

**INDUSTRIAL DEVELOPMENT AND THE STATE OF THE NATURAL  
ENVIRONMENT, A CASE OF ABOGETA DIVISION,  
MERU CENTRAL DISTRICT, KENYA**

**BY**

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## DECLARATION

I do hereby declare that, this research has never been submitted to any other institution of higher learning for any award. All the information entirely depends on my effort.

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### **APPROVAL**

This research resulted from the study effort in the area of training and has carried out under my supervision. I thereby approve it for final submission for the award of Bachelor of Arts with Education of Kampala International University

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## **DEDICATION**

This research study is dedicated to my family members. My beloved Mum Sarah Mwebia, my dad Francis Mwebia, my uncle Silas Kirimi, uncle Gilbert Muthuri, aunt Ireen kawira, my great friends Perps, my brothers Joel, Eric, Ezra, sisters Rose, Christine, great friends and businessman Lawrence, misheck, Murithi, (manuu), mzee M'mugambi Mageria, Mutuma M'mugambi, Muthuri (wacia), Jim (retailer) and all my friends in Kampala International University like Chris, Pius, Nico, Nancie, Joyce, and others who helped and encouraged me to come up with this entire work.

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## **ABSTRACT**

*The purpose of the study was to assess the industrial development and the state of the natural environment, a case of Abogeta Division Meru Central District Kenya. The objectives of the study were to assess the extent to which the establishment of industries have contributed to air pollution, establish the effects of industrial pollution on water and land, find out how the establishment of industries has contributed to the destruction of the natural forests and to assess the impact of industrial noise on the local population. The methods used for data collection were questionnaires for both industrialists and retailers and interviews for selected industrialists. Data was analyzed and presented by the use of frequencies, percentages, tables and pie charts. The findings revealed that industrial development has led to an increase in air pollution, it has affected the quality of water and increased land pollution, it has caused the destruction of natural forests and has resulted to noise pollution which affects the local population. The study recommended that the government should pass strict laws that should aim at reducing industrial pollution and waste products. The government should encourage source reduction, recycling and treatment of industrial wastes before disposal. The manufacturers should minimize excessive packing and encourage the use of biodegradable materials. The government should specify gazetted areas, produce enough electric power supply to supplement wood fuel and embark on a tree planting campaign.*

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## **DEFINITIONS OF TERMS.**

<b>Natural environment-</b>	Refers to the earth's surface and atmosphere, including living organisms as well as air, water, soil and other resources necessary to sustain life.
<b>Global warming-</b>	An increase in the earth's temperature due to the green house effect.
<b>Green house effect-</b>	The build up of carbon dioxide in the earth's atmosphere that allows light to enter but inhibits the release of heat, believed to cause global warming.
<b>Technology-</b>	Is information about how to use the material resources of the environment to satisfy human needs and desires.
<b>Ecology-</b>	The study of the interaction of living organism and the natural environment.
<b>Environmental deficit-</b>	Profound and negative long-term harm to the natural environment caused by humanity's focus on short term materials affluence.
<b>Hazardous wastes-</b>	These are wastes that can potentially cause or significantly contribute to serious, usually irreversible illness and many health problems.
<b>E.P.A -</b>	Environmental Protection Agency
<b>DDT-</b>	DicloroDiphenylTrichloroethane.
<b>Ecosystem-</b>	A group of interacting species along with their physical environment.
<b>Extinction-</b>	Complete disappearance of species which may be natural or as environmental conditions changes.

## **CHAPTER ONE**

### **1.0 Introduction**

This chapter is concerned with the background of the study, the statement of the problem, purpose of the study, specific objectives of the study, research questions, the scope of the study, significance of the study and the limitation of the study.

According to Abraham, (1997); Kidd and Lee (1997), right from the start people recognized the materials benefit of industrial technology, but only a century later did they begin to see the long term effects on the natural environment. Indeed, one trait of the recent post industrial era is a growing concern for environmental quality.

### **1.1 Back ground of the study**

According to the 6<sup>th</sup> Annual report of the Meru Council on Environmental Quality (2008), right from the start, our ancestors in Abogeta division in the 19<sup>th</sup>c who were hunters and gatherers had only simple technology. So they had very little effect on the environment. Nature ruled much of their way of life; they lived according to the migration of animals, the changing of the seasons and natural events such as fires, floods and droughts. Generally the area was rich in biodiversity characterized by the existence of a large and huge variety of flora and fauna (plants and animals). There were regular and predictable seasonal changes.

In Abogeta since many people relied on horticulture, (small scale farming), pastrolism (the herding of animals), or agriculture (with animal drawn ploughs, though it had a greater capacity to affect the environment. The environmental impact of these technologies was limited because people using them relied on muscle power.

According to the same report, the industrial development led to the establishments of the manufacturing industries and factories in the area coupled with other automobiles which release pollutants into the atmosphere. The impact of industrial development in Abogeta in the recent years has resulted into chemical pollution. These chemicals are found in food, they are used in detergents, fertilizers, pesticides, plastics, clothing, insulation and almost everything else.

Further more in the same Annual Report (2008), of the Meru Council on Environmental Quality. The manufacturer of chemical and various products requires disposing of the waste. Waste disposal around the Meru show grounds on Meru-Nanyuki road comprises of the toxic industrial products and chemicals. The huge amounts of toxic chemicals are released into the air, water, land and underground.

For the case of solid waste pollution people throw away enormous amounts of old food, glass, plastics, metals, textiles, rubber, wood and papers, for the cases where these wastes are not biogradable, it means that they are preserved in the landfills or environment hundreds of years hence causing environmental problems.

According to the Meru municipal report (2008), other impacts of the industrial development in Abogeta zone includes; water pollution, air pollution and land pollution. Toxication results into acid rains, declining biodiversity, extinction of some animal species and eventually global warming and its associated problems like floods, droughts, and declining crop yields.

## **1.2 Statement of the problem**

Industrial development has of recent been identified to have a major impact on the natural environment in Abogeta Division. The establishment of industries and factories has led to poor waste disposal, excessive usage of plastic and polythene bags and chemicals in this location which has resulted to increased air pollution, land pollution and water pollution, of course if this continues there will be increased cases of health problems, destruction of the natural forests, declining biodiversity and declining crops yields to support the growing number of population hence the need to carry out this study.

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

The study was conducted to assess the industrial development and the state of natural environment in Abogeta division, Meru central district, Kenya.

## **1.4 Specific objectives of the study.**

The following objectives guided the researcher in carrying out this study.

1. To assess the extent to which the establishment of industries have contributed to air pollution.
2. To establish the effects of industrial pollution on water and land.
3. To find out how the establishment of industries has contributed to the destruction of the natural forests.
4. To assess the impact of industrial noise on the local population.

## **1.5 Research questions**

1. To what extent has establishment of industries contributed to air pollution?
2. What are the effects of industrial pollution on water and land?

3. How has the establishment of industries contributed to the destruction of the natural forests?
4. What is the impact of industrial noise on the local population?

### **1.6 Scope of the study**

The study was conducted in Abogeta division, Meru central district Kenya. The study covered three major markets. The selected markets were Kanyakine, Mitunguu and Igoji markets since they were convenient for the researcher to carry out his study. The study took the researcher five months to complete his study since it commenced from December 2009 and ended in May 2010, information was got from industrialists and retailers.

### **1.7 significance of the study**

The study will help the local government authorities and the community in the conservation of finite resources, that is, satisfying our present wants with a responsible eye towards the future.

The study will help the environment activists, the society, the industries and factories around in reducing wastes which cause adverse environmental problems. However, the success depends on educating people to reduce wastes and passing laws that require the recycling of certain materials and proper disposal of industrial wastes.

The study will help in enhancing understanding and sensitization to the entire community about the aim of ensuring a waste management and disposal from the industrial related products.

### **1.8 limitation of the study**

The following obstacles were experienced during the study.

1. Some respondents were reluctant to reveal some information due to the fear of the local authorities. However, this problem was overcome by the researcher assuring them that the information was confidential and it will be used for the purpose of study only.
2. There were transport problems since the study was conducted on a rainy season. This was solved by the researcher buying gum boots and the umbrella to ensure the study was carried out successfully.
3. There was a shortage of funds to finance the entire project. However, this was overcome by the researcher borrowing more funds from parents to complete the study.
4. The time allocation was not enough to visit all the planned areas. This is because the study was conducted during the semester, so the researcher had to use little time to conduct his study. However, this was overcome by proper time planning.

## **CHAPTER TWO**

### **REVIEW OF THE RELATED LITERATURE**

#### **2.0 Introduction**

This chapter gives the insight about the impact of industrial development on the natural environment as viewed by various authors. According to them, industrial development has resulted to increased air pollution, water pollution, land pollution, destruction of the natural forests and declining biodiversity.

According to Revelle (1971), pollution is the harmful alteration of our environment by our own actions. Pollutants are either unwanted by-products of our activities or by obnoxious residues of products we have made, used and thrown away.

#### **2.1 The extent to which establishment of industries have contributed to air pollution.**

According to Anderson (1982:40) pollution and depletion of the environment are noted in our industrial economy. According to him he noted that various products of our industrial economy can make indoor pollution even worse than out door. Further, the industrial workers are directly exposed to a multitude of occupational hazards.

According to Stanley & Baca (1997), air pollution is mostly from automobiles and industrial pollution. A major cause of air pollution of air pollution in the United States is the extensive use of automobiles. The automobiles also bears heavy responsibility for the rapid depletion of the world's oil reserves. The case of automobiles illustrates the dilemmas of our environmental pollution.



According to the 6<sup>th</sup> Annual report of the Meru council on environment quality (2008). The industrial economy affects us all, not just those who work directly in it. Air pollution is a by product of generating electrical power and producing the extra-ordinary variety of industrial products we use. Industrial fuel combustion accounts for a good deal of the air pollution in the area and about eight other industrial processes contribute more than half the particulates and an important fraction of the sulphur dioxide, carbon monoxide and hydrogen emission into the atmosphere.

According to Robert (1992). The business and industry not only lobby for industrial growth they vigorously oppose pollution-control proposals and in some cases, have managed to defeat the proposals either by lobbying or by influencing public opinion hence the continuing rates of air pollution.

According to the 6<sup>th</sup> Annual report of the Meru Council on Environmental Quality (2008), most air pollution in Abogeta is caused by the burning of fuels-oil and natural gas. Air pollution is associated with industrial processes, for example flour mills and with the internal combustion engines of the motor vehicles on the streets and highways.

According to the report, there is another kind of air pollution that is receiving increasing attention, however, the pollution of the atmosphere with toxic vapor from manufactured products and with electromagnetic radiation. The former is illustrated by the vapours given off from formaldehyde, which is used in the manufacture of numerous products used around the home.

The latter has been called "electronic smog" (Gold; 1980) and is due to such things as radio antennas, garage door openers, citizens band

radios, micro wave ovens and the multitude of the electronic products that surrounds us.

According to the 6<sup>th</sup> Annual report of the Meru Council on Environmental Quality (2008), air pollution has resulted to health problems such as aggravation of respiratory diseases, including asthma, chronic bronchitis and emphysema, reduced lung function; irritation of eyes and respiratory tracts; increased mortality. According to the report there has been a dramatic increase of asthma cases from early 1990s to 2008. Other effects include corrosion of metals, deterioration of electrical metals, textiles, finishes and coatings, building stones, formation of acid rains of injury and reduced growth in plants due to interference with photosynthesis processes. There is also increased clouds formation of acid rains, leaf injury and reduced growth in plants due to interference with photosynthesis processes. There is also increased clouds formation due to increase in condensation nuclei leading to floods in some areas in Meru.

According to Lauer and Lauer (2002); the other problem that dramatizes our environmental problems is the threat to the Ozone layer. Ozone is a rare form of oxygen that is poisonous to human beings at ground level but is necessary to the upper atmosphere to absorb the deadly ultraviolet radiation of the sun. Higher than normal concentration at ground level pose health problems to the eyes, throat and lungs to humans and ecosystem. High voltage electronic equipments create ground level Ozone. Ironically, electronic air cleaners which have been used to reduce the other kinds of air pollution are another kind of equipments that generate ozone. The ecosystem is so complex that sometimes our apparent victories come back to haunt us.

The ozone in the upper atmosphere is reduced as a result of a number of human activities, including the use of nitrogen fertilizers, supersonic air planes, fluorocarbons from aerosols spray cans (now banned in the United States) and nuclear explosions in the atmosphere. The effects of a depleted ozone layer are under reaching involving changes in the earth's climate, destruction of some plants and animal life, reduced crop yields, increased incidence of skin cancer, possible genetic changes to plants and human and an impact on the food chain of the oceans; (Brown 1993: Mc Ginn 1999).

## **2.2 The effect of industrial pollution on water and land**

Water pollution is a most immediate problem in the third world. Contaminated water in poor countries results in high death rates from cholera, typhoid, dysentery and diarrhoea. A serious threat to drinking water comes from the chemicals that farmers put on their fields to increase yields, kill pests (pesticides) and destroy weeds (herbicides). The chemicals applied seep in wells and rain into streams and rivers.

According to Revelle (1971), he identified eight different kinds of water pollution in the United States.

First is organic sewage, which requires dissolved oxygen in order to be transformed into carbon dioxide, water, phosphates, nitrates and certain plant nutrients less oxygen is needed if the sewage is treated, but the amount of treatment varies from place to place and in some cases there is no treatment.

Eutrophication, a second kind of water pollution is over fertilization of water, from excess nutrients, leading to algae growth and oxygen depletion. Eutrophication threatens aquatic life. It has already killed a great number of fish in the United States and other parts of the world.

A third type of water pollution results from infectious agents. Many water borne bacteria that cause diseases have been eliminated in the United States but there is still some danger from infectious viruses such as hepatitis.

Organic chemicals such as insecticides, pesticides and detergents cause a fourth kind of water pollution. These too may be highly toxic to aquatic life and to the creatures that use the water and the aquatic life in it.

Inorganic and miscellaneous chemicals constitute a fifth category of water pollutants. These can alter the life of a body of water, kill fish and create unpleasant tastes when the water is used as a drinking supply.

Sixth "sediments from land erosion may cause pollution. These sediments can reduce a stream's ability to assimilate oxygen-demanding wastes and prevent sunlight required by aquatic plants from penetrating the river" Revelle (1971).

Radioactive substances, a seventh kind of water pollutant, are likely to become more serious if nuclear plants to generate electricity become more common.

The eighth kind of water pollution is waste heat from power plants and industry. Overheated water holds less oxygen and fish and other aquatic life are generally very sensitive to temperature changes.

According to the 6<sup>th</sup> Annual report of the Meru Council on Environmental Quality(2008). Water pollution is also a by-product of industrial processes; this includes some thermal pollution, which occurs when water is taken from a water way in large quantities and used for cooling.

The heated water can raise the temperature of the river it is dumped back into to a point that is dangerous for aquatic life.

According to the Nairobi citizen's advisory committee on environmental quality (2007), Nairobi River is one of the most polluted rivers from industrial wastes in Kenya.

According to Stanley and Baca (1997), the major sources of water pollution are industries which pour into rivers, lakes and oceans a vast array of contaminants such as lead, asbestos, detergents, solvents, acid and ammonia, farmers, whose pesticides, herbicides fertilizers and animals wastes drain into streams and lakes; cities which dispose of their wastes including sewage into rivers to end up down stream in another city's drinking water, and oil spills caused by tanker accidents and in offshore drilling.

According to Lenssen (1993) and Bright (2000). The problem of acid rain is caused by sulfur dioxide from coal burning plants and factories, and by nitrogen oxides from automobiles exhaust and some industries. As they rise, the chemicals mix with some water vapour to form sulfuric and nitric acids that fall to the earth as acid rain or snow. Acid rain has been responsible for such things as killing fish in lakes damaging forests, reducing crop yields, contributing to health problems and causing damage to buildings and monuments, moreover the damages may occur hundreds or thousands of miles away from where the sulfur dioxide emissions occurred.

### **2.3 Effects of industrial pollution on land**

According to Robert (1992), soil as well as air and water may be polluted, pesticides, herbicides, chemical wastes, radio active fall out, acid rain and garbage can all infect the soil. Some of the chemicals used as pesticides are hazardous to both human beings and soil. Unfortunately, these chemical are also relatively stable in soil; residues have been found years after the chemical were used.

According to Postel (1987), the pesticide DDT for example was banned in the United States when some of its consequences became known. It interfered with the formation of normal egg shells in certain birds, adding to the potential extinction of some species. It is incredibly stable, having been found in penguins in the Antarctic, in blood and fat of most Americans and carrots and spinach sold in supermarkets more than a decade after being banned.

The problem of pesticides is compounded by the fact that the pests tend to develop a resistance to their effects, so that increasing quantities are required over time. And if the natural enemies of a particular pest disappear a pest control program may require monstrous increase in dosage of the pest.

According to Kenya's Nema report (2009).plastics waste in Kenya is poorly managed by the majority of the people and yet this could be a dangers to our health.

The common poor practices of plastic waste management is haphazard dumping and burning of plastic waste plastics are composed of a number of additives ie a group of chemicals added to plastics to confer special properties to the plastics eg antioxidants, plasticizers colorants, ultraviolet absorbers, antiblocking and anti static agents.

According to the Kenya Nema report (2009). The major effect of industrial development on land is the poor disposal of polythene bags which are not biodegradable. According to the report many industrial products, the sugar, salt and bread among others are packed in polythene papers which are later thrown or dumped anywhere causing a great land pollution.

According to the Nema report (2009), when plastics are burnt, pollutants are emitted and these include; particulate matter, sulphur dioxides, carbon monoxide, volatile organic compounds, nitrogen oxides etc and heavy metals such as mercury, cadmium and lead which are highly toxic which is a threat to human beings and the entire ecosystem.

According to Raven and Berg (2001). There are two types of solid waste i.e. municipal solid waste which consist of solid materials discarded by homes, offices, buildings, retail stores, restaurants, and institutional facilities. Municipal solid waste is a heterogeneous mixture composed primarily of paper and paper board, yard waste, plastics, metals, wood, food waste, glass and other materials such as rubber, leather and textiles.

Non-municipal solid waste includes wastes from mining (mostly waste rock), agriculture and industry.

When the solid wastes are poorly dumped there is the poisonous methane gas that is released in the surrounding air as micro organisms decompose the solid waste. Liquid that oozes and seeps through the solid waste heap ultimately finds its way into the soil, surface water and ground water. Hazardous materials that dissolve in this liquid often contaminate soil and water.

## **2.4 The effects of establishment of industries on the destruction of natural forests.**

According to the Kenya- Nema report (2009), Global warming is caused by increased industrial pollution; the clearing of forests to make way for farms, settlements and factories.

Many of the forests are cleared to create room for industrial raw materials like the case for agricultural industries and even to create room for the expansion and establishment of new factories and industries.

On 28<sup>th</sup> December, 2009. the citizen television in Kenya reported that the kipngatich Tea factory is a major contributor to the destruction of the controversial Mau forest because it is a major beneficiary of the tea plantations established after the forest was cleared , and also gets its wood fuel for tea drying from the Mau forest.

The destruction of the Mau forest has led to the drying of river Mara and several other rivers in the Rift Valley province which have their catchments areas within the man forest. Consequently, it has resulted to rainfall failure hence a decline in crop yield in the adjacent areas. However, it is reportedly that plans are underway to relocate the settlers and replant the forest, although experts say it will take over 80 years to grow to its original nature.

According to the Kenya Nema report (2009), wood using factories dealing in baking, lime production, tea and coffee drying, tobacco curing, fish smoking, sugar production, pottery and brick laying have speeded up the process of forest destruction. The fact that these industries obtain their wood fuel needs from somewhere, the moment there is supply shortage, the survival of these industries is threatened.



## **2.5 The impact of industrial noise on the local population**

According to Raven, Berg & Johnson (2001), sound is caused by vibrations in the air (or some other medium) that reach the ears and stimulate a sensation of hearing. Sound is called noise when it becomes loud or disagreeable, particularly if it results in physiological or psychological harm. Like other kinds of pollution in the environment noise pollution can be reduced, although there is a cost associated with its reduction.

Most of the noise produced in the environment is of human origin. Vehicles of transport, reusing of old metal scraps and heavy traffic cause outside noise that assails our ears. Indoor dish- washers, thrash compactors, washing machines, televisions and stereos add to the noise pollution.

Prolonged exposure to noise damages hearing. Loud, high-pitched noise from the industries injures the hair cells on the cochlea. Because injured hair cells are not replaced by the body. Prolonged exposure to loud noise results in permanent hearing impairments.

In addition, to hearing loss, noise from these industries produces several physiological effects in the body. It increases the heart rate, dilates the pupils and causes muscle contraction.

According to Raven, Berg & Johnson (2001), evidence exists that prolonged exposure to high level of noise causes a permanent contraction of blood vessels, which can increase the blood pressure, thereby contributing to heart diseases. Other physiological effects associated with noise pollution include migraine headaches, nausea, dizziness and gastric ulcers. Noise pollution also causes psychological stress.

In conclusion, according to Bormann (1990), from today's vantage points. We draw an ironic and sobering conclusion. As we have gained the greatest technological power and industrial development to make our lives better, we have put the lives of our future generation into jeopardy. The evidence is mounting that we are running up an environmental deficit.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.0 Introduction**

This chapter describes the methodology that the researcher used in carrying out this study. It gives description of the research design, organization of the study and the instruments used in data collection.

#### **3.1 Research design**

The researcher used a cross sectional research design which used both qualitative and quantitative methods together information about the state of environment in the area of study.

#### **3.2 Organization of the study**

##### **3.2.1 Study area.**

The study was conducted in Abogeta Division, Meru central district, Kenya. The establishment of industries in the area has caused a serious threat to the natural environment and therefore it was necessary to carry out this study.

##### **3.2.2 Study population.**

The study involved industrialists and retailers. This is because they were more aware and reliable to have the necessary information to help the researcher carry out his study.

##### **3.2.3 Sample size.**

Three local markets were chosen on the basis of their location. 15 industrialists and 15 retailers were randomly selected in each market. Generally, 90 respondents were supposed to give information but only 75

were available in the whole study. 45 retailers and 30 industrialists filled the questionnaire but only 16 industrialists in three markets were available for oral interview.

### **3.2. 4 Sampling techniques**

Both the industrialists and the retailers were selected by simple random sampling techniques. This technique was more convenient for obtaining the necessary information.

## **3.3 Data collection**

### **3.3.1 Instrumentation.**

The instruments of data collection were questionnaires and interviews guide. The industrialists filled the questionnaire and some were interviewed since they were considered to have the necessary information on the subject of study, while the retailers filled in the questionnaires.

### **3.3.2 Data collection procedure**

Before the study was conducted, the researcher sought permission from the university and the various places so as to conduct the research in their areas. The purpose of the study was explained to the concerned respondents at all levels for accuracy reasons of the information.

### **3.3.3 Data analysis**

Frequencies and percentages were used to determine the number of sample respondents used in the research process. The researcher also used tables and pie charts in the analysis of the information.

## CHAPTER FOUR

### PRESENTATION OF DATA, ANALYSIS AND INTERPRETATION

#### 4.0 Introduction

This chapter is concerned with data presentation analysis and interpretation. It analyses and interprets data concerning industrial development and the state of natural environment, a case of Abogeta division, Meru central district, Kenya. The objectives of the study were to assess to what extent has the industrial development contributed to air pollution, to establish the effects of industrial pollution on water and land, to find out how the establishment of industries has contributed to the impact of industrial forests and to assess the impact of industrial noise on the local population.

#### 4.1 Background characteristics of the respondents

Table 1. Shows the profile of the respondents

Respondent	Number of respondents	Percentage
Industrial	30	40
Retailers	45	60
Total	75	100
<b>Sex</b>		
Male	48	64
Female	27	36
Total	75	100
<b>Markets</b>		
Kanyakine	22	29.3
Mitunguu	27	36
Igoji	26	34.7
<b>Total</b>	75	100

Source: field data 2010

The table shows the background characteristics of respondents. It indicates their occupations, sex and the markets residence of the respondents. Further the table shows the number of respondents and percentage according to the characteristic of the respondents.

The study gathered information from 75 respondents that is, 33 industrialists representing 40% and 45 retailers representing 60% and 27 of the respondents were female representing 36% and 48 of the respondents were male representing 64%.

The study covered 3 markets of Kanyakine with 22 respondents (29.3%), with 15 retailers (20%) and 7 industrialists (9.3%), Mitunguu market with 27 respondents 36%, with 15 retailers (20%, and 12 industrialists (16%), and Igoji market with 15 retailers (20%) and 11 industrialists (14.7%).

#### **4.2 The extent to which the establishment of industries have contributed to air pollution**

The first objective was to assess the extent to which the establishment of industries has contributed to air pollution. The study established that air pollution has increased in the region due to the establishment of industries, particularly flour mills and this has resulted to some respiratory diseases. The study also found that carbon dioxide, carbon monoxide, sulphur dioxide and hydrogen gases are largely produced by these industries.

##### **4.2.1 Establishment of industries has led to air pollution.**

It was important to establish from the respondents whether indeed the establishment of industries has led to air pollution. According to the

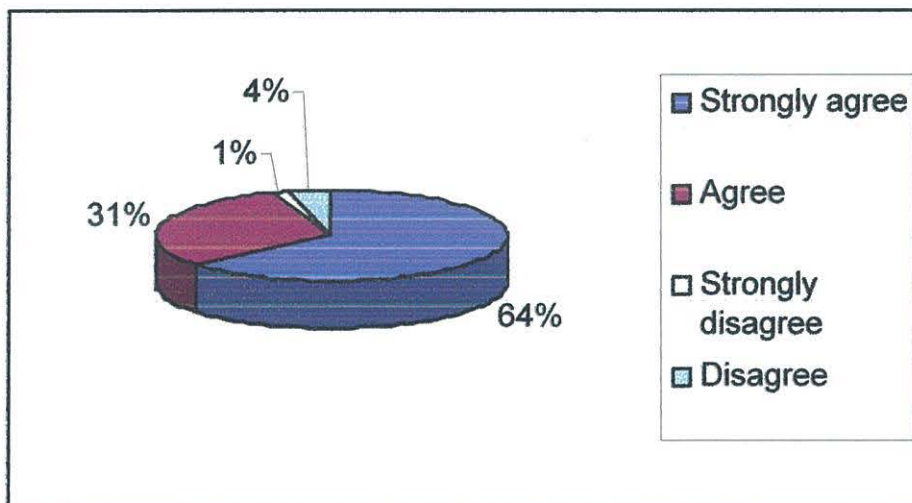
respondents, air pollution has increased due to the establishment of industries in the region.

**Table 2: Opinion on whether establishment of industries has led to air pollution.**

Respondents	Frequency	Percentage
Strongly agree	48	64
Agree	23	30.7
Strangely disagree	1	1.3
Disagree	3	4
Total	75	100

Source: filed data 2010

**Pie chart 1: Opinion on whether establishment of industries has led to air pollution**



The table and the pie chart shows that 64%, of the respondents strongly agreed that establishment of industries has contributed to air pollution, 30.7%, agreed, 1.3% strongly disagreed and 4% disagreed. The interviewed industrialists revealed that they usually burn most of the waste materials used to pack the industrial products and this results to

air pollution. This agrees with Stanley and Baca (1997), who pointed out that air pollution is mostly from automobiles, and industrial pollution. It also agrees with Anderson (1982:40) whose opinion was that both pollution and depletion of the environment are rooted in our industrial economy.

#### 4.2.2 Air pollution and respiratory diseases

It was important to find out from the respondents whether air pollution has resulted to respiratory diseases. The study revealed that air pollution results into some respiratory diseases due to harmful particles released into the air as shown in table 3.

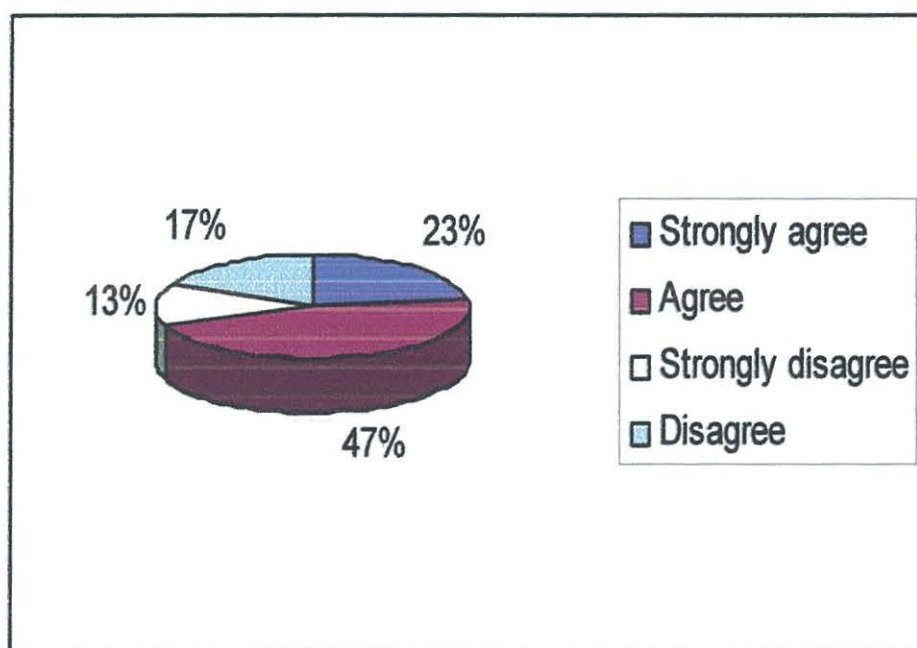
**Table 3. Opinion on whether air pollution has caused respiratory disease.**

<b>Respondents</b>	<b>Frequency</b>	<b>Percentage</b>
Strongly agree	17	22.7
Agree	35	46.7
Strongly disagree	10	13.3
Disagree	13	17.3
Total	75	100

Source: field data 2010



**Pie chart 2: opinion on whether air pollution has caused respiratory diseases**



The table and the pie chart indicate that 22.7% of the respondents strongly agreed that air pollution has caused respiratory diseases 46.7% agreed, 13.3% strongly disagreed and 17.3% disagreed. The industrialists who were interviewed revealed that cough cases may not be attributed to air pollution but the changing climatic conditions, while they revealed that although asthma cases are mostly hereditary they might be related to air pollution since most cases are reported in areas which have highly polluted air conditions, therefore the relationship between asthma and air pollution cannot be ruled out.

#### 4.2.3 Contribution of flour mills to air pollution.

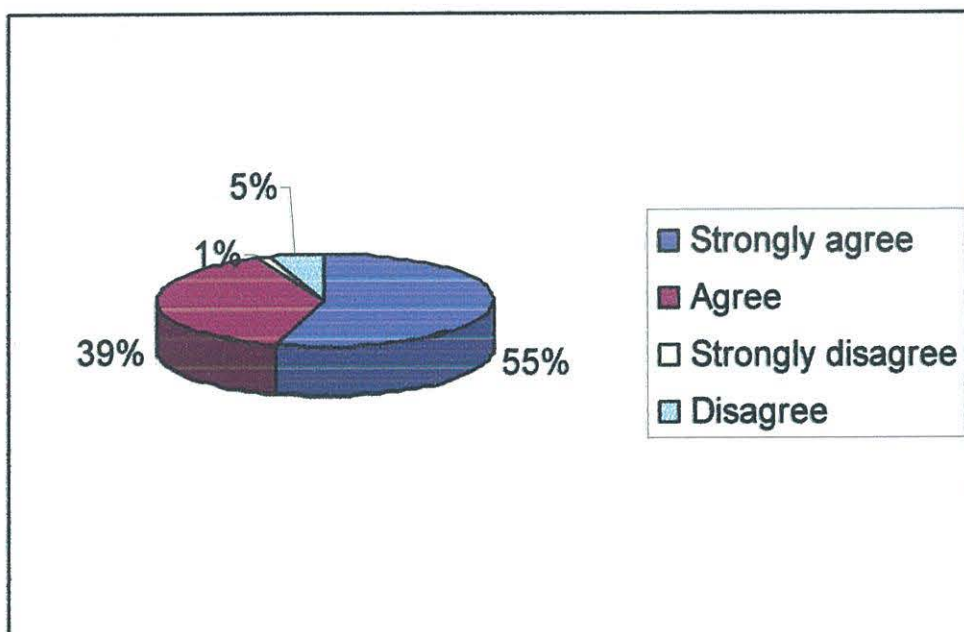
It was important to establish from the respondents whether indeed the presence of flour mills contributed to air pollution. The study established that flour mills contribute greatly to air pollution as shown in table 4.

**Table 4: Opinion on whether flour mills contribute to air pollution**

Respondent	Frequency	Percentage
Strongly agree	41	54.7
Agree	29	38.7
Strongly disagree	1	1.3
Disagree	4	5.3
Total	75	100

Source: field data 2010.

**Pie chart 3: Opinion on whether flour mills contribute to air pollution**



The table and the pie chart indicate that 54.7% of the respondents strongly agreed that flour mills contributed to air pollution, 38.7%, agreed, 1.3% strongly disagreed and 5.3% disagreed. The industrialists

who were interviewed revealed that many flour mills use petroleum products which produce thick cloudy smoke when they are milling. This agrees with the 6<sup>th</sup> Annual report of the Meru council on environmental quality (2008), that air pollution in Abogeta is caused by the burning of fuels-oil and natural gas. According to the report air pollution is associated with industrial processes for example, flour mills and with the internal combustion engines of the motor vehicles.

#### **4.2.4 Industrial emission of poisonous gases**

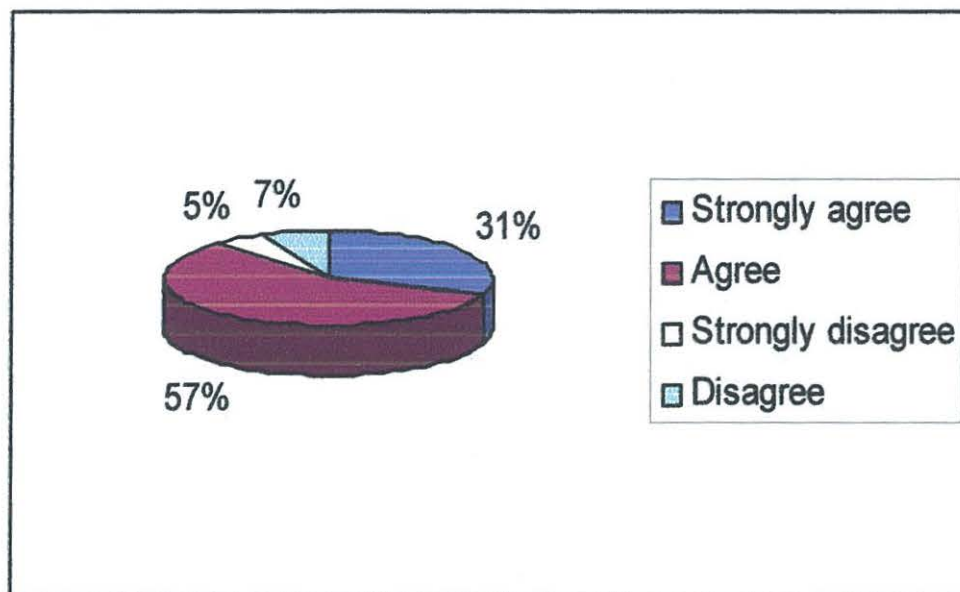
It was important to establish from the respondents whether industries in the locality emitted poisonous gases. The study established that carbon dioxide, carbon monoxide, sulphur dioxide and hydrogen gases are mainly produced by these industries.

**Table 5: Opinion on whether industries emitted poisonous gases.**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Strongly agree	23	30.7
Agree	43	57.3
Strongly disagree	4	5.3
Disagree	5	6.7
Total	75	100

Source: field data 2010

**Pie chart 4 Opinion on whether industries emitted poisonous gases**



The table and the pie chart indicates that 30.7% of the respondents strongly agreed that established industries emitted poisonous gases, 57.3% agreed, 5.3 strongly disagreed and 6.7% disagreed. The view of the respondents coincides with that of the 6<sup>th</sup> annual report of the Meru council on environment quality (2008), that industrial fuel combustion accounts for a good deal of the air pollution in the area and about eight other industrial processes contribute more than half the particulates and an important fraction of the sulphur dioxide, carbon monoxide and hydrogen emissions into the atmosphere.

#### **4.3 The effects of industrial pollution on water**

The second objective was to establish the effects of industrial pollution on water. The study established that industries and households dispose their waste products in rivers and this has affected the quality of water and consequently interfered with the health of the local population.



#### 4.3.1 Water pollution and industrial waste disposal

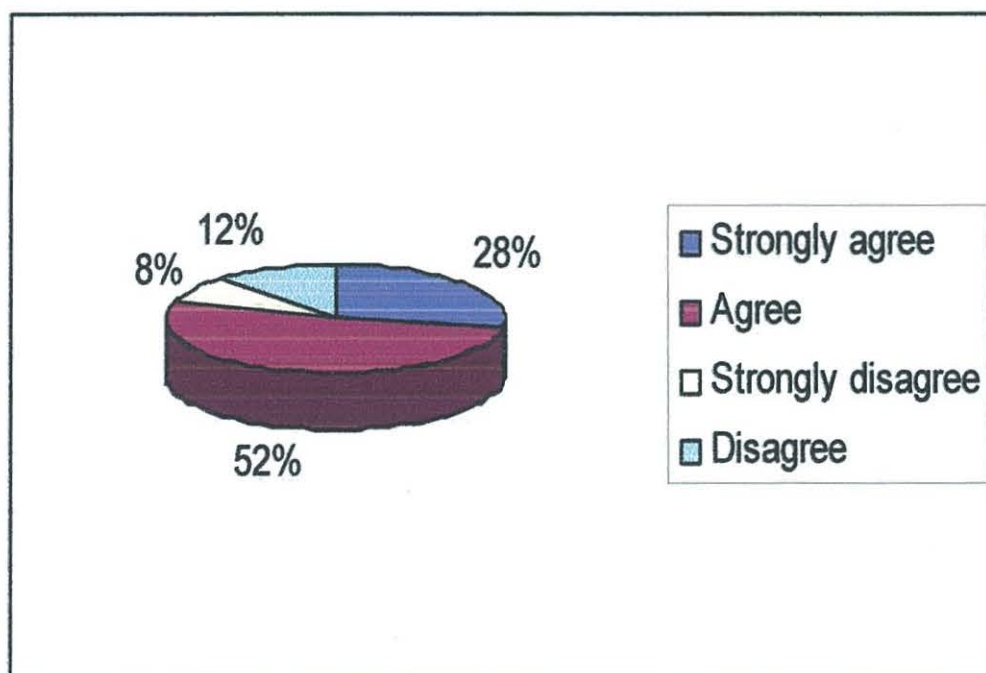
It was important to establish from the respondents whether industrial waste disposal has led to water pollution. The study established that industrial wastes are greatly disposed in rivers

**Table 6: Opinion on whether industrial waste disposal has led to water pollution.**

Response	Frequency	Percentage
Strongly agree	21	28
Agree	39	52
Strongly disagree	6	8
Disagree	9	12
Total	75	100

Source: field data 2010

**Pie chart 5: Opinion on whether industrial waste disposal has led to water pollution**



The table and the pie chart indicate that 28% of the respondents strongly agreed that industrial waste disposal has contributed to water pollution, while 52% agree, 8% strongly disagreed and 12% disagreed. The industrialists who were interviewed revealed that they dumped industrial wastes in rivers to avoid paying collection charges to the municipal authorities. This is in agreement with Stanley and Baca (1997), that the major sources of water pollution are industries which pour into rivers, lakes and oceans a vast array of contaminants.

#### **4.3.2 Industrial waste disposal and the quality of water**

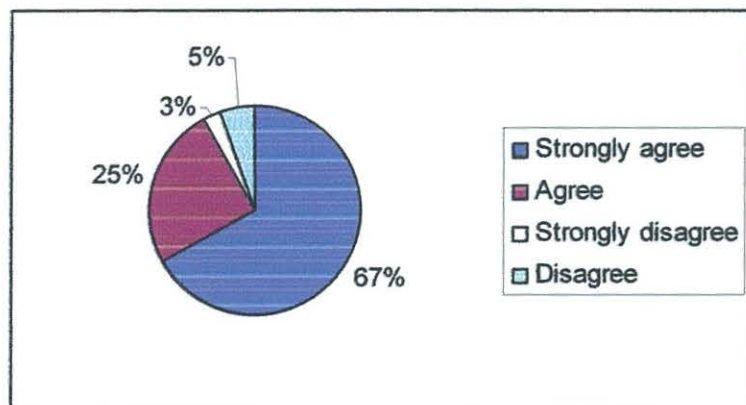
It was necessary to establish from the respondents whether industrial waste disposal has affected the quality of water. The study established that the quality of water has been affected by the disposal of industrial waste products in rivers.

**Table 7: Opinion on whether disposal of industrial wastes has affected the quality of water.**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Strongly agree	50	66.7
Agree	19	25.3
Strongly disagree	2	2.7
Disagree	4	5.3
Total	75	100

Source: field data 2010

**Pie chart 7: Opinion on whether disposal of industrial waste has affected the quality of water.**



The table and the pie chart indicate that 66.7% of the respondents strongly agree that the disposal industrial waste products has affected the quality of water, while 25.3% agree, 2.7% strongly disagreed and 5.3% disagreed. The industrialists who were interviewed revealed that the water tastes have seemed to be unpleasant when used for domestic uses and also they revealed that the fish species in many rivers have completely disappeared. This agrees with Stanley and Baca (1997), that industries pour contaminants such as lead, asbestos, detergents, solvents, acid and ammonia into rivers; farmers contaminated water by the use of industrial products, such as pesticides, herbicides and fertilizers. According to Revelle (1971), he identified that eutrophication which is a kind of water pollution that leads to over fertilization of water from excess nutrients, leading to algae growth and oxygen depletion situation that threatens aquatic life.

#### **4.3.3 Water pollution and health problems**

It was important to establish from the respondents indeed whether water pollution from industrial waste products leads to health problems. The

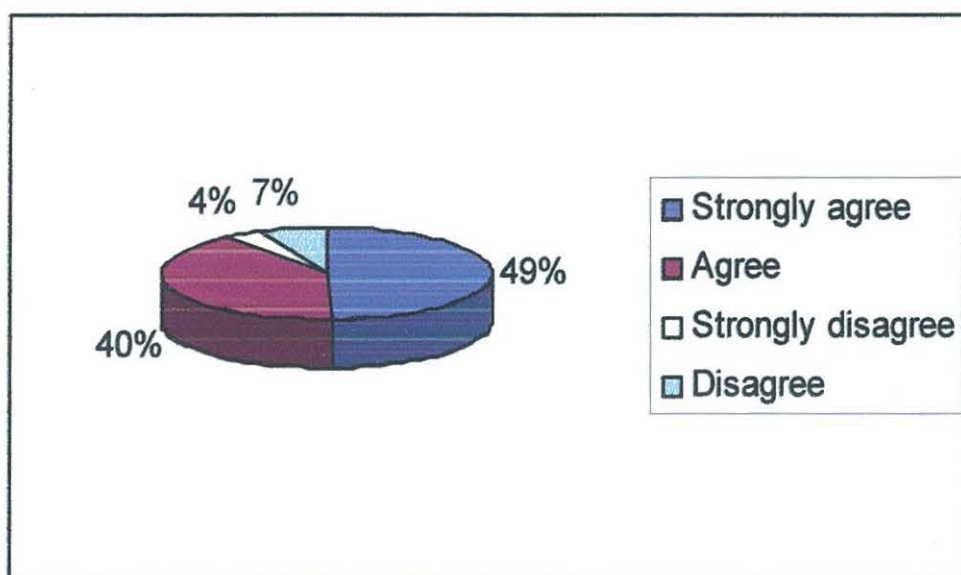
study established that water pollution has affected the local population's health as shown in the table and pie chart below.

**Table 8: Opinion on whether water pollution has caused health problems.**

Response	Frequency	Percentage
Strongly agree	37	49.3
Agree	30	40
Strongly disagree	3	4
Disagree	5	6.7
Total	75	100

Source: field data 2010

**Pie chart 7: Opinion on whether water pollution has caused health problems.**



The table and the pie chart indicate that 49.3% of the respondents strongly agreed that water pollution has affected their health, 40% agreed, 4% strongly disagreed and 6.7% disagreed. The industrialists who were interviewed revealed that contamination of water has resulted to an increase in contagious diseases like typhoid, dysentery, cholera



and diarrhea cases. They also revealed that contaminated water has caused an increase in teeth decay in the locality. According to Revelle (1971), he identified that water pollution may result from infectious agents leading to water borne bacterias that cause diseases and infectious viruses such as hepatitis.

#### **4.4 The effects of industrial pollution on land**

This was the second objective to establish the effects of industrial pollution on land. The study established that industrial wastes are mainly disposed on land and the major pollutants included plastics, polythene papers, metals and glasses. It also revealed that pesticides, herbicides and fertilizers are widely used in the locality whereby they cause land pollution.

##### **4.4.1 Industrial waste disposal on land**

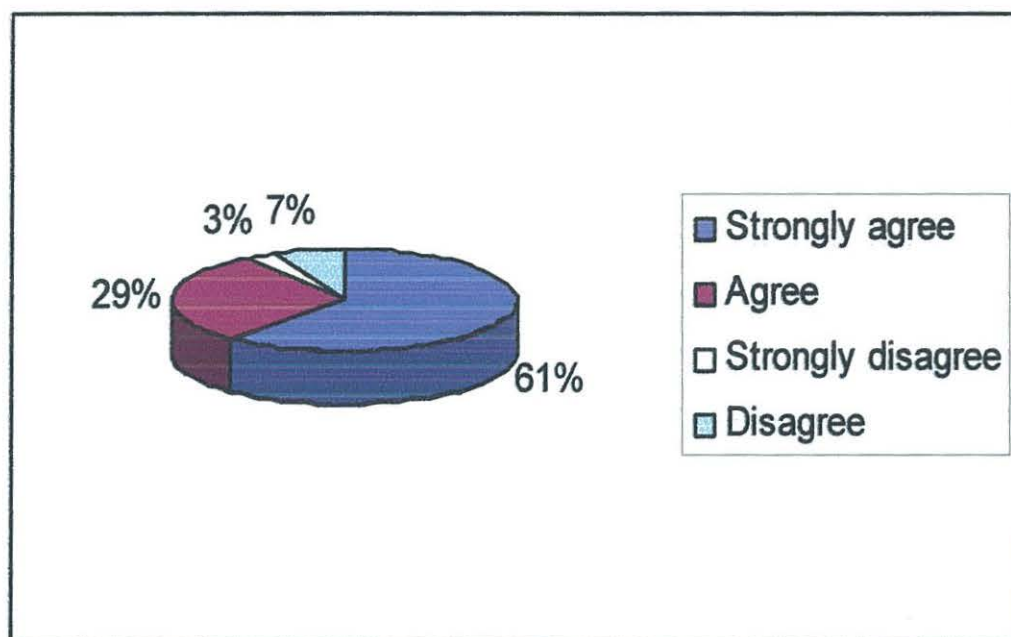
It was necessary to establish from the respondents whether indeed industrial waste products are disposed on land, hence resulting to land pollution. The study established that people dispose most of industrial waste products on land thus resulting to increased land pollution.

**Table 9: Opinion on whether people dispose industrial wastes on land.**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Strongly agree	46	61.3
Agree	22	29.3
Strongly disagree	2	2.7
Disagree	5	6.7
Total	75	100

Source: field data a2010

**Pie chart 8: Opinion on whether people dispose industrial wastes on land**



The table and the pie chart indicates that 61.3% of the respondents strongly agreed that people dispose industrial waste products on land 29.3% agreed, 2.7% strongly disagreed and 6.7% disagreed. According to the Kenya Nema report (2009). The major effect of the industrial development on land is the poor disposal of polythene bags which are not biodegradable. The common practice of plastic waste the solid wastes are poorly dumped, there is the poisonous methane gas that is released in the surrounding air as micro organisms decompose the solid waste. Hazardous materials that dissolve in this liquid often contaminate soil and water.

#### **4.4.2 Major contribution of industrial wastes on land pollution**

It was important to establish whether indeed industrial wastes are the major contribution to land pollution. The study established that plastics

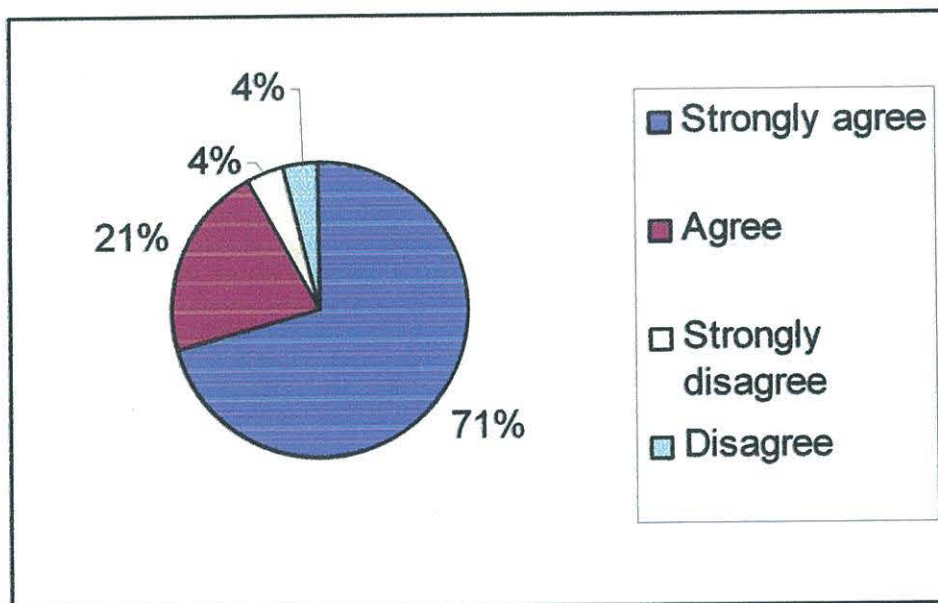
polythene papers, metals and glass are the major industrial wastes that contribute to land pollution.

**Table 10: Opinion on whether plastics, polythene papers, metals and glass are the major industrial wastes that contribute to land pollution.**

Response	Frequency	Percentage
Strongly agree	53	70.7
Agree	16	21.3
Strongly disagree	3	4
Disagree	3	4
Total	75	100

Source: field data 2010

**Pie chart 9: Opinion on whether plastics, polythene papers, metals and glass are the major industrial waste that contribute to land pollution.**



The table and the pie chart indicates that 70.7% of the respondents strongly agree that plastics, polythene papers, metals and glass are the major industrial wastes that contributed to land pollution, 21.3% agree, 4% strongly disagree and 4% disagree. According to Raven and Berg (2001), there are two types of solid waste, that is, municipal solid waste which consists of solid materials discarded by homes, offices buildings, retail stores, restaurants, schools, prisons, libraries and other commercial and institutional facilities, municipal solid waste is a heterogeneous mixture composed primarily of paper and paper boards, yard waste, plastics, metals, wood, food waste, glass and other materials such as rubber, leather and textile. According to them, the other type is the non-municipal solid waste include, wasted from mining (mostly waste rock), agriculture and industry.

#### **4.4.3 The usage of pesticides, herbicides and fertilizers in the locality**

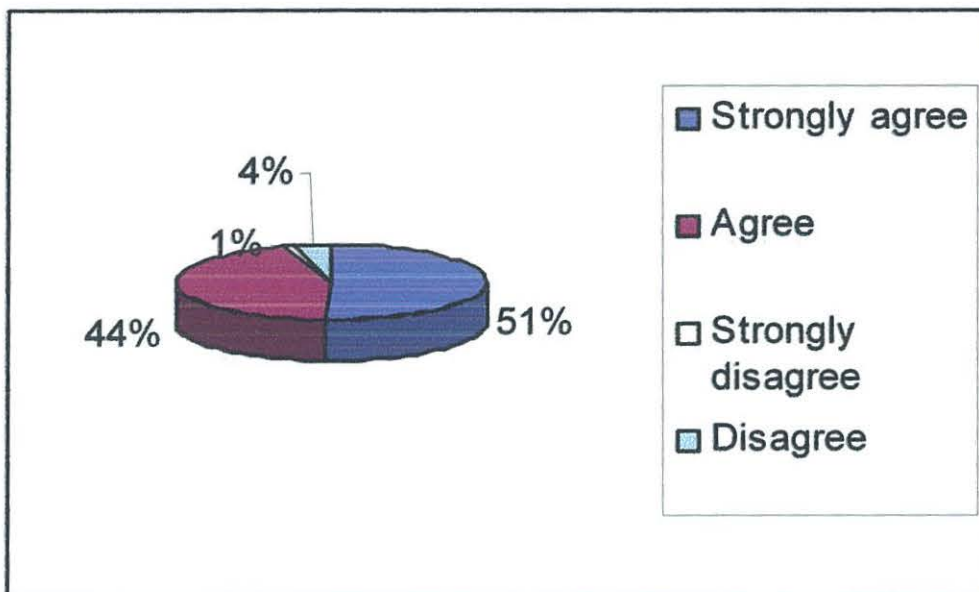
It was important for the researcher to find out from the respondents whether indeed pesticides, herbicides and fertilizers are widely used in the locality hence contributing to land pollution. The study established that pesticides, herbicides and fertilizers are widely used in the area and this cause land pollution.

**Table 11: Opinion on whether pesticides, herbicides and fertilizers are widely used in the locality**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Strongly agree	38	50.7
Agree	33	44
Strongly disagree	1	1.3
Disagree	3	4
Total	75	100

Source: field data 2010

**Pie chart 10: Opinion on whether pesticides, herbicides and fertilizers are widely used in the locality.**



The table and the pie chart indicates that 50.7% of the respondents strongly agreed that pesticides, herbicides and fertilizers are widely used in the locality while 44% agreed, 1.3% strongly disagreed and 4% disagreed. According to Robert (1992), soil as well as air and water may be polluted. Pesticides, herbicides, chemical wastes, radio active fallout acid rain and garbage can all infect the soil. Some of the chemicals used as pesticides are hazardous to both human beings and soil. Unfortunately these chemicals are also relatively stable in the soil, residues have been found years after the chemicals were used. According to Stanley & Baca (2001), a serious threat of pollution came from the chemicals that farmers put on their fields to increase yields, to kill pests (pesticides) and destroy weeds (herbicides).

#### **4.5 Effects of establishment of industries on the destruction of the natural forests.**

The third objective was to find out how the establishment of industries has contributed to the destruction of the natural forests. The study found out that most industries established in the area use wood fuel and this has consequently led to the reduction of the vegetation cover.

##### **4.5.1 Established industries use wood fuel**

It was important for the researcher to establish from the respondents whether indeed the established industries in the area used wood fuel. The study revealed that industries established in the area used and still require wood fuel in their production processes.

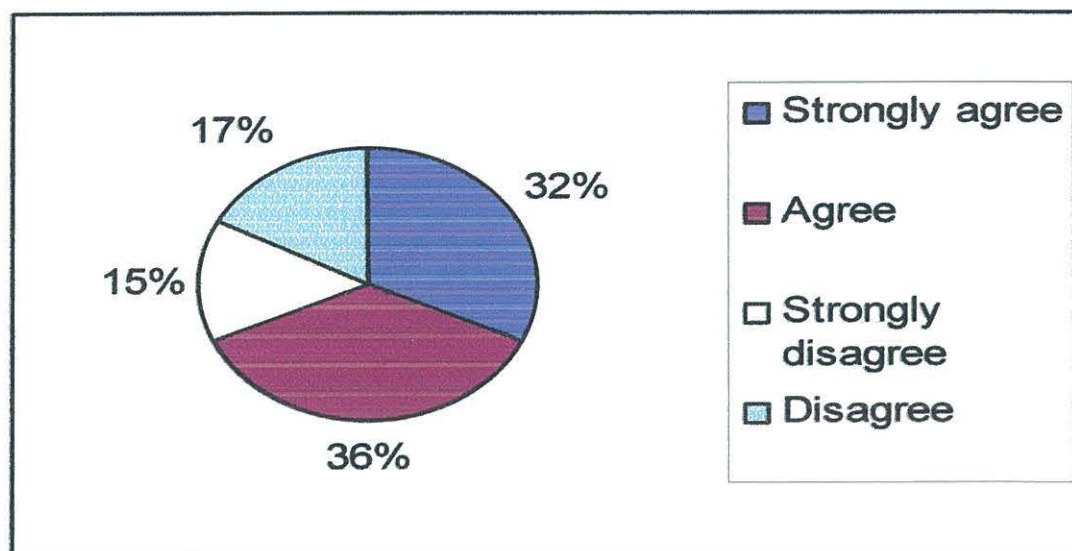
**Table 12: Opinion on whether established industries use wood fuel**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Strongly agree	24	32
Agree	27	36
Strongly disagree	11	14.7
Disagree	13	17.3
Total	75	100

Source: field data 2010.



**Pie chart 11: Opinion on whether established industries use wood fuel.**



The table and the pie chart indicates that 32% of the respondents strongly agreed that industries established in the area use wood fuel, while 36% agreed, 14.7% strongly disagreed and 17.3% disagreed. The interviewed industrialists revealed that wood using factories dealing in baking, tea and coffee drying, tobacco curing, pottery and brick laying have speeded up the process of forest destruction.

#### **4.5.2 Establishment of industries and reduction of the vegetation cover.**

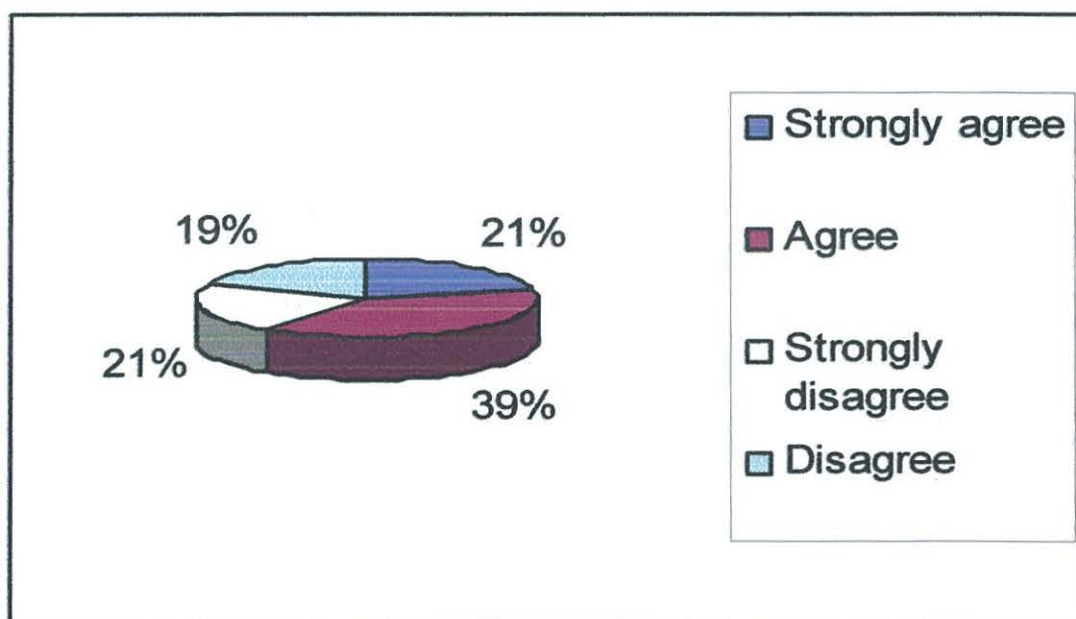
It was important to establish from the respondents whether indeed the establishment of industrial in the locality has led to the reduction of the vegetation cover. The study established that reduction of the vegetation cover is greatly attributed to the establishment of industries in the area because of the need for expansion of industries and the need for raw materials by agricultural industries.

**Table 13: Opinion on whether the establishment of industries has led to reduction of vegetation cover.**

Response	Frequency	Percentage
Strongly agree	16	21.3
Agree	29	38.7
Strongly disagree	16	21.3
Disagree	14	18.7
Total	75	100

Source: field data 2010

**Pie chart 12: Opinion on whether the establishment of industries has led to reduction of vegetation cover.**



The table and the pie chart indicate that 21.3% of the respondents strongly agreed that the establishment of industries has led to reduction of vegetation cover, 38.7% agreed, 21.3% strongly disagreed and 18.7%



disagreed. The industrialists who were interviewed revealed that the need for more room for expansion of industries has resulted to the clearance of the natural vegetation. They further revealed that the great need for raw materials in the agricultural industries which have resulted to the clearance of the natural vegetation to create room for plantations.

#### **4.6 Impact of industrial noise on the local population**

The fourth objective was to assess the impact of industrial noise on the local population. The study established that the industries in the area does not produce unnecessary noise but the noise has resulted to some health problems to some local people, particularly those who work directly in these industries and those who have their residences close to these industries.

##### **4.6.1 Noise pollution and establishment of industries.**

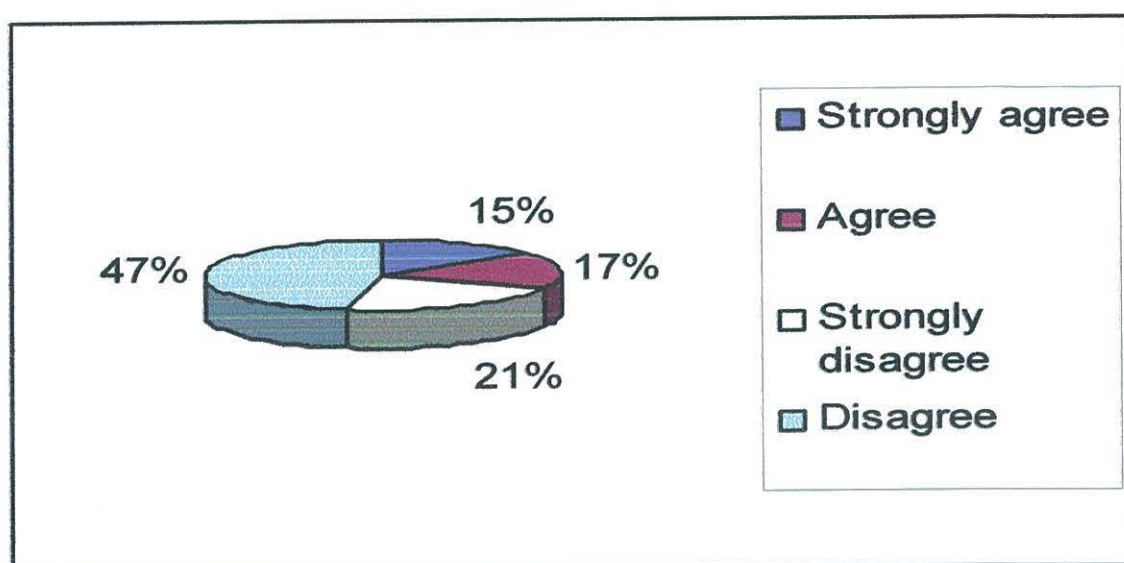
It was important for the researcher to establish whether indeed established industries in the locality produced unnecessary noise. The study revealed that industries established in the area don't produce unnecessary noise though many revealed it was irritating.

**Table 14: Opinion on whether industries in the locality produce unnecessary noise.**

Response	Frequency	Percentage
Strongly agree	11	14.7
Agree	13	17.3
Strongly disagree	16	2.3
Disagree	35	46.7
Total	75	100

Source: field data 2010

**Pie chart 13: Opinion on whether industries in the locality produce unnecessary noise**



The table and the pie chart indicate that only 14.7% of the respondents strongly agreed that industries in the locality produce unnecessary noise, 17.3%, agreed, 21.3% strongly disagree and 46.7% disagreed. The industrialists who were interviewed revealed that although these industries produce noise, the local population is the major beneficiary from the products produced by these industries, they further defended themselves by ascertaining that the local population receive incomes

when they sell the raw materials to these industries and industries provide job opportunities to the local population.

#### **4.6.2 Industrial noise and health problems**

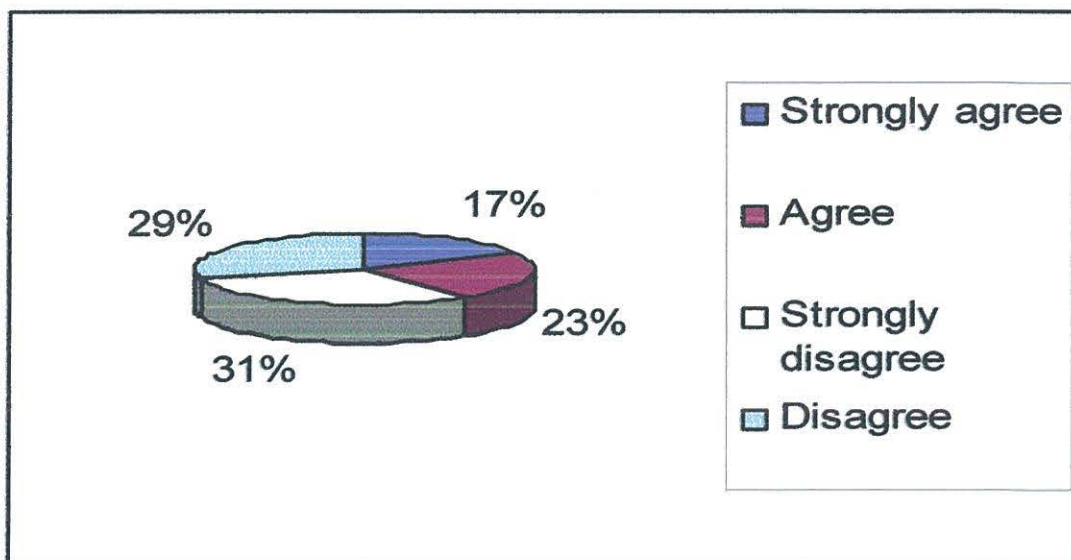
It was important for the researcher to find out whether indeed industrial noise had any health problems to the local population. The study established that those who work directly in these industries and those who reside close to the industries complain about the disturbance caused by the loud industrial noise.

**Table 15: Opinion on whether industrial noise has health effects to the local population.**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Strongly agree	13	17.3
Agree	17	22.7
Strongly disagree	23	30.7
Disagree	22	29.3
Total	75	100

Source: filed data 2010

**Pie chart 14: Opinion on whether industrial noise has health effects to the local population.**



The table and the pie chart indicates that 17.3% of the respondents strongly agreed that industrial noise has healthy effects, while 22.7% agreed, 30.7% strongly disagreed and 29.3% disagreed. The industrialists who were interviewed revealed that residents who lived near these industries and those who worked in them complained of hearing problems. according to Raven, Berg and Johnson (2001), evidence exists that prolonged exposure to high level of noise cause a permanent contraction of blood vessel which can increase the blood pressure, thereby contributing to heart disease. Other physiological effects associated with noise pollution included migraine headaches, nausea, dizziness and gastric ulcers.

Noise pollution also causes psychological stress, further more prolonged exposure to noise damages ears. Loud, high-pitched noise injures the hair cells in the cochlea. Because injured hair cells are not replaced by the body, prolonged exposure to loud noise results in permanent hearing impairments.

## **CHAPTER FIVE**

### **SUMMARY OF FINDINGS, DISCUSSION, CONCLUSION AND RECOMMENDATIONS**

#### **5.0 Introduction**

This chapter is concerned with the discussion of the findings about the industrial development and the state of the natural environment. It provides the conclusion drawn from the findings and recommendations on how to reduce pollution to maintain a health environment. The chapter also provides areas for further research.

#### **5.1 Summary of the findings and discussion**

The first objective was to assess the extent to which the establishments of industries have contributed to air pollution. From the research analysis 64% of the respondents, views drawn in Abogeta division admits that the establishment of industries in the area has actually contributed to air pollution. This is evident since 55% admitted that flour mills contributed to air pollution and 57% of the respondents agreed that industries produced poisonous gases like carbon dioxide, sulphur dioxide and hydrogen. This agrees with the 6<sup>th</sup> annual reports of the Meru council on environmental quality (2008) which established that air pollution is associated with industrial process for example flour mills. In addition this is supported by Stanley & Baca (1997), that air pollution is mostly from automobiles and industrial pollution. However, it disagrees with Anderson (1982), who noted that various products of our industrial economy can make indoor pollution even worse than out door. The study reveled that air pollution results into some respiratory diseases due to harmful particles released into the air, those who were interviewed revealed that although asthma cases are mostly hereditary they might be related to air pollution since most asthma cases are reported in areas which have highly polluted air conditions. This agrees with the council report which established that air pollution has resulted to health

problems such as aggravation of respiratory diseases, including asthma, chronic bronchitis and emphysema.

The second research objective was to establish the effects of industrial pollution on water and land. The study revealed that 52% of the respondents agreed that people do dispose industrial wastes in water while 61% strongly agreed that they disposed their industrial waste on land and 29% agreed. This agrees with Stanley & Baca (1997), who identified that the major sources of water pollution are industries which pour into rivers, lakes and oceans a vast array of contaminants such as lead, asbestos, detergents, solvents, acids and ammonia. On the effects of industrial pollution on land, the study's views agrees with Robert (1992), who identified that soil as well as air and water may be polluted. The study revealed that 67% of the respondents strongly agreed that industrial pollution has affected the quality of water while 49% strongly agreed and 40% agreed that water pollution has resulted to healthy problems. The industrialists, who are interviewed that contamination of water has resulted to contagious diseases like typhoid, dysentery, cholera and diarrhea. This agrees with Stanley and Baca (1997), who viewed out that contaminated water in poor countries results in high death rates from cholera, typhoid, dysentery and diarrhea. They agreed that a serious threat to drinking water comes from the chemicals that farmers, put on their field to increase yields. Kill pests (pesticides) and destroy weed (herbicides). The chemicals applied seep in wells and rain into streams and rivers, hence they agree with the research views which established that pesticides, herbicides and fertilizers are a source of land pollution and are widely used in the locality. The study revealed that 71% of the respondents strongly agreed that plastics, polythene papers, metals and glass are the major industrial wastes that pollute the land. This agrees with the Kenya Nema Report (2009), which established that the major effect of industrial development in land is the poor disposal of

polythene bags which are not biodegradable. It also agrees with Raven & Berg (2001), that, municipal solid wastes that pollute the land is an heterogeneous mixture composed primarily of paper and paper boards, yard waste, plastics, metals, wood, food waste, glass and other materials such as rubber leather and textiles.

The third research objective was to find out how the establishment of industries have contributed to the destruction of the natural forests. The study revealed that 32% strongly agree and 36% agree that the established industries in the locality use wood fuel, while 21% strongly agreed and 39% agreed that establishment of industries in the area has led to the reduction of vegetation cover. The interviewed industrialists revealed that this is due to the need of room for expansion of industries and the need for raw materials. They further revealed that wood using factories dealing in baking, tea and coffee drying, tobacco curing, pottery and brick laying have speeded up the process of forest destruction. This significantly agrees with the Kenya Nema report (2009) which established that global warming is caused by increased industrial pollution; the clearing of forests to make way for farms, settlements and factories. It further identified that many of the forests are cleared to create room for industrial raw materials like the case for agricultural industries and also create room for the expansion and establishment of new factories and industries.

The fourth research objective was to assess the impact of industrial noise on the local population. The study established that the industries located in the area do not produce unnecessary noise. This is interpreted in the basis that 47% of the respondents disagreed that industries located in the area produce unnecessary noise. However, the interviewed industrialists pointed out that the noise has some health problems to the people who reside near these industries and those who worked directly in

the industries since they complained of hearing problems and disturbance from the industrial noise. However, only 17% strongly agreed and 23% agreed that industrial noise has resulted to other health effects. This agrees with Raven and Johnson (2001) who viewed out that most of the noise produced in the environment is of human origin, since industrial noise produced, reusing of old metal scraps and heavy traffic causes outside noise that assails our ears.

## **5.2 Conclusion**

The aim of the study was to assess industrial development and the state of the natural environment, a case of Abogeta division, Meru central district Kenya.

The first objective was to assess the extent to which the establishment of industries have contributed to air pollution. The findings indicated that air pollution has increased particularly due to flour mills established in the area. This has resulted to respiratory diseases like asthma and the increase in poisonous gases like carbon dioxide, carbon monoxide, sulphur dioxide and hydrogen which increase air pollution.

The second objective was to establish the effects of industrial pollution on water and land. The study established that the disposal of industrial wastes rivers has affected the quality of water and consequently led to health problems with increasing cases of contagious disease like typhoid, dysentery, cholera and diarrhea. For the case of land pollution, the study established that industrial wastes are mainly disposed on land and the major pollutants include plastics, polythene papers, metals and glass. It also revealed that pesticides, herbicides and fertilizers are widely used in the locality hence causing land pollution.

The third objective was to find out how the establishment of industries has contributed to the destruction of the natural forests. The study



found out that industries located in the area used wood fuel and therefore the reduction of the vegetation cover is greatly attributed to the establishment of industries because of the need for expansion of industries and the need for raw materials. The study found out that wood using factories dealing in baking, tea and coffee drying, tobacco curing, pottery and brick laying have speeded up the process of forest destruction.

The fourth objective was to assess the impact of industrial noise on the local population. The study findings indicate that the established industries did not produce unnecessary noise but the respondents revealed that the noise caused some hearing problems. They also complained of the disturbances from the industrial noise.

### **5.3 Recommendations**

Basing on the finding of the study, the researcher made the following recommendations;

In order to reduce air pollution the government should pass laws that require modification of furnaces and engines used in industries to provide more complete combustion which helps to control the production of both carbon monoxide and hydrocarbons.

The government should ensure industries reduce air pollution through particulate removal by the use of filters to remove particles physically by trapping them in porous mesh of cotton cloth, spun glass filters, which allows air to pass through but holds back solids.

The government should encourage the use of catalytic afterburners which immediately follow combustion to oxidize most unburnt gases.

The government should ensure that industries smoke stacks are fitted with electrostatic precipitators, fabric filters, scrubbers or other technologies to remove particulate matter.

Pollution on land and water can be solved by the government emphasize on source reduction. The object of source reduction is to reduce the amount of hazardous waste generated by manufacturing or other processes, for example changes in the chemical processes involved, equipments used, raw materials used or maintenance measures may successfully reduce the amount or toxicity of the hazardous waste produced.

The government should encourage recycling and resource recovering. Hazardous chemical waste may contain materials that can be recovered for future use. For example acids and solvents collect contaminants when they are used in manufacturing processes. These acids and solvents can be processed to remove the contaminants and can then be reused in the same or in different manufacturing processes.

The government should ensure treatment of hazardous wastes before disposal to change their physical or chemical composition and reduce their toxic or hazardous characteristics.

Industries should ensure that they produce less wastes. Excess packaging of food and consumer products is one of our greatest sources of unnecessary wastes. However, much of this packaging is primarily for marketing and has little to do with product protection. So, manufactures and retailers should be persuaded to reduce these wasteful practices.

Manufacturers should ensure that where disposable packaging is necessary they use materials that are compostable or degradable. Photodegradable plastics break down when exposed to ultraviolet radiation. Biogradable plastics incorporate material such as corn starch that can be decomposed by microorganism.

The government should establish financial penalties for production of products which negatively affect the environment.

The government should provide financial incentive for industrial practices and products that benefit the environment by enhancing sustainability, for example, reducing waste production and using recycled products.

The local authorities should sensitize and educate the local community on the ways to properly dispose waste industrial products and clearly explain to the community the dangers of poor wastes disposal.

Industrial effects on the natural forests can be reduced if the government clearly specifies the gazette forested areas to protect them from unnecessary exploitation.

The government should ensure enough electric power production and supply to supplement those industries which use wood fuel.

The government should carry out a tree planting campaign to replant trees where they have been cleared and also encourage the local people to practice agro forestry whereby an individual should be required to set a certain portion of his land for tree planting.

In controlling industrial noise, the government should put up strict laws that discourage production of loud sounds in industries that cause noise pollution.

The government should ensure that noise producing industries put up shields between the noise producer and the hearer which can help to reduce or control noise pollution.

The government should put up strict measures to ensure that industries producing loud noise are installed with noise absorbing materials around them.

#### **5.4 Areas of further research.**

The researcher based his study on the impacts of industrial development on the state of the natural environment. Since the area of natural environment is a bit broad, the study is open to more research. The researcher is quite optimistic that more advance remedies can be achieved if other researchers carried out more research on specific environmental entities. This is because industrial development is still causing more adverse effects on the natural environment and consequently affecting the welfare of human existence.

## REFERENCES

1. D-Stanley Eitzen and Maxine Baca Zinn (1997), Social problems, 7<sup>th</sup> edition , Allyn and Bacon Publishers, USA.
2. Lauer H. Robert (1992), Social Problem 5<sup>th</sup> edition W.M.C Brown Publishers. U.S.A
3. Lauer H. Robert and Jeanette C. Lauer.(2002). Social Problems and the Quality life. 8<sup>th</sup> edition, MC Graw Hill Publishing Company, New York, U.S.A.
4. Mooney A, Linda, David Knox and Caroline Schacht (1978) Understanding Social Problems , 4<sup>th</sup> edition, Thomson Wadsworth Publishers.
5. Nairobi Citizens Advisory Committee Report on Environmental Quality .(2007), Nairobi publishers, Kenya.
6. Nema News Vol 7, June 2009 , Produced by the department of district support coordination and Public Education Nairobi, Kenya.
7. Raven and Berg (2001) Environment , 3<sup>rd</sup> edition , Harcourt college Publishers, USA.
8. Sullivan J. Thomas ,(1997) , social Problems,4<sup>th</sup> edition Allyn and Bacon Company , United states.
9. Prentice hall upper Saddle (2001) , Social Problems 5<sup>th</sup> edition , New Jersey.
10. 6<sup>th</sup> Annual Report of the Meru council an Environmental Quality (2008) ,Government Printing office , Meru.

## **APPENDICES**

### **APPENDIX 1**

#### **Questions for industrialists and retailers**

Dear sir /madam

Please participate in doing this questionnaire to enable the researcher in collecting data about the topic, "Industrial development and the state of natural environment, a case of Abogeta Division, Meru central District , Kenya."

The information will be treated confidentially and would be used for the purpose of study only .

#### **Instructions**

- i) Tick the most appropriate option.
- ii) Do not write your name on this sheet.

#### **The extent to which the establishment of industries have contributed to air pollution.**

1. Establishment of industries has led to air pollution

Strongly agree [ ] agree [ ]

Strongly disagree [ ] disagree [ ]

2. Air pollution has caused respiratory diseases

Strongly agree [ ] agree [ ]

Strongly disagree [ ] disagree [ ]

3. Flour mills contribute to air pollution

Strongly agree [ ] agree [ ]

Strongly disagree [ ] disagree [ ]

4. Carbon dioxide, carbon monoxide, sulphur dioxide and hydrogen gases are produced by these industries.

Strongly agree [ ] agree [ ]

Strongly disagree [ ] disagree [ ]

### **The effects of industrial pollution on water**

5. People dispose industrial wastes in rivers.

Strongly agree [   ]                      agree [   ]

Strongly disagree[   ]                      disagree [   ]

6. The disposal of industrial waste products has affected the quality of water.

Strongly agree [   ]                      agree [   ]

Strongly disagree [   ]                      disagree [   ]

7. Water pollution has affected my health

Strongly agree [   ]                      agree [   ]

Strongly disagree [   ]                      disagree[   ]

### **The effects of industrial pollution on land**

8. People dispose industrial waste on land.

Strongly agree [   ]                      agree [   ]

Strongly disagree [   ]                      disagree [   ]

9. Plastics, polythene paper , metals and glass are the major industrial wastes that pollute the land

Strongly agree [   ]                      agree[   ]

Strongly disagree[   ]                      disagree[   ]

10.            Pesticide, herbicides and fertilizers are widely used in the locality.

Strongly agree [   ]                      agree[   ]

Strongly disagree[   ]                      disagree[   ]

### **Contribution of established industries on the destruction of the natural forests.**

11.            Industries established here use wood fuel.

Strongly agree [   ]                      agree[   ]

Strongly disagree[   ]                      disagree[   ]

12. Establishment of industries has led to the reduction of vegetation cover.

Strongly agree [ ] agree [ ]

Strongly disagree [ ] disagree [ ]

**Impact of industrial noise on the local population**

13. Industries in the locality produce unnecessary noise

Strongly agree[ ] agree[ ]

Strongly disagree [ ] disagree[ ]

14. Industrial noise has affected my health

Strongly agree[ ] agree[ ]

Strongly disagree[ ] disagree[ ]



## APPENDIX 2

### Oral interview guide for industrialists

1. Have industries contributed to air pollution?
2. Does air pollution cause respiratory diseases in the locality?
3. Do you think the increase in cough cases is as a result of air pollution from these industries?
4. How does a flour mills contribute to air pollution?
5. Are there cases of asthma related to air pollution in the locality?
6. Where do you disposal your industrial wastes?

Land ..... Rivers.....

7a) How has the disposal of waste products affects the quality of water?

b) Do you think this has any effect on your health? If yes, how?

8a) Do industries located here use wood fuel?

b) Has this led to the reduction of vegetation cover? If yes , How?

.....

c) Name some of these industries) i .....

ii.....

iii.....

iv.....

9a) Do these industries produce unnecessary noise?

b) How has this affected your health?

10. What are some possible solutions to these problems?



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**FACULTY OF EDUCATION  
Office of the Dean**

Tuesday, February 2, 2010

**TO WHOM IT MAY CONCERN**

Dear Sir/Madam,

**RESEARCH INTRODUCTORY LETTER**

Mr. /Ms. /Mrs. MWEBIA ELIAS MUTEMBEI... Reg.No. BAE/14343/71/01  
is a student in the Faculty of Education. He/~~She~~ is now carrying out  
a study about INDUSTRIAL DEVELOPMENT AND THE STATE OF THE  
NATURAL ENVIRONMENT IN ABOGETA DIVISION, MERU CENTRAL DISTRICT as one of the  
requirements for the completion of his/~~her~~ studies. He/~~She~~ is thus  
introduced to you.

Kindly help him/~~her~~ accordingly.

Thank you.

  
**DR. S.A. OYEBADE**

**DEAN, FACULTY OF EDUCATION**

