EE or some other community education which had no influence on residents' life styles in the way they interacted with their environment.

Therefore, if the types of education offered fail to change behaviour of the learners, then the type of education is neither conscientisation nor behavioural change advocated by Paulo and Watson. The reason for importance of conscientisation and behavioural learning is to empower residents of Makululu and Kasanda Mine Compounds on effects of lead contamination. In affirmation, Paulo (1989) referred to conscientisation, which is a form of behavioural change learning as an educational approach which does not support political suppression of the poor but take sides with the poor in an attempt to free the learner and the educator from the bondage of silence. In such a situation, education aims at helping low positioned residents to develop themselves, their

communities and nation as a whole. This could be achieved through implementation of EE programmes to increase environmental awareness in the study areas.

#### **5.4.2 Suggested topics for Inclusion in teaching Awareness Programmes**

The information from the findings revealed that there were a lot of issues communities wanted to be addressed apart from greening. This was in light of some residents who suggested that people needed to be taught on environmental health, pollution in general, effects of mining in the surrounding areas and the danger of mine dumps and monitoring of facilitators' activities. This meant that there was a lot of dissatisfaction concerning the topics that were brought to them without consultation. In agreement to this view, Lupele (2002) has shown that the communities needed to be empowered with relevant knowledge to help them be able to preserve their natural resources and how to live in less conflict between man and the environment.

This implies that community participation at all stages of project implementation is important if the project was to succeed and be accepted by the community. It should also meet the needs of the residents. This is in line with ZCCM-IH (2003) which observed that environmental awareness to be successful, the messages that are developed should be compatible with the community's norms. The implication of this is that, inappropriate topics implemented in a community with environmental problems could result into failure. In line with this, ECZ (2004) has shown that community involvement and education seeks to address the issue of community ownership and thus diminish the extent of vandalism which could only be reduced by working with the community. This could imply that if people had not accepted a programme, even its teaching would be meaningless. The implication is that, the community should be involved and consulted before implementing any project in its locality for its success.

On the issue of behavioural change in targeted areas, though the study has revealed that most of the residents 32.4% had not changed in behaviour as there were no new traits of behaviour that were seen. On the other hand, the study has revealed that some residents had changed in behaviour as they were able to practice greening around their homes if they had excess water. This showed that respondents mainly from Kasanda Mine area afforded greening since there were many residents who were in formal employment and were able to settle water bills. In Makululu, the responses indicated that they failed to practice greening because the water kiosks supplied water irregularly. The payment of water kiosk monthly bills was K4.00 per household. The situation showed that many residents fail to access clean water from kiosks because they are unable to settle water bills. Agreeing to this assertion, Loubser (2011) has indicated that usually when environment become degraded, impoverished or polluted, it is invariably the poor and dispossessed who suffer

disproportionately. Further, it has shown that the poor are usually least equipped to cope financially, materially, and in terms of skills with environmental stress and its consequences upon their lives.

In line with this MoFNP (2006) adds that, unplanned squatter settlements are without proper roads, drainage, clean drinking water, and sanitation and health facilities. This confirms the problem of water in Makululu. The study also revealed that some families took their children for screening so that they could receive food supplements. This situation implies that, there are many residents unemployed who live in poverty and wait for hand outs to survive. It also shows that such residents to find money to pay for water are complete luxury, when they could forego some meals because of lack of money to put food on the table. This implies that these residents could not solve this problem of environmental issues on their own. The government therefore should help to relocate residents in much polluted areas. In addition, Reuters (2010) has shown that about 15,000 people were relocated from Jiyuan in central Henan Province to other locations safe after 1000 children living around China's largest smelter plant were found to have excess lead in their blood. The same could happen for residents of Makululu and Kasanda Mine Compounds, especially those who could not manage to live by suggested precaution measures of greening their yards.

The study has also established that soil is still sold in markets as observed by the researcher during field data collection. The implication is that the lessons could not have changed people's attitudes and behaviour. Therefore, since there was no behaviour and attitude change in residents of the study areas, then EE which targets to change people's behaviour was supposed to be introduced. In agreement Paulo (1989) observed that critical thinking, conscientisation and dialogue helped society to be transformed in attitude and behaviour. That could only be realised by encouraging EE to be taught in these areas to help change residents' attitudes and behaviour towards their environment.

#### **5.4.3 Has Awareness Programmes Gained Ground or Not?**

The information collected on whether or not environmental awareness had gained ground among residents of these study areas, showed that majority of the respondents 67.6% indicated that they had not gained ground. This implies that the type of awareness education conducted in the study areas was not EE but something else. Though there was initiative of sensitisation, little or very negligible has been achieved. This has been as a result of unchanged attitude by the residents. This agrees with Paulo (1989) which indicated that critical consciousness encouraged power awareness, critical literacy, desocialisation and self education. This could mean that the type of education should create lifelong skills of knowing how to handle environmental problems in their areas. The awareness programmes had a number of challenges as shown below:

(a) Lack of lessons on lead and poorly trained facilitators. Concerning lessons on lead, the study established that some respondents never learnt anything on effects of lead contamination. That was underscored through responses of mismatch information on problems associated to environmental health related to effects of lead poisoning, where respondents indicated malaria and HIV/AIDS among others as effects of lead contamination. This could mean that facilitators were not available to teach the residents about environmental problems. This assertion was confirmed by facilitators who stated that the compounds like Makululu were too big to be covered by few trained community facilitators. Consenting to this point ATSDR (2007) which has shown that to ensure safety in residents' lives and play parks, needed staff with expertise in various areas of the environment to work closely with communities to identify concerns, provide updates on ongoing activities, and offer education as needed by communities affected.

(b) World Bank funded a project (CEP) that was supposed to educate people about lead contamination. The study revealed that the leaders misused the funds meant for awareness project resulting in World Bank's pull out of the project. This implied that leaders were selfish and greedy, and failed to share the information they had known with other community members. Some respondents complained in Lamba: (Pakweba ati intungulushi shili no bufumushi na bu kaitemwe, tashisambilishapo bambi ifyo shasambilile muma hotela) "leaders were selfish and greedy, they did not teach others what they had learnt in lodges and hotels." This was contrary to Chipatu (2011) which has indicated that there was growth in the number of institutions, NGOs, community groups and even individuals working responsibly to address environmental issues in local communities. The trend of leaders deprived a lot of residents from acquiring environmental information on how to live safely in lead contaminated areas.

(c) The study also revealed that leaders lacked commitment resulting into poor performance of environmental awareness programmes. The situation implies that leaders did not care about residents getting the correct information. This resulted into information transfer failure because of poor link between programme sponsors and residents. This caused many people to miss important information about how they could take care of their environment and avoid lead contamination. In view of this, ZCCM-IH plc (2005) identified that improvement on flow of information between stakeholders and community-led committees and residents, are important ways of achieving awareness programmes.

(d) The respondents revealed that the environmental awareness programmes could not succeed because of several factors. Erratic water supply and high water bills were fundamental. Practicing greening was difficult since it depended on water for its success. CEP used to distribute free water



while LWSC started commercialising it. This was a serious abrogation of the UN charter concerning human rights, which stipulated that every individual had a right to water. In agreement with this assertion, (ECZ, undated) has indicated that basic rights included the right to clean water, a safe environment, and livelihood, the right to be free from intimidation and violence, and the right to be fairly compensated for loss. Instead LWSC charged its water bills beyond the reach of Kasanda Mine and Makululu residents. This was denying residents the right to enjoy a service of water which was now unaffordable. That calls for government's intervention to provide these residents of the study areas free clean and safe water, and make their environment safe for human habitation. This implies that the purpose of these water facilities were no longer there to enable people green and wet their yards to suppress the dust. This left the residents without grass, trees and wet ground exposed to blown dust from the dumpsites and surroundings at home. This made residents much vulnerable to lead contamination.

The poor plans on security of the facilities did not involve residents hence resulted into severe vandalism of the infrastructure put up as sources of information and play parks in the compounds. This situation has left people with limited places to source environmental information and safe play parks for children as these have been turned into residential plots. ECZ (2004) indicated that community involvement and education seeks to address the issue of community ownership and thus diminished the extent of vandalism that could only be reduced by community involvement, also promoting sustainable use of rehabilitated sites. This implied that for a programme to be successful there should be consultative meetings with residents to plan, implement, continuous monitoring and evaluation of the project. Because of these problems, environmental education programmes in these compounds were unpopular and meaningless to residents.

#### **5.4.4 Responses on how EE could be used to address the Effects of Lead Contamination**

Respondents were asked on how best they could possibly use EE activities to address environmental hazards such as effects of lead contamination in Makululu and Kasanda Mine Compounds. The responses were:

- (a) Train more community facilitators among the locals where those locals would be present all the time to educate residents on lead contamination and mitigation. These should be trained in such a way that they understand different environmental issues. In support of this view, WMC (2005) has shown that trained representatives should be holding different influential positions in the community to easily help awareness programmes succeed. The existing facilitators needed to be re-trained as they seem not to be up to date with understanding of environmental issues.
- (b) The study revealed that facilitators needed to be supervised and ensure that they sensitised the locals with correct environmental information. Acknowledging this idea, ECZ (2007) mentioned

that formal meetings could be held for planning, monitoring and evaluation of the project initiated. In line with this, ATSDR (2007) has provided that there was need for staff with expertise in various areas of the environment to work closely with communities to identify concerns, provide updates on ongoing activities, and offer education as needed. The facilitators also needed motivation by giving them either bicycles, motorbikes or a small monthly token to encourage them work towards increasing environmental awareness on effects of lead contamination.

(c) Respondents felt that there was need to encourage door to door campaigns on the environmental problems of the areas and how to avoid them. Consenting to this point, ATSDR (2007) has shown that experts and funded partners met with individuals through community gatherings in open forums, and even at their homes to listen to their environmental health concerns provide information and conduct investigation. This could produce great results on raising awareness among residents since there would be no absentees. However, this was something ZCCM-IH had started. Therefore, it could just be adopting what they had earlier done. This should be done regularly. Conducting it twice a year incorporates even the in migration.

(d) Through sharing experiences in small groups about the dangers found in the mining compounds and how to deal with them, the shared experiences should be on the effects of lead contamination and how they could be resolved in their localities. This was supported by ZCCM-IH Plc (2005) which has shown that groups should share progress of awareness programmes and challenges.

(e) Community land use for the benefit of all residents. There should be no one allowed to settle in an area that could endanger their own lives or the lives of other community members because of being exposed to effects of lead contamination.

(f) The community should be taught on community project ownership where they guarded initiated projects jealously in the areas, feeling that it was their own and avoid vandalism. Acknowledging this ECZ (2004) has indicated that community involvement and education seeks to address the issue of community ownership and thus diminish the extent of vandalism which could only be reduced by working with the community. The EPICs also should be equipped with materials aimed at raising environmental awareness concerns. There is also need to improve literacy levels to reduce on language barriers to learning. In support of this, ECZ (2008) has acknowledged that in Zambia education equally takes a central role in information dissemination and is a key determinant of the lifestyle and general status of the population.

(g) Having EE centres (EEC) set up to be installed in all strategic points of the compounds in order to provide free environmental information about the effects of lead contamination. At EECs, a facilitator would have a desk to distribute brochures on designated days. <http://www.epa.gov/superfund/tools/cag/index.htm> has acknowledged that other groups in the community should be involved to address the impacts of mining on the environment. Similarly, a

community youth group would put up sketches or drama in which the main message could be tailored towards informing public change and environmental awareness. Being a cultural event, obviously it could be a crowd puller. In line with this, Patrick (2004) has shown that use of stories, role playing, and songs could help residents recognise sources of lead and learn prevention behaviours.

(h) Through airing of community radio and TV programmes where quiz, debate, question and answer session on environmental challenges of the areas, how these problems could be solved and dangers of unresolved environmental issues to people and other living things. Examples of topics which would be covered could include: sanitation, lead poison, erratic water supply and hygiene. In addition, Loubser (2011) has agreed to this idea by adding that, different strategies and methods could be used in teaching, such as debates, stories, panel discussion and television or radio discussions.

(i) A localised curriculum was discussed at length. The respondents suggested that a curriculum concerning lead contamination and environmental degradation to be included in formal education from grades 1 to 12. It was revealed that residents quoted the Bible that if a child is taught while still young, would not depart from it in their old age. This meant that, if the pupils were taught at early stage environmental issues, they would be good ambassadors of the programme in their later lives. Teaching of the old would not be easy as they have difficulties in attitude change. In addition, MoE (1996) mentioned that to enable and provide an education system that could meet the needs of Zambia and its people, change of syllabus is central. Sharing the same view, King County (2013) mentioned that to solve environmental problems residents received educational information on how to reduce their exposure to contaminated soils, and had access to curriculums geared toward teaching people how to work and play safe around contaminated soil. Therefore, the challenge to implement localised curriculum in the syllabus remains government's responsibility through MoE under the department of curriculum development. This would make the curriculum meaningful to different communities across the country learning only issues of their environmental concern.

(j) The norm of seminars is that, technocrats end their lectures in hotels. The residents expect facilitators to go to the grassroots and implement their knowledge learnt from hotel conference rooms. Poorly trained facilitators distort the information as they went to disseminate it to residents. [www.oregonstate.edu/wrlte](http://www.oregonstate.edu/wrlte) has revealed that development of effective solutions to environmental programmes requires a well educated and trained, professional work force. Ideally, the residents would love to have experts speak to them face to face as they could be at liberty to attend to questions from the public technically.

## **5.5 Summary of the Chapter**

The study had revealed that to address the challenges of environmental hazards, EE activities could

best be used by identifying various forums such as workshops, seminars where the entire residents were in attendance and various groups performing drama and poetry. These activities would achieve the anticipated environmental results.

The study also has revealed that the best way to address effects of lead contamination in the study areas is the use of EE activities in schools to have a long lasting effect on their lives when they learn it while young. However, the study has shown that there are a lot of things lacking in achieving raised environmental awareness concerning effects of lead contamination in affected areas. In order for that to be successful, it demands for concerted efforts from different stakeholders to find a lasting solution in deciding who should do the sensitisation programmes that residents require. To create full participation from the learners, the inclusion of the localised syllabus, its content should be examinable to learners in the study areas to attract interest to learn such. The next chapter presents the conclusion and recommendations of the study.

## **CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS**

### **6.1 Introduction**

This chapter presents the conclusion and recommendations of the study based on the findings and discussion on the residents' awareness on the effects of lead contamination in Zambia's Makululu and Kasanda Mine Compounds of Kabwe District.

### **6.2 Conclusion**

The study was based on four objectives and responded to four research questions. The first objective and research question sought to establish the state of awareness by residents of Makululu and Kasanda Mine Compounds of Kabwe about the effects of lead contamination on their lives and environment. In regard to the objective and research question, both were answered.

The findings of the study revealed that residents are aware that there is lead contamination in these compounds. However, the information about effects of lead contamination was not easy to access. Lack of information has not resulted into behavioural and social change among residents' life style regarding effects of lead poison as attitude of residents towards environment continue to be bad. The majority of respondents knew the problems related to lead contamination such as poor performance of children in school. Although there was some mismatch in identifying problems caused by effects of lead contamination as some respondents identified HIV/AIDS as one of the problems caused by lead poison among others.

However, it was also surprising that most residents obtained awareness information through neighbours and clinic. From neighbours, the information could be distorted as it spread from one person to another who had little knowledge of environmental education. Nevertheless, the respondents are aware that lead contamination affected all groups of people especially children and women because they like eating soil.

The second objective and research question was aimed at determining the nature of sensitisation that has been done concerning effects of lead contamination on residents. This objective and research question was answered as findings of the study established that most respondents 63.8% of the study areas are not aware that there were sensitisation programmes in these areas. They said that the main institution which sensitised residents about lead contamination was the clinic represented by 16.2%. They also confirmed that most sensitisation took place mainly at the clinic 22.9% and homes at 20.0%.

The third objective and research question sought to investigate residents' participation in different activities aimed at reducing the effects of lead pollution in the affected areas. The study established that 58.1% of respondents did not participate in awareness programmes.

The data collected revealed that residents did not participate in awareness programmes because they were not aware of such. Of these, 22.0% of the respondents had said that they did not know about

awareness programmes, and the other 20.0% of the respondents had indicated that they had no ideas about awareness programmes or meetings because of few facilitators. The study also revealed that 40.0% of the respondents were not involved in planning meetings and the other 37.1% had no idea about such meetings. All this revelation entailed that there were no EE activities in the study areas to foster sensitisation campaign on effects of lead contamination to residents and environment.

The fourth objective and research question set to establish possible contributions made by environmental education to address effects of lead contamination in the awareness campaign programmes in the affected areas.

The study revealed that under CEP community needs were not fully addressed and needed more lessons to address the needs of community. They also suggested possible ways in which environmental education could be used to address the effects of lead contamination as follows:

- (a) they must train more community facilitators to educate locals on effects of lead contamination.
- (b) facilitators needed to be supervised and monitored regularly to ensure correct information was disseminated to residents of the study areas.
- (c) door to door sensitisation should be promoted to avoid leaving out some households on sensitisation campaigns.
- (d) there was need to share experiences in small groups about dangers of lead contamination.
- (e) community land should be used to the benefit of all residents.
- (f) residents should learn project ownership to avoid vandalism and all that could be learnt through environmental education.
- (g) there was need to establish environmental education centres in strategic points to provide information to all the residents.
- (h) there was need to encourage community radio and television programmes to debate, quiz, question and answer on effects of lead contamination to increase awareness among residents.
- (i) encourage expert presentations to the entire community for all residents to benefit at once together.
- (j) localise the curriculum where environmental education could be taught to all pupils from grades 1 to 12 and make the subject examinable to all learners in the affected areas.

Finally, the data collected revealed that there were very few residents who participated in actual environmental awareness lessons and that environmental awareness currently are not conducted in Makululu and Kasanda Mine Compounds. This made the areas become haven for residents who understood less about their environment and engaged in illegal activities which exposed them and their families to effects of lead contamination.

The data also revealed that environmental education activities could work well to address effects of lead contamination. From this revelation, it was clear that the locals lacked environmental education

to help them manage the problems of effects of lead contamination. If environmental hazards escalated, it is the poor who suffer. Being poor and ignorant of human rights and victim of fate or poverty should not be allowed to spell hard life on the residents of Makululu and Kasanda Mine Compounds. Therefore, there is need to find ways to address these issues with the urgency deserved.

It is argued that if education programmes that are given to residents of Makululu and Kasanda Mine Compounds have to be appreciated, they should bring positive change of behaviour and attitudes towards the environment. In agreement to this, Paulo (1989) observed that critical thinking, conscientisation and dialogue helped society to be transformed in attitude and behaviour, awareness, knowledge and adoption of particular practices taught to increase efficiency. It should therefore, be appreciated that if these are not seen in residents that are accessing environmental awareness education under various facilitators, then the type of education provided to residents fell below expectation of conscientisation and behaviorism theory of learning advocated by Paulo Freire and Watson with friends respectively.

### **6.3 Recommendations**

The recommendations are made based on the actual research findings. The study first highlights the actual findings then followed by the recommendations.

1. The study revealed that the awareness programmes were rarely conducted in the study areas. Therefore, it is recommended that there is need for an increase in environmental awareness activities to enable residents become aware that the problem at hand is really serious and requires their full participation to eradicate it.
2. The data collected revealed that the awareness activities only emphasised greening and soil remediation. In view of such a finding, it is therefore recommended that the programme is intensified by inclusion of other topics such as, 'effects of mining on the environment and surrounding communities'. These could be taught in a more interesting manner where drama, theatre, brochures, mobile announcements are used to teach on the effects of lead contamination in their localities.
3. The findings of the research revealed that about 77.0% of the respondents were not involved in planning of programmes to be implemented in their areas. Arising from that, it is recommended that there is need to allow all stakeholders to participate in planning of the programmes that affect their lives. Their participation would help them have an input in the contents they want to learn for their own benefit.
4. The study further revealed that the challenges in the failure of implementation of awareness programmes was partly due to ill trained facilitators, few facilitators and lack of funding from the

central government. In that regard, it is recommended that there is need to increase training and re-training of facilitators, and increase funding to support these awareness programmes from council so that quality education relevant to the problems of the locals is achieved.

5. The data collected showed that most residents knew that the environmental issues could only be addressed through a well planned and designed programme instituted environmental education programmes in these areas. Arising from that, it is recommended that more environmental education programmes should take place in these communities in order for the locals to be fully aware of their environmental problems, how they would affect individuals and entire community, and how they could be addressed.

#### **6.4 Suggestions for Future Research**

The study focused on awareness of effects of lead contamination in Zambia's Makululu and Kasanda Mine Compounds. This study ought to be seen as a preliminary encounter in this area. There is need for further research which could focus on: Factors that beset the implementation of Environmental Education in the syllabus as a subject in formal and informal institutions providing training to mining residents; Environmental education to do with the role of mining companies and ZEMA in raising public environmental awareness and education in mining towns of Zambia.



## References

- Achola, P. and Bless, C. (1997). **Fundamentals of Social Research Methods: An African Perspective**. Lusaka: Government Printers.
- Aongola, L. et al (2009). **Creating and Protecting Zambia's wealth: "experience and next in environmental Mainstreaming"**. Natural Resource Issues No.14. London: International Institute for Environmental and Development.
- ATSDR (2007). **Safeguarding communities from chemical exposures**. (Available at [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)).
- Ariasingam, D.L., et al (1999). **"Environmental Education: Building Constituencies"**, World Bank.
- Best, J.W. (1970). **Research in Education**. New Jersey: Prentice-Hall, Eaglewood cliff.
- Central Statistics Office (2006). **Selected Social Economic Indicators 2004-2005**. Lusaka: CSO.
- Chibale, H. (2013). **An Assessment of the Performance of Adult Education Programmes in the Farmer Input Support Programme in Kawama Camp of Kabwe (Dissertation: M.Ed.A)**. Lusaka: University of Zambia.
- Chilisa, B. and Preece, J. (2005). **Research Methods for Adult Educators in Africa**. Cape Town: Pearson Education and UNESCO Institute for Education.
- Chipatu, L. (2011). **Environmental Education to address negative impacts of copper mining in Kankoyo township of Zambia's Copperbelt Region (Dissertation: M.Ed E.E.)**. Lusaka: University of Zambia.
- Cleveland, L.M. et al (2008). **'Lead hazards for pregnant women and children': Part 1: Immigrants and the poor shoulder most of the burden of lead exposure in this country. Part 1 of a two-part article details how exposure happens, whom it affects, and the harm it can do'**. *The American journal of nursing* (on-line: USA).
- Cohen, L, Manion, L and Morrison, K. (2000). **Research Methods in Education**. London: Routledge Falmer.
- CSO (2004). **Living conditions monitoring survey report 2004**. Lusaka: CSO printing press.
- CSO, Report (2011). **Knowledge, Attitude, Practice and Behaviour Survey (KAPBS2). Kabwe: CSO Regional Office publications**.
- DoE (1995). **White paper on education and training**. Pretoria: Department of Education.

DoE (2002). **Revised National Curriculum Statement: Grades R-9 (Schools)**. Pretoria:

Department of Education.

Dorcas, Mbewe (2003) [Vol. 2]. **Knowledge, Attitude Practices and Beliefs [KAPB] Survey**. Kitwe and Kabwe: ZCCM-IH.

EAD (2000). **Reducing lead poisoning in the home: Training Manual**. Maryland: EAD.

ECZ (undated). **Air pollution**. Lusaka: ECZ printing press.

ECZ (undated). **Environmental Management Act**. Lusaka: ECZ printing press.

ECZ (2000). **State of Environment in Zambia**. Lusaka: ECZ Publications.

ECZ (2001). **State of Environment in Zambia 2000**. Lusaka: ECZ Publications.

ECZ (2004). **Annual Report for 2004**: Lusaka: ECZ Publications.

ECZ (2004). **The Enviro-line: Mining activities and their effect on the environment: ECZ hosts information dissemination workshop for media. September-December 2004: issue no. 22**.

ECZ (2006). <http://www.necz.org.zm/ce/sub-component-2.html>. Accessed 29<sup>th</sup> August, 2013 12:03 Hours.

ECZ (2007). **Communication and information strategy**. Lusaka: Norconsult .A.S.

ECZ (2008). **Zambia Environmental Outlook Report 3**. Lusaka: ECZ Publications.

Elsworth, S. (1990). **A Dictionary of the Environment**. London: Paladin, Grafton Books.

Engleson, D.C. (1991). **A Guide to Curriculum Planning in Environmental Education**. Madison, Wisc: Department of Public administration.

**Environmental Management Act, 2011. Environmental Management, No.12 of 2011 87. Lusaka.**

Ghosh, B.N. (1982). **Scientific Method and Social Research**. (5<sup>th</sup> edition). New Delhi: Sterling Publishers Private Limited.

Government of the Republic of Zambia (GRZ) (1983). **Zambia Secondary School Atlas**. London: George Philip and son limited.

Goulding, A. et al (2011). **Black Lechwe**. Lusaka: wecsz.

GRZ and IUCN (1985). **The national conservation strategy for Zambia**. U.K: Avon Litho Ltd.

Haag, J.S. (1978). **Focus on Health**. Steck-Vaughn Company, Austin.

Heller, T, (2008). **‘Lead contamination in Uruguay: La Teja’ Neighbourhood case’**. **Reviews of environmental contamination and toxicology. Reviews of environmental contamination toxicology**. (Online).

Hesselink, F.J. (2000). **Communication Training for Asian Biodiversity Coordinators: A Needs Assessment, Utrecht and Presentation for the UNESCO CBD Working Group of Experts**. Bergen Norway: UNESCO.

<http://www.epa.gov/education.html> Accessed 17th December, 2013 21:29hours.

<http://www.lusakatimes.com/2008/11/13/no-compensation-for-leadpoisoningvictimsinkabwe-mwale.html> Accessed 29th December, 2013 15:07hours.

<http://www.worstepolluted.Org/projects-reports/displays/45.html> Accessed 23<sup>rd</sup> January, 2014. 15:23hours.

<http://www.fao.org/docrep/x0178E/x017804.htm> Accessed 13<sup>th</sup> November, 2013. 21.17 hours.

International Labour Organisation (2011). **Children in Hazardous Work**. San Francisco: ILO.

International Union for Conservation of Nature and Natural Resources (IUCN) (1980). **World Conservation Strategy: Living resource conservation for sustainable development**. Switzerland: IUCN, UNEP and WWF.

IRIN Africa (2005). **The Humanitarian News and Analysis Service of the UN Office for the Coordination of Humanitarian Affairs**. New York. <http://www.irinnews.org/in.depth.html> Accessed 27<sup>th</sup> July, 2013. 14:43Hours.

Kabwe Municipal Council (2010). **Kabwe District State of the Environment Outlook Report**. Kabwe: Kabwe Municipal Council and ECZ.

Karpagam, M. (1999). **Environmental Economics: Global Environmental issues-problems and Responses: Air pollution**. New Delhi: Sterling publishers private Ltd.

Kelly, M. (1998), **Mining and the Freshwater Environment**. London: Elsevier Applied Science/  
British Petroleum

King County (2013). **Lead and its Human effects**. USA: Seattle and King County.

Komex International (2001 and 2002). **Environmental Assessment of the Copperbelt**

**Environment Project.** Calgary, Canada: Komex International.

Kombo, D.K. and Tromp, D.A.L. (2006). **Proposal and Thesis writing.** Nairobi: Pauline Publications Africa.

LaBark, K.S., and Distrehoft, J.F. (1998). **Conditioning Awareness, and the Hippocampus. Volume 8. No. 6.**

Lupele, J. (2002). **Contextual profile as a monitoring tool. Discussion paper.** Lusaka; WWF Zambia Education Project.

Loubser, C.P. (ed.) (2011). **Environmental Education: South African Perspectives.** Pretoria: Van Schaik Publishers.

Mankapi, L. (2001). **The Closure of Kabwe mine and its Impact on the Socio-economic transformation of Kabwe urban, Zambia. (Dissertation: MSc).** Lusaka: University of Zambia.

Mdluli, S.B. (1977). **African Conservation Awareness. Paper Delivered at the Conference on Creating Environmental Awareness Under the Auspices of the Council for the Habitat.** Stellenbosch.

Meyer, P.A., et al (2005). **Improving strategies to prevent childhood lead poisoning using local data. International Journal of Hygiene and environmental Health. Volume. 208.**

Mining, Minerals, and Sustainable Development (MMSD) (2002). **Breaking New Ground.** [http://www.pdf.wri.org/mining\\_background\\_literature\\_review.pdf](http://www.pdf.wri.org/mining_background_literature_review.pdf). Accessed 7<sup>th</sup> August 2013 15:57Hours.

Ministry of Environment and Natural Resources (MENR) (1994). **The National Environmental Action Plan.** Lusaka: ECZ Plan.

MoE (1996). **Educating our Future. National Education Policy.** Lusaka: ZEPH.

MoFNP (2006). **Fifth National Development plan 2006-2010.** Lusaka: GRZ

Mwamwenda, T.S. (1995). **Educational Psychology, (2<sup>nd</sup> edition).** Durban: Butterworths.

Mweemba, L. (2013). **Agenda 21 Chapter 36: Promoting Education, Public Awareness and Training.** Lecture notes. University of Zambia.

Nakicenovic, N.A. et al (ed) (1998). **Global energy perspectives**. Cambridge: Cambridge University press.

Namafe, C.M. (14-17<sup>th</sup> May, 2013). **Proposed framework for integrating cross cutting and emerging issues into Zambian teacher education curriculum: Paper presented at the MESVTEE technical workshop on curriculum review for teacher education**, provincial resource centre, Kabwe.

National Academic of Sciences (1993). **Measuring lead exposure in infants, children, and other sensitive populations**. Washington, DC: National Academy press.

Ngoma, P.S. (2005). **Statistics in Adult Education**. Lusaka: ZAOU.

Odum, E.P. (1969). **Fundamentals of Ecology**. London: W. B. Saunders Company.

Ogula, A. P. (1998). **A Hand Book on Educational Research**. Nairobi: New Kemit Publishers.

Oliver M. Mugenda and Abel G. Mugenda (2003). **Research Methods: Quantitative and Qualitative Approaches**. Nairobi: African Centre for Technology Studies Press.

Orodho, A.J., and Kombo, D.K. (2002). **Research Methods**. Nairobi: Kenyatta University, Institute of Open Learning.

Panneerselvam, A., and Mohana Ramakrishnan (2009). **Environmental Science Education**. New Delhi: Sterling Publishers Private Limited.

Patrick, J. L. (2004). **Awareness Education Safety: A Guide to Lead-safe Living**. Oregon State: University Press.

Paulo, F. (1989). **Pedagogy of the Oppressed**. New York: Continuum Publishing Company.

Puyol, A. (1999). **Communication Efectiva para Ivolucrar Actores Claves en Las Estrategias de Biodiversidad, Report an IUCN CEC Training and Networking Workshop for South American NBSAP Coordinators, Galapagos, IUCN SUR**. Quito: IUCN.

Regan, P. and Turner, T. (2007). **‘Working to prevent lead poisoning in children: getting the lead out’**. (Online).

Reuters (2010): [www.lusakatimes.com/2001/06/21.Mining-leaves-toxic-legacy-in-kabwe-town](http://www.lusakatimes.com/2001/06/21.Mining-leaves-toxic-legacy-in-kabwe-town). 31st December, 2013. Accessed 21:07Hours.

Rose, M. Glass-Pue (2006). **Childhood Lead Poisoning Prevention Program Community Awareness Pilot**. USA: CDC, Environmental Health.

Rosenberg, E. et al (2008). **Towards better environmental sustainability practices: Methods and processes to support change-oriented learning**. Grahamstown: Rhodes University press.

Rossi, E. (2008). **‘Low level environmental lead exposure-A continuing challenge: The clinical biochemist**. **Reviews/Australian Association of Clinical Biochemists**. RMC 2533151. PMID 18787684.

Sanborn, M.D. et al (2002). **‘Identifying and managing adverse environmental health effects: 3 lead exposure’ Canadian Medical Journal**. PMID 111081.

Sarantakos, S. (1993). **Social Research**. Riverina: Macmillan Publication.

Schwela, D. (1995). **‘Public Health implications of urban air pollution in developing countries’ paper presented at the tenth world clean air congress, 28<sup>th</sup> May- 2<sup>nd</sup> June**. Finland: Erjos.

Sidhu, K.S. (2006). **Methodology of Research in Education**. New Delhi: Sterling Publishers Private Limited.

Simasiku, P. et al (2008). **The impact of wildlife management policies on communities and conservation in game management areas in Zambia: Message to policy makers**. Lusaka: Natural Resources Consultative Forum.

Stephens, C. and Ahern, M. (2001). **Worker and Community Health Impacts Related to Mining Operations Internationally: A Rapid Review of the Literature**, International Institute for Environment and Development.

Tao He and Huang, A.H. (1992). **Study on the lead-contaminated rice grown near a smelter**. Beijing: China J public health publications.

UNESCO-UNEP (1976). **‘The Belgrade Charter’**. Belgrade: UNESCO-UNEP.

UNESCO-UNEP (1977). **First Intergovernmental Conference on Environmental Education Final Report, Tbilisi, USSR**. Paris: UNESCO.

UNESCO-UNEP (1978). **Tbilisi Principles of Environmental Education**. Paris: UNESCO-UNEP.

UNESCO-UNEP (1987). **Educational Congress on Environmental Education and Training**. Moscow: UNESCO-UNEP.

UNCEP (1992, June). **Chapter 36: Promoting Education, public awareness and training of agenda 21. Report of the United Nations Conference on Development**, Rio de Janeiro, Brazil. Retrieved on 16<sup>th</sup> august, 2013: <http://www.unesco.org/iau/sd/rtf/sderio.rtf>.

US Environmental Protection Agency (2003). **Superfund Lead-Contaminated Residential Sites Handbook: Lead Sites Workgroup**. <http://www.epa.gov/superfund/programs/lead/ieubk.html>. Accessed 1st August, 2013 12:19 Hours.

U.S. Department of health and Human Services (2005). **Health Consultation: Copper Basic Mining district Copperhill**. Polk County: Tennessee.

Vedantam Shankar (July, 8, 2007). **‘Research links lead exposure, criminal activity: Washington post**. Retrieved November 24, 2013.

Water Management Consultants Ltd (WMC Ltd) (2006). **Copperbelt Environment Project: Kabwe Scoping and Design Study Phase III Report: Site Rehabilitation and Environmental Management Plan**. United Kingdom: Water Management Consultants Ltd.

Wamsley, R.D. and Mazury, D. (1999). **A Management Plan for the Blesboksprint Ramsar Site. Vol 2: Objectives and Management Plan**. Pretoria: University of Pretoria.

Wheeler, K. (1975). **The Genesis of Environmental Education**. In Martin, G., and Wheeler, K., (Eds), **Insights into Environmental Education**. Edinburgh: Oliver and Boyd.

World Bank (2002). **Toxics and Poverty: The impact of Toxic Substances on the Poor developing Countries**. Washington, DC: World Bank Publication.

**World Bank Technical paper number 154 (1991)**. Washington D.C: Library of Congress Cataloging-in-Publication Data.

World Health Organisation (2002). **Reducing Risk: Promoting Health Life**. Geneva: WHO Report.

Yu, X.M. and Ye, G.J. (1991). **Determination of lead and cadmium concentration in children’s toys**. China: Zhonghua Yu Fang publications.

ZCCM-IH plc (undated). **Copperbelt Environment Project**. Kitwe: CEP Regional.

**ZCCM-IH Risk Communication Project 2003 Interviewer’s Instructions Manual**. Kitwe and Kabwe: ZCCM-IH.

**ZCCM-IH plc. Incorporated in the Republic of Zambia, Copperbelt Environment Project. Project Implementation Manual final Draft, November, 2002. Kitwe: CEP**

**ZCCM-IH plc. Incorporated in the Republic of Zambia CEP. Workshop held from 26<sup>th</sup> to 27<sup>th</sup> October, 2005 at Tuskers hotel. Kabwe: CEP.**

**ZCCM-IH plc (1995). ‘Kabwe Mine Site Rehabilitation and Decommissioning Plan,’ ZCCM. Lusaka: Unpublished.**



## APPENDICES

### APPENDIX 1

#### AWARENESS OF EFFECTS OF LEAD CONTAMINATION IN ZAMBIA'S MAKULULU AND KASANDA MINE COMPOUNDS OF KABWE DISTRICT

#### QUESTIONNAIRE FOR RESIDENTS AND PUPILS OF KABWE: KASANDA MINE AND MAKULULU COMPOUNDS

I am a post graduate student in Master of Education degree in Environmental Education, and conducting a research on the above subject. Kindly help to answer this questionnaire, answering all questions by ticking or writing in spaces provided, and where you are not sure feel free to ask me. The information you are going to provide will be purely for academic purposes and will be used as such, meaning confidentiality shall be exercised seriously. You are advised not to write your name or any form of identity on this questionnaire. However, you are free to withdraw at any point you so wish. Your cooperation will be appreciated.

#### SECTION A: PERSONAL DETAILS

1. Sex:    Male ☐                  Female ☐
2. Age
  - a. 14-30 years ☐ b. 31-40 years ☐ c. 41-50 years ☐ d. 51 years and above ☐
3. Educational level attained.
  - a. Primary level ☐ b. Secondary level ☐ c. Tertiary level ☐ d. No education ☐
4. What do you do for a living?
  - a. Public Sector ☐ b. Private Sector ☐ c. Business Sector ☐ d. Not working ☐                  e. Full time student ☐
5. For how long have you lived in your compound?
  - a. 0-2 years ☐ b. 3-5 years ☐ c. 5 years and above ☐

#### SECTION B: ENVIRONMENTAL AWARENESS

6. What do you understand by the term environmental awareness?  
.....  
.....  
.....
7. (a) Are you aware that there is presence of lead contamination in your compound?
  - a. Yes ☐ b. No ☐

(b) If yes, how did you know about the presence of lead contamination in your compound?

.....  
.....

8. What are the methods used to make residents aware of the effects of lead contamination in your community?

.....  
.....

9. What common health problems are faced in these communities?

.....  
.....

10. What do you think are the common causes of these stated health problems?

.....  
.....

11. Which people are most likely affected by lead contamination?

a. Children ☐ b. Women ☐ c. Men ☐ d. All of the above ☐

Suggest reasons to support your answer

.....  
.....

12. How does lead contamination affect the:

Children.....

Women.....

Men.....

Natural Environment.....

### **SECTION C: SENSITISATION ON AWARENESS OF EFFECTS OF LEAD CONTAMINATION LESSONS**

13. Is there awareness campaign programmes aimed at addressing lead contamination taking place in your area?

a. Yes ☐ b. No ☐

14. Which institutions teach awareness campaign programmes in your locality

.....  
.....  
.....

15. Is it easy for residents of these areas to access information on effects of lead contamination?

a. Yes ☐ b. No ☐

16. Explain the sources of information for these residents:

.....  
.....

17. Where are centres of awareness for lead contamination lessons?

.....  
.....

#### **SECTION D: PARTICIPATION ON AWARENESS OF EFFECTS OF LEAD CONTAMINATION LESSONS**

18. (a) Do residents participate in these awareness lessons?

a. Yes ☐ b. No ☐

(b) If yes to question 18 above, how often do residents of these areas participate in lessons about effects of lead contamination?

a. Weekly ☐ b. Monthly ☐ c. Every 6 months ☐ d. Annually ☐

e. No time at all ☐

19. Explain how the residents of these compounds are involved in planning sensitisation lessons about effects of lead contamination?

.....  
.....

20. What reasons make other residents not to participate in awareness lessons?

.....  
.....

21. Do you still need to receive awareness lessons in your compounds?

a. Yes ☐ b. No ☐

#### **SECTION E: CONTRIBUTIONS MADE BY ENVIRONMENTAL EDUCATION TO REDUCE EFFECTS OF LEAD CONTAMINATION ON THE LIVES OF PEOPLE OF MAKULULU AND KASANDA MINE COMPOUNDS**

22. What topics do facilitators teach to the community on awareness of effects of lead contamination?

.....  
.....

23. (a) Do you think that lead contamination programmes have been dealt with adequately?

A. Yes [ ]      b. No [ ]

(b) If yes to question 23 above, explain to support your answer

.....  
.....

24. Mention the topics you would suggest to facilitators to include in teaching of effects of lead contamination

.....  
.....  
.....

25. After residents have been taught of awareness lessons on the effects of lead contamination, how has the lessons changed their behaviour?

.....  
.....

26. (a) In your own opinion, has the awareness campaign programmes gained ground or not?

a. Yes [ ]      b. No [ ]

(b) If your response is no to question 26 (a) above, state the possible barriers to the successful awareness campaign programmes on the effects of lead contamination in Makululu and Kasanda Mine compounds?

.....  
.....  
.....

27. Suggest how best you think environmental education could be used in order to address the effects of lead contamination in Makululu and Kasanda mine compounds:

.....  
.....  
.....

**Thank you for Participating in this study**

## **APPENDIX 2**

### **AWARENESS OF EFFECTS OF LEAD CONTAMINATION IN ZAMBIA'S MAKULULU AND KASANDA MINE COMPOUNDS OF KABWE DISTRICT**

#### **INTERVIEW GUIDE TO GOVERNMENT OFFICIALS AND FACILITATORS OF ENVIRONMENTAL AWARENESS PROGRAMMES TO RESIDENTS OF KASANDA MINE AND MAKULULU COMPOUNDS, KABWE**

I am a post graduate student in Master of Education degree in Environmental Education, and conducting a research on the above subject. Kindly answer these questions freely in this interview. The information you are going to provide will be purely for academic purpose and will be used as such, meaning confidentiality shall be exercised seriously. Your cooperation will be appreciated.

1. What is the title of your job?
2. For how long have you held this position?
3. What do you understand by the term environmental awareness?
4. (a) Are you aware that there is presence of lead contamination in Makululu and Kasanda Mine compounds?  
(b) If your answer is yes to question 4 above, state how you came to know about the presence of lead contamination in the said compounds?
5. What are the methods used to make people aware of effects of lead contamination in the named areas?
6. What common health problems are faced in these compounds?
7. What do you think are the common causes of the stated health problems?
8. (a) Which people are most likely affected by effects of lead contamination?  
(b) Suggest reasons to support your answer in question 8 above.
9. How does lead contamination affect the:  
  
-Children -Women -Men - Natural Environment
10. Is there awareness campaign programmes aimed at addressing lead contamination taking place in these compounds?
11. Which institutions teach awareness campaign programmes in these compounds?
12. Is it easy for residents of these compounds to access information on effects of lead contamination?
13. Explain the sources of information for these residents.
14. Where are centres of awareness lessons conducted?

15. (a) Do residents participate in these awareness programmes?  
(b) If yes to question 15 above, how often do residents of these compounds participate in lessons about effects of lead contamination?
16. How do you involve the residents of Makululu and Kasanda mine compounds in planning sensitisation lessons about effects of lead contamination?
17. What reasons make other residents not to participate in awareness lessons?
18. Do you still need to receive awareness lessons in your compounds?
19. What topics do facilitators teach to the community on awareness of effects of lead contamination?
20. (a) Do you think lead contamination programmes have been dealt adequately?  
(b) If yes to question 20 above, explain to support your answer
21. Mention the topics you would suggest to facilitators to include in teaching of effects of lead contamination.
22. After residents have been taught of awareness lessons on the effects of lead contamination, how has the lessons changed their behaviour?
23. (a) In your own opinion, explain how these awareness campaign programmes have gained ground?  
(b) If not, what could be the possible barrier to the successful awareness campaign programme on effects of lead contamination?
24. Suggest how best you think environmental education could be used in order to address the effects of lead contamination in Makululu and Kasanda Mine compounds.

**Thank you for Participating in this study.**

### APPENDIX 3

#### Research Budget

S/N	Description	Quantity	Unity Price	Total in Kwacha
1	Transport	Visiting Makululu and Kasanda mine (8 times)	K50	K400
		Trips from Kabwe to Lusaka (6 times)	K70	K840
2	Equipment	12A toner (1)	K800	K800
		Video/digital camera (1)	K1800	K1800
3	Stationery	Reams of paper (02)	K30	K60
		Pens (6)	K2	K12
		Flash discs (2)	K150	K300
		Box file (1)	K20	K20
		Stapler/Staples	K70	K70
		Perforator (1)	K50	K50
4	Meal Allowance	Lunch Meals during data collection (8 times)	K25	K200
		Meals when in Lusaka (6 times)	K25	K150
5	Production Cost	Printing and Binding Proposal (4 copies)	K60	K240
		Printing and Binding Final copies (4)	K70	K280
6	Total cost			K5222

## APPENDIX 4

### Activity Time Plan

Activity	Details of Activity	Duration	Dates
Proposal Writing	Review of Literature  Development or Designing of Research Instruments  Production of Final Draft of Research Proposal	Two Months	May 2013  To  June 2013
Submission of Final Version of Proposal	Printing and Binding of the final version of Proposal Report	Two Months	July 2013  To  September 2013
Data Collection	Design of Instruments and Pilot Study	One Month	October 2013
Field Work	Actual data collection in the field	Two Months	November 2013  To  December 2013
Data Analysis and Processing	Preparation, Presentation and Analysing data (data processing and analysis)	Three months	January 2014  To  March 2014
Report Preparation	Report Writing, typing and editing	Two months	May 2014  To  July 2014
Report Production	Proof reading, production, submission of final draft	Three months	August 2014  To October 2014



