

UNIVERSITY OF NAIROBI

FACULTY OF ARTS

DEPARTMENT OF SOCIOLOGY

**POLLUTION IN THIKA MUNICIPALITY:
ASSESSMENT OF COMMUNITY-BASED
AWARENESS AND PERCEPTION**

**A PROJECT PAPER IN PARTIAL FULFILMENT OF THE
REQUIREMENT OF MASTER OF ARTS DEGREE IN
DISASTER MANAGEMENT**

By

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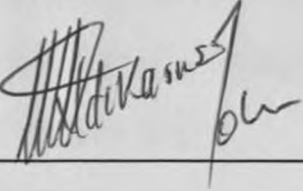
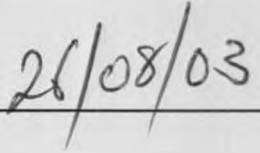
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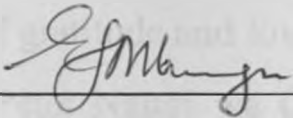
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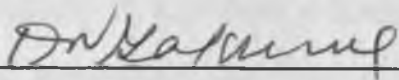
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DEDICATION

This work has been dedicated to my dearest and hard working mother Teresia, who has struggled to see me what I am today. I owe her a lot of gratitude and love and may God bless you Mum. And my father Peter Ngugi wa Gathute who worked hard in my early life but God called him in heavenly beautified home. May he rest in peace of heavenly love.

My brothers and sisters, for their ever presence moral support, especially my elder sister, Minnie Ngugi who used to telephone me, and with a word of encouragement. *"Keep on my brother, by hard work and prayers you will make it"* and my young sister, Mariana Ndikaru in London - England who encouraged me more to further my education and *"the sky should be the limit."*

In addition, Anne Ngugi who continually encouraged me on the importance of higher education, *"status and properties can be taken away from you but nobody can remove what you have accumulated in education except death"* Anne always told me.

To all of my sub-clan, *Ethaga mbari ya Agathiru* who have and will set their feet on the road of more education and wisdom

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Last but not least, I extend my deep appreciation to the respondents, participants in the focus group discussions, key informants from the government, Managers/Directors, Municipal Council of Thika and all other interviewees who contributed to the research process. To all of you, I humbly say, "May the Almighty God Bless You"

However, I wish to make it clear here that the persons, I have named above are not responsible for the views and errors in this work, I am single-handedly answerable for the substance, the style and the conclusions of this study.

QUOTATIONS

Africa's future is the subject of fierce debate. The western press is full of warnings about environmental and economic collapse and the development workers continue to create supposed solutions to the problem they see. But while these outsiders haggle over projections and prophecies, Africans are working on a variety of small grassroots projects that may change the course of their future

PROFESSOR WANGARI MAATHAI



In September 14, 1992. Father Ndikaru was quoted saying that "The ultimate solutions to our environment situation may not be forthcoming at the turn of a switch. But we have a lot hope of getting there as we now have a lot more insight of what oils environment, of what needs to be done, we are confident of possible change as we now look forward to " how soon" rather than still being concerned with "why" and 'how".

REV FR NDIKARU WA TERESIA



In the bible story of creation, genesis chapter one, verse one to thirty, "After some six days of heavy work God looked at everything He made and He was pleased" And so on the seventh day. He decided to take a rest. The world must have a beautiful place to live and work by then, as its wonderful environment was what God had in mind as the ultimate togetherness of all the natural systems on earth and the universe for the sustenance of all forms of life.

THE JERUSALEM BIBLE



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ABBREVIATIONS

CCP	Chernobyl Power Plant
CBD	Central Business District
CBO	Community Based Organizations
DMK	Del Monte (K) limited
FGM	Focus Group Discuss
KEMRI	Kenya Medical Research Institute
KENGO	Kenya Energy and Environment Organization
NEAP	National Environment Action Plan
OHCD	Occupational Health and safety Department
SPSS	Statistical Package for Social Science
TMC	Thika Municipal Council
TDDP	Thika District Development Plan
TARDA	Tana and Athi river Development Authority
USEPA	United States Environment Protection Agency
UNCED	United Nation Conference and Development
UNEP	United Nation of Environment Programme
UCIL	United Carbide India Limited
UNCHE	United Nation Conference on Human Environment
URTI	Upper Respiratory Tract Infection
WHO	World Health Organization
WSSD	World Summit on Sustainable Development
WCED	World Commission on Environment and Development
WDR	World Development Report
WCN	World Charter for Nature
WED	World Environment Day

ABSTRACT

The main objective of this paper was to investigate on issues related to community involvement in pollution management in Thika Municipality. The study objectives were the following.

- To establish and reliably quantify the pollution awareness levels in Thika Municipality
- To find out the perception and attitudes towards pollution problems in Thika Municipality
- To identify and appraise community mechanisms for pollution prevention.
- To suggesting guidelines for community pollution prevention strategies.

To achieve the objectives of this study, both quantitative and qualitative research methodologies were used. The qualitative phase consisted of face-to-face interviews administered questionnaire.

In addition rating questions were used to quantify public opinion. The qualitative phases consisted several focus group discussions and in-depth interviews to selected members of the community in questions. In essence, the qualitative phase was used to provide more insights and findings obtained from the quantitative phase.

Among the major findings, air, water and solid wasted pollution were adversely mentioned as the problem the community. On the other hand, noise pollution was not considered to be harmful in any way to the community. This was due to the limited knowledge of the community

The major effects of polluting enumerated included the destruction of buildings and other structures. And the increase in audience in Human URTIs and other related infections. In terms of institution capacity to handle pollutions, a gap was identified as it regards expected and seize delivery to key players; the local authorities. To fill this gap, community based organizations with objectives on environmental management were seen to offer implementing services.

Among the major recommendations, was that all the key stakeholders i.e. the industrialist, community, and the government should put measures in place to ambit any situations that will otherwise lead to pollution disaster scenarios. In addition to that, the government needs to initiate and implement realistic policy guidelines that would control pollution problems nationwide. There lacks a comprehensive policy framework in relation to pollution and especially in the urban areas.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

One of the things likely to be noticed in the activities of people living in towns and everywhere nowadays is their desire to live in environments that are pollution free. A significant number of people in towns are actively involved, both personally and communally in environmental quality improvement and subsequent sustaining activities. Pollution is one of the major problems affecting human beings today. Although all human activity produces waste, Pollution is highly pronounced in the urban areas as opposed to rural areas. Mainly as a result of industrial waste and accidentals.

According to Cropper, et al. (1995:77), in midnight December 2-3, 1984, over 40 tonnes of highly poisonous Methyl iso cyanate (MC) gas leaked out of the pesticide factory of Union Carbide in Bhopal (India). The Methylisocyanate in the tank was filled to 87% of its capacity while maximum permissible of 50% was not stored at zero degrees centigrade as prescribed. The siren to warn neighborhood communities was sounded more than one hour after the leak started. Two hundred and fifty thousand people died in the immediate aftermath, for the poisons had enveloped an area of 40 square kms. At least 10,000 people have died in the years that have passed, and 10 more are dying every month due to exposure to related diseases.

The survivors, however, face a fate worse than death. They suffer from acute breathlessness, pain in the eyes, brain damage, menstrual chaos and loss of immunity.

Hazardous chemicals dumped within and outside the factory have contaminated the soil, ground water to date. In February 1989, the Government sold out the people it claimed to represent, by agreeing to a settlement of US\$ 470 million with the corporation, which is less than one seventh of the original claims. In addition, the Government has since done next to nothing to rehabilitate the survivors with hygienic living conditions and appropriate livelihood options. Instead, the government has had survivors beaten up, arrested and even jailed for demanding justice from the factory. In May 1991, the Government demolished the houses of over 15,000 Muslim gas affected people and forcibly relocated them 13kms away from the city. Union Carbide Corporation, with a majority 50.9% share holding in Union Carbide India Limited (UCIL), controlled all decisions regarding design, operation, maintenance and management of UCIL facilities in India from its headquarters at Danbury, Connecticut, USA. (Cropper, et al op. cit., 117)

In the building of the Hawk's Nest Tunnel in 1930 in West Virginia, 5000 workers (65% of who were black) were employed by the corporation. As many as 2000 workers died of silicosis¹ which was due to lack of protection against exposure to silica dust. In 1981, 402 employees in Carbide's battery factory in Indonesia were suffering from kidney disease from exposure to mercury. In July 1985, 998 people in California Carbide were poisoned from eating watermelon contaminated with Temik pesticide produced by Carbide (one of the products of its Bhopal factory)

¹Lung fibrosis caused by the inhalation of dust containing silica

On April 26, 1986 at 1.23am technicians at the Chernobyl Power Plant in the Ukraine (former Soviet Union) allowed the power in the fourth graphite reactor to fall to low levels as part of a controlled experiment, which went wrong. The reactor overheated causing a meltdown of the core². Two explosions blew the top off the reactor building releasing clouds of deadly radioactive material in the atmosphere for over 10 days. The people of Chernobyl were exposed to radioactivity 100 times greater than that of Hiroshima Bomb.

The World and Northern Europe experienced clouds of radioactive material being blown northward through the sky. Seventy percent of the radiation is estimated to have fallen on Belarus and 10 years later babies are still being born with no arms, no eyes, or only stumps for limbs. It is estimated that over 15 million people have been victimized by the disaster in some way and it will cost over 60 billion dollars to make these people healthy.

Pollution tops the list in the major problems that affect Africa as a continent, while urban crime follows.³ It is evident that such problems such as urban epidemics (a large proportion of it) stem from pollution. Pollution affects the quality of life of urban residents in many ways. Considering the ramifications of pollution types; it is difficult to break the nexus between pollution and quality of urban life. Pollution is not a preserve of the developed countries only. It is a phenomenon that has also had far-reaching consequences in other part of the world as well.

² www.chernobyl.com

³ Garlauskas 1975 Pp. 37

In Africa, for example there is a lot of pollution related problems. Already urban centers in Africa face pollution as one of the major draw barks for sustainable development⁴ with Air, land, noise and solid waste pollution constituting the major categories of pollution. As a result, many African governments have incorporated National Environment Action Plans in their development efforts. (Kenya Development Plan, 1994/6

The United Nation Conference on Human Environment held during June 5-11, 1972 in Stockholm was the first international event, which created global awareness about the environment by placing environmental concerns on top of the agenda of major international topics. To commemorate this great event June 5 of every year is rightly observed as the "World Environment Day". The Stockholm Declaration called for the World community to bear the responsibility to protect and improve the environment for present and future generations

The United Nations Environment Programme (UNEP) convened a meeting in 1982 to assess the state of the environment and changes in the perception of environment since 1972. In 1983, the United Nation General Assembly (WCED) created the "World Commission on Environment and Development". This commission consisted of 21 countries that were entrusted with the tasks of formulation of a "global agenda for change" and prepares an environmental perspective up to the year 2000.⁵

⁴ Ibid. Pp. 93

⁵ United Nation Report (1992). Nairobi

The Agenda 21, in Rio Declaration on Environment and Development was adopted by more than 178 Governments at the United Nations Conference on Environment and Development (UNCED). The conference that is also known as " The Earth Summit" was held in Rio de Janeiro, Brazil on 3rd to 14th June 1992. The conference was to reaffirm the Declaration of the United Nation Conference on the Human Environment, adopted in Stockholm aimed at building upon it. The Agenda emphasized that, in order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation. This means that economic development with a polluted environment is no development at all. The Rio de Janeiro Conference identified the environmental and global development challenges and opportunities and their inter-linkages up to the end of this century.

The full implementation of Agenda 21, the Programme for further implementation of Agenda 21 and the commitments to the Rio de Janeiro principles were strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa from 26th August to 4th September 2002. In the Conference where nearly 200 countries met it was agreed that by 2020 chemicals would be made and used in ways to minimize severe harmful impact on humans and the environment⁶.

Environmental policy issues in Kenya have been affected by multiplicity of reasons that has made it stagnate and lag behind when compared to other parts of the world. In essence, environmental policy is still at its infant stages in Kenya, when compared to other parts of the world such as Europe. This section aims at underscoring the major

⁶ Nation Media Group, The Daily Nation, Thursday, September 5, 2002 p. 13, Nairobi

drawbacks surrounding effective process involved in structuring environmental policy issues in Kenya.

In Kenya, pollution is still a major problem especially in the urban centers. This has been attributed largely due to industrial activities. One of the most affected urban centers with this regard is Thika Municipality. Industrial fumes from chemical industries pollute Thika town. As matter of fact, Kenya Energy and Environmental Organization (KENGO), Kenya Medical Research Institute (KEMRI) and the Catholic Archdiocese of Nairobi carried out a study to establish the extent and effects of the problem of pollution. The major findings included that; the air is polluted not only by industries but also by the domestic fuel consumption though to a less extent.

In terms of the evolution of environmental policy in Kenya, there are significant landmarks, which elucidated vital environmental concerns. Sessional papers including Session paper No.10. of 1965 have made very explicit statements about natural resource management and anticipated the current interests in sustainable development.

The world commission on Environmental and Development in report to the United Nation in 1987 defined the "Sustainable development" as the needs of the present with compromising the ability of future generation to meet their own needs. From a local scale, in as much as it is not wide spread, pollution is still crucial issue. Currently, the major concern in Kenya is the reclamation of the water quality of Nairobi River. However, other pollution problems still exist, as a matter of concern; pollution is a major problem too in other industrial towns of Kenya. Thika for example, has a number of

chemical industries that emit poisonous fumes to the atmosphere that are lethal to human, plants and animal life. (Kengo,2000)

1.2 Problem Statement

Communities are supposed to be aware of the most pressuring problems of the society. Therefore the problem in turn generates both different perceptions and attitudes towards it. Pollution awareness levels and facts concerning perception and social attitudes towards it have so far not been elaborately established.

This study therefore, aimed at identifying and quantifying the awareness levels of pollution problem in Thika Municipality. With emphasize on perceptions of the communities living in the area as regard to pollution. The emphasis was placed on the perceptions of the communities living in the area as regard to pollution. It is on this view that, the people's reactions towards polluted environment are not properly understood; it needs to be investigated in depth.

The awareness levels, perceptions and attitudes towards pollution are expected to generate some sort of social action among the residents and communities living in Thika Municipality. However, it is not very clearly documented on the status of community participation in an attempt to contribute positively towards protection of their environments.

Most pollution studies pay more attention (Lauwery J.A. 1969) to measuring ambient pollution concentrations than to finding out how to reduce their generation. The main premise in this context is that, the government has not entirely dealt with the evident

problem of pollution in Thika Municipality (Gitau, 2000). In this respect, the community improved their awareness in establishing evidence of their polluted environment. These results to develop attitudes based on the perceptions of the local government to provide anti-pollution measures. This prompts the community to take charge and protect their environment irrespective of the governments' unwillingness to address the pollution problem. This research project aimed at assuring the following key research questions.

1. What are the quantifiable awareness levels with regard to different types of pollution in Thika Municipality
2. What facts are known by the community about their perception and attitudes towards pollution in Thika Municipality
3. What mechanisms and strategies do the residents of Thika Municipality use to take control of the problems of pollution and their efforts as a community to reduce the chances of leading to disaster level?

1.3 Study Objective

The general objective of this study was to assess the contribution of the community as they formed social groups to combat the pollution problem in Thika Municipality.

The following are the specific objectives

1. To establish and reliably quantify the pollution awareness levels in Thika Municipality and to find out the perception and attitudes towards pollution problems by the Thika community.

2. To identify and appraise community mechanism for pollution disaster prevention with the aim of suggesting more guides lines on ideas for community pollution prevention strategies.

1.4 Scope and Limitations of the Study

This study explains the social related as facts of pollution prevention strategies in Thika Municipality. The major concern was to highlight on the communities' perceptions, attitudes and awareness levels. Any other aspect outside the stated framework above was considered out of scope of this study.

The study was limited to Thika area due to financial and time constraints. The study dimension of this research piece is restricted to only the ones that have a social dimension and possibly have a social implication. In as much as the scope of this study we only limited our self to Thika Municipality, the results of this study have implication in other communities living in industrial towns affected by air pollution especially those emanating from local chemical industries. In mind are such towns such as Webuye, Kisumu, and Nakuru, Nairobi and Mombasa just to mention a few. The study narrowed down to particular aspect of environmental concerns: soils, animals, plants, water and atmospheric pollution. Thika Municipality is chosen due to concentration of industries and people (community) working in the factories, which will make them a targeted sample in the project.

Thika Municipality was selected to be the main study area because of its location size, convenience and the concentration of the industries. The study area is predominantly the Central Business District and Makongeni Estate in Thika Municipality administrative division of Thika District. The population of Thika town is 120,000 people from various ethnic groups. There are twenty-eight major industries and over- fifty minor industries⁷.

1.5 Justification of the study

Pollution is a widely researched phenomenon, not only from the global scale but locally as well. The problem in Thika Municipality has received a lot of attention from political circles and the media. For several years there have been campaigns that have gone on in order to address pollution issues. There are no clear methods established in a bid to control the pollution disaster in Thika and environs. As a first step towards achieving this, it is vital to assess the awareness, attitude and perception of the residents in order to develop sustainable pollution management programs.

Emphasis on the social dimension of pollution prevention from a local point of view is currently lacking. Therefore it is important to examine the best ways community organization can get involved themselves in sustainable management of pollution in Thika.

The study generated key insights and suggestion for strengthening the community awareness, perceptions and attitudes. Major industrial town in Kenya, face similar pollution problems. The findings of this study provided relevant knowledge and plan that

⁷ Thika District Development Plan, 1997

can be replicated in the other towns as strategy of expanding the product of this study
countrywide and even beyond

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 LITERATURE REVIEW

Pollution is not a new phenomenon. Anywhere human beings utilize resources unsustainable result to pollution. Different authorities have thus defined pollution variously. According to the U.S Environmental Protection Agency (hereinafter EPA) pollution is defined as generally the preserve of substance in the environment that because of chemical composition prevents the functioning of normal process and produces undesirable environmental health effects.

The atmosphere is a dynamic system, which steadily absorb various pollutants from natural as well as man-made sources, thus acting as a natural sink. For the purposes of this study, pollution is seen to be the introduction of substances to the physical environment that would change the existing quality of natural processes that are essential to life on earth from desirable to undesirable levels. These effects are harmful especially in issues related to human, plants and animal health.

Torori and Akara (1995) present that pollution can be subdivided into other mutually exclusive constituents. That is , different types of pollution.

Air pollution

The air we breathe is about one-fifth oxygen and a little less four-fifth nitrogen. The gasoline -powered internal combustion engines of car, trucks and buses cause most air pollution. The largest industrial polluters are petroleum refineries. (Dye 1995:179) Electrical Power Plants also contribute to total air pollutants by burning coal or oil for electric power. Heating is also a major source of pollution: homes, apartments, and offices use coal, gas and oil for heat.

According to Thinkquest Online Library, (quoted by Silengo 1998) urban air pollution is seen as an indication of disturbances to the composition of compounds in the atmosphere. This may be summarized as; excess emission of gases/vapours into the atmosphere, saturation of chemical compounds/particulates; rate of dissipation is smaller than the rate of absorption through various biogeochemical cycles. This is especially the carbon and nitrogen cycles and finally as emergence of new chemical reactions of reactive and non-biodegradable compounds. As such urban air pollution is seen to induce further global warming, acid rain, smog, and ozone depletion just to mention a few effects.

Air pollution is experienced when the atmosphere is mixed with foreign gaseous material that is different from the major constituents of pure air itself. Most industries produce visible fumes and clouds of dust. The dirt is under two categories, which are $PM_{2.5}$ and PM_{10} . The first category is dust made up of relatively coarse particles produced by mechanical operations and settle immediately depending on size. $PM_{2.5}$ particulates generally represent several chemically distinctive classes of particles that are emitted or

formed within the ambient air as very small particles. They are generated as carbonaceous particles in wood smoke and diesel exhaust emissions. The second category is particulates that are very small and remain in the atmosphere for a long time. PM_{10} are the larger particles and are largely composed of soils that are dispersed into the air. Both the $PM_{2.5}$ and PM_{10} are complex mixture in the chemical sense.

Table 1. A summary of sources and composition between $Pm_{2.5}$ and Pm_{10}

	$PM_{2.5}$	PM_{10}
Formed from	Chemical reaction, nucleation, condensation, coagulation, evaporation of fog and cloud droplets in which gases have dissolved and reacted.	Mechanical disruptions, evaporation of sprays suspension of dusts
Source	Combustion of carbonaceous materials, transformation products from NO_x SO_2 and organic compounds.	Resuspension of industrial dust, suspension from disturbed soil e.g. farming, unpaved roads, construction and demolition, oil combustion

Source: Garlauskeas, A.B. (1975)

Fine and larger particles typically exhibit different behavior in the atmosphere. Once formed, fine particles on account of their very low deposition rate, are quite persistent and very often are uniformly distributed throughout an air mass. Larger particles generally deposit more rapidly, and as a result, total larger particle mass is less uniform in concentration across a given air shed. The gaseous component is the one characterized by introducing other harmful and poisonous gaseous substance. Most chemical industries

release a substantial amount of gaseous waste to the atmosphere. The most crucial ones include sulphur dioxide and carbon monoxide

Carbon Monoxide

Carbon monoxide is a product of the incomplete combustion of carbon and carbon compounds. It is colorless, odorless, non-irritating and yet toxic with adverse effects on human health. It interferes with oxygen absorption by the red cells and thus restricts the supply of oxygen by the blood to the body tissues and is fatal in large doses or concentrations⁸. Though carbon dioxide is totally harmless to humans and animals, its effects when combined with other gases retains infra - red rays in the atmosphere resulting in the global warming known as the green house effect. The major contributor of carbon monoxide is the incomplete combustion of fossil fuels.

Dioxide and Sulphur Trioxide

Sulphur dioxide is a product of the combustion of sulphur or of fuel containing sulphur such as coal and oil. The sulphur contained in crude oil is removed during the refining process, but some of it remains especially in heavier refined products like diesel fuel, which contain 0.1-0.3% sulphur (Bara, 2000). It is a respiratory irritant and often attacks building materials. Sulphur trioxide is mainly the product of sulphur dioxide oxidation in the air under sunlight and is usually converted in the atmosphere to sulphuric acid mist; it is highly corrosive and more toxic than sulphur dioxide.

⁸ Garlauskeas. op. cit.. Pp. 89

The major sources of sulphur oxides are industrial operation with a manufacture of sulphuric acid and use of furnace oils in industrial boilers and Processing of paper

Nitrogen Oxides (No_x)

Two oxides of nitrogen exist in the atmosphere i.e. nitrogen oxide and nitrogen dioxide.

Nitrogen oxide is readily oxidized in the atmosphere to nitrogen dioxide and consequently the effects of nitrogen dioxide are more important. Nitrogen and sulphur oxides, together with unburned hydrocarbons, are the principal components of acid rain.

Major sources of nitrogen oxides are incomplete combustion of fossil fuels.

Table 2. Sources of some important air pollution and their effect on Human beings and animals

Pollutant	Major sources	Typical effects
Carbon monoxide (Co)	Incomplete combustion of fuel. Automobile exhausts, blast furnaces and tobacco smoking.	Toxicity, blood poisoning, which leads to death.
Sulphur dioxide (So_2)	Combustion of coal. Combustion of petroleum, burning of refuse, Sulphuric acid plants	Increased breathing rate and feeling of air-starvation, Aggravation of asthma suffocation chronic bronchitis, Irritation of eyes and throat
Oxides of Nitrogen (No_x)	Automobile exhausts, Gas-fired furnaces, boilers, Fertilizer industries and combustion of wood and refuse	Respiratory irritation, headache, bronchitis, loss of appetite, corrosion of teeth
Carbon dioxide (Co_2)	Automobile exhausts and combustion of fuel	Toxic in quantities.
Dust	Asbestos factories, Ceramic industries, Glass industries and cement industries	Damage to respiratory tracts and eyes and corrosive to mucus membranes

Source: S.S. Dara (2002)

Water Pollution

This results from contamination of water that serves as life support systems on earth. This for example is experienced as a result of discharging untreated effluent into sewers, lakes, and rivers that eventually drain into the lakes or rivers. This therefore alters the safety standards prescribed for human, plants and animal use⁹. Chemical pollution in water is nitrates; nitrites, pesticides and the effects are manifested as poison.

Water is essential for the survival of any form of life. Water account for about 70% of the weight of human body. The menace of water-borne disease s and epidemics still threatens the wellbeing of community; that is clear water is of vital significance for the welfare of community. According to UNEP's Global Environment Outlook - 3rd report, the main concerns are how to manage climate change, fresh water and urbanization. Climate change is seen through floods, drought and extreme weather conditions are blamed on industrial pollution. The people affected by climate disasters increased from 147 million a year in the 1980s to 211 million in the 1990s.

UNEP Executive Director, Dr Klaus Toepfer¹⁰ took plunge into the Rhine River. He did prove to the world that he had done a good job of clearing the polluted waterway.

⁹ Bara, Op. cit., 2000

¹⁰ Klaus Toepfer is UNEP Executive Director. He was Germany Federal Minister of the Environment, Nature Conservation and Nuclear Safety from 1987 to 1994.

For this he stole the hearts of the German public back in the 1980s, long before the UN appointed him police and possibly redeem the global environment from the vantage point in Kenyan capital, Nairobi. The pollution scenario creates or causes migration and relocation of human societies. Pollution is outrightly known to have very significant negative affects such that, many governments have invested highly in pollution prevention programs to safeguard both the water and intergenerational equity of its preparation.

Land pollution

This is also referred to as soil pollution. In this case, hazardous waste is released to the land surface. It involves the deposition of solid waste, accumulation of non-biodegradable materials, toxification of chemicals into poisons leading to poorer land quality. The common classifications of major sources that lead to urban land pollution are: urban agriculture, mining and quarrying, sewage sludge, industrial waste, demolitions, constructions, and household wastes. The types of solid waste disposed of as garbage has changed, with plastics and papers replacing metal in the garbage pail. There are three methods of disposing of waste - Landfills, Incineration and Recycling.¹¹ According to Dye (1995:179), Modern landfills have replaced town dumps. Landfills are usually lined with clay so that potentially toxic wastes do not seep into the water systems.

¹¹Bara, op. cit.

The second method to dispose solid waste is to burn the garbage; modern incinerators are equipped with machinery to separate the garbage in different types, with scrubbers to reduce air pollution from the burning.

The problem with this method is the substances from chimney of the incinerator; the emitted wastes are smoke, nitrogen, carbon monoxide, and hydrogen chloride. Therefore, this method reduces pollution, not eliminated.

A third method of reducing the amount of solid waste is recycling. Recycling is the conversion of the waste into useful products. For example, newspapers are recycled into cardboard, Insulation. Recycling does have a modest effect in reducing the load on incinerators and landfills

According to Garlauskeas (1975), he defines land pollution as the weathered layer of the earth's crust with living organism and their product of decay. Soil pollution differs from water pollution or air pollution, because the pollutant remains in direct contact with soil for longer period (time). The hazardous chemical can also enter the human food chain from soil or water plants.

Noise pollution

The term "Noise" may be defined as an unwanted sound at wrong time and a wrong place. Noise pollution presumably may be somewhat endemic to urban environments as opposed to rural landscapes. Measuring noise pollution is no easy task, however research in the issue, first of all has characterized urban noises as road traffic, air traffic, rail traffic, neighbourhood and domestic noise incompatible land use and industrial noises.

Secondly, different indices have been developed to check and estimate pollution levels. Some of the quantities derived from this include the decibel method, which estimates the intensity level of urban noises¹².

Noise pollution mostly occurs in urban areas where, industrial, construction, transport machinery produce undesirably high noise levels that create discomfort in running day to day lives of the communities living near them. And the industries do emit high-pitched sound (noise), which may impair the hearing capability of the community. It is important to reduce noise pollution particularly in urban and industrial areas.

Table 3. Typical Noise sources in Industries and methods of Noise Control

Equipment	Noise sources	Methods for noise control
Crane, Excavator, and Bulldozer	Engine	Fitting of more efficient silencer or exhauster
Pump	Engine pulsing	Enclosure the working area in acoustic covers.
Motors	Cooling fans	Intake muffler, unidirectional fan
Engines	Air intake and exhaust	Enclosing intake and discharge lines, use of quieter fan

Source: S.S. Dara (2002)

In as much as the quality of urban life is as broad, and that pollution per se affects the holistic environment, the standpoint of this paper is centered on pollution aspects of the urban environment. It is difficult at the present time to assess the full impact of air pollution on health. In the street of urban cities like Durban, Nairobi, Lagos London and Tokyo at certain hours of heavy traffic, carbon monoxide can deprive the body of

¹² Idem. 2002

oxygen; people exposed to it may exhibit drowsiness, headache, poor vision and reduced capacity to reason. Nitrogen oxide irritates the eyes, nose, throat and respiratory system.

Urban pollution hence poses a threat to existence of urban dwellers. This therefore contributes to the status of quality of life of people living in urban centers. As such, it is needful to assess the quality of urban life and explore ways by which urban pollution affects the levels of quality of life of urban dwellers.

Pneumonia is responsible for the deaths of thousands of children in the developing countries each year. This is largely thought to be associated with exposure to the dangerous pollutants produced by the indoor burning coal and paraffin¹³.

Many studies in African country shows those children are involved in all kind of economical activities. It means that they are exposed to all kinds of risks. The environmental risks because they are often working in the streets or in open place and occupational risks. (Because they are exposed to different risk factors of production) The fact is that they also are living in some urban without clean drinking water, light and sewage systems.

Indoor air pollution is a primary cause of chronic and acute respiratory infections (ARIs), which kill two million children each year, more than any other infectious disease. The second largest of children in Africa is diarrhea. According to the World Health Organization (WHO: 1999), "the prevention of diarrhoea ... depends on the

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improvement of water supplies and sanitation". According to Dye (1995:176) Urban quality of life is costly "removing the last traces of any environmental pollution is extremely costly, it is impossible to remove all risk of accident or illness". The monoxide damages plants (flowers) and buildings, so it is clear that urban residents have been found to be twice as likely to contract lung cancer as in rural area residents.

Impact of pollution

Economists view pollution as a cost of product, a cost that produces may try to externalize to others. If pollution becomes a cost to its produces, it will be reduced through the ordinary operation of a free market economy. Taxes on pollution, imposed on those who generate them, would provide economic incentives for individual, firms and local governments to find the cheapest and most effective method to limit pollution. A tax on each firm that generates pollution based on the amount and type of pollution generated. Each polluter would be given the information and motivation to reduce pollution as cheaply and efficiently as possible in order to limit tax. Those who do so would be rewarded with lower taxes and higher profits. The environmental policy should be shifted away from centralized bureaucratic control and toward decentralized market incentives. It is possible to increase environmental quality, which of the some time promoting economic growth. Charging business and household by the amount of garbage collected. Direct charges based on the volume of the garbage collected, would inspire business and households to buy less unnecessary packaging and to undertake recycling effort voluntarily.

The world's worst polluters are underdeveloped nations, as income increase, people make greater efforts to improve environmental quality but it should be noted that even developed nations are also polluters. Market economies according to Thomas Dye (1995:175) are more successful at environmental protection than social economies.

Studies conducted in Belgium and America (Lauwery J.A. 1969) show that many people in large industrial cities are made ill when stagnation of the polluted air in atmosphere allows pollution level to rise catastrophically. In 1930, about 6,000 people fell ill and 60 died during a period of air stagnation in the Meuse Valley, the industrial heart of Belgium. In 1948 half of the population of Donora, Pennsylvania, USA was affected during a prolonged period of stagnation and 20 people died.

In 1952, Four thousand excess deaths were attributed to an incidence that occurred when a stagnant atmosphere of fog combined with smoke and sulphur dioxide (SO₂) over some five days during the month of December. The disaster brought on great public pressure for better air quality management in cities and urban. The World Development Report, (WDR, 1992:27) has identified that reducing pollution to levels that meet World Health Organization could prevent 300,000 to 700,000 deaths a year. Philip Ndegwa¹⁴ "Africa's Development Crisis (1985:15) He argues that environmental crisis represent a threat to people.

¹⁴ In 1985, Philip Ndegwa was then Governor of Central Bank of Kenya.

Human health is threatened by various forms of pollution and become obvious that the environmental dimension must be borne in mind in all economic activities. In 1976, Kenya becomes part to the convention on the preservation of marine pollution by dumping of wastes and other matters. This was to control pollution of the sea by dumping and to encourage regional agreement supplementary of the convention (Kiss 289-350). The "World Charter for Nature" a UNEP publication portrays the awareness that mankind is part of nature and the life depends on the balance functioning of the nature, thus without any pollution

Wagner in his book " Environment and man" (1971) show that changes have occurred and changed the face of the world. Humankind are been a problem to its self by what they produce, resulting the pollution. Human beings are affected by environmental changes, mostly due to pollution. He emphasizes on environmental education so as to improve communication with policy.

Jude Ongong'a¹⁵ in a paper " Humankind Superiority for or against nature" (1992) observed that a bad environment dehumanize the health of the people. He emphasizes that; the nature should be protected from pollution, for if it is left to deteriorate, then the human survival will be minimal.

¹⁵ Prof. Jude Ongong'a is the senior lecturer in Kenyatta University

Investigations carried out between July 1984 and June 1985 by Prof. O. Ojwang of Kenya University to establish lead levels in the dust in Nairobi found relatively high amounts in streets with heavy motor vehicles traffic. The studies found that the lead concentration in Nairobi was high than Jeddah, Saudi Arabia, but lower than Birmingham the United Kingdom.

Dr W.D Sakari of the Occupational Health and Safety Department (OHCD) in Nairobi told a seminar organized by Kenya Medical Research Institute in 1989 that a survey carried out in 60 factories in Nairobi, Mombasa, Nakuru and Kisumu showed that as many as 20,000 workers are exposed to noise above the International Labour Organization's suggested levels of 90 decibels. Sakari said that the workers were at risk of getting noise-induced deafness (Sakari, 1987) In May 2003 a joint research by students from Kenyatta University and the Department of Geography of the University of Trier, Germany, found that certain streets in Nairobi experience intolerable noise levels above the desirable 65 decibels (dBA).

Noise levels in several parts of Nairobi's Central Business District (CBD) have been found to be in excess of the desirable tolerable levels conducive for business, well-being and health. They reveal this in their report *Liveable streets in Nairobi: How much noise is tolerable?* Lecturers from both universities supervised the research. The Eastern parts of Nairobi including Tom Mboya and Ronald Ngala streets, River Road and parts of Moi Avenue were found to experience the highest noise levels of up to 80 dBA and in some cases even maximum levels of 100dBA.

The continuous exposure to noise, according to medical experts in excess of the optimum levels, increases by 20 per cent, the risk of one getting cardiac and circulatory diseases than one living in a silent street. Health consequences for children who live in noisy streets include poor concentration, reading problems, little talent in solving difficult tasks and disturbed social behaviour.

Students participating in the research included Kosgey Maswai Kipyego, Inga Dinks, Manuela Henkel, Edwin Kipkosgei Sang, Carsten Jeblick and Paul Kerario. They were involved an exchange programme to Germany and vice versa. The high noise levels are attributed to economic activities, street vendors selling their wares, hooting by vehicles and matatus as well as shouting by conductors, street preachers and comedians.

The Southern, the Western and North Eastern parts of the Central Business District were found to be less noisy than other parts of the city especially the smaller streets in the Central Business District like Loita and Moktar Daddah streets. The lowest noise levels can only be found in small restaurants and some coffee bars, and parks such as Uhuru Park and Jevanjee Gardens. The students who spent several months doing the research and concluded that the noise produced by vehicles, music shops, pedestrians, hawkers, preachers and others in the whole of the Central Business District have reached an unacceptable level. They state that the acceptable levels of noise near schools and hospitals should not exceed 57 decibels while that of residential areas should not exceed

59 dBA. They recommend a ban to unnecessary hooting and that the hawkers, preachers and comedians operate in designated open spaces¹⁶.

In 1987, a leather tanning plant, which was to be located near Sagana Bridge by Kirinyaga Leather Works (K) was order closed. The factory was found to constitute an environment threat to health of community around and Masiga Dam and Sagana River¹⁷.

In 1989, there was a community outcry over a chemical plant in Miritini, Mombasa that produced cooper oxychloride and constructed next to Kenya Co-operative Creameries (KCC). The study done was that the waste products from the chemical were toxic and posed a serious danger to the milk firm and serious health hazard to the community in the area.¹⁸

In 1990, a year later after Miritini saga a Paper Manufacturing Project that was to be up next to Masinga dam near Sagana was suspended. The suspension was due to the Tana and Athi River Development Authority (TARDA) under whom the dam falls protested after their research, saying that the plant posed an environmental hazard to the Corporations catchment area around the dam¹⁹

The Tana and Athi River Development Authority cited air pollution, effects of the factory's waster waters on marine life, pollution of domestic waters and the effects on irrigation. A lot has been documented about pollution scenarios in different parts of the

¹⁶ Marceline Nyambala, The Standard Newspaper " Liveable streets in Nairobi: How much noise is tolerable?" May 2nd 2003. Pp. 7

¹⁷ Kenya Broadcast Corporation, Nairobi, July 6th, 1987

¹⁸ The Daily nation, Nairobi, July 21st 1989

¹⁹ Ibid. 1987

world and locally as well. However, the pollution problem in Thika is not properly documented. Then latter credible literature on the major pollution types in Kenya and especially Thika Municipality requires immediate attention. This study is bound to cover this gap

2.1.1 Pollution Situation in Thika Municipality

As early as 1990, Thika was one of the most polluted urban centers in Kenya. This was evidenced by a lot of social action against some of the major industrialists who were considered to be the principal polluters. Such an example included the KEL chemical plant that sought to be closed by the residents.

Greater Thika supported the outcry that culminated with a demonstration led by Catholic priest Fr John Ndikaru Wa Teresia²⁰ was supported by the greater Thika. The anti-protest and demonstrations were well published through the local dailies and therefore attracted national interest. Community brought the government authority to Thika to establish the cause of the outcry. The polluting industries were on the defensive. The official government report in investigation strongly suggested a detailed analysis of the problem, but they lacked the necessary resources²¹.

Thika town is one of most heavily industrialized municipalities in Kenya and over one hundred thousand people in Thika and its environs are exposed to industrial pollution

²⁰ Father Ndikaru wa Teresia is the author of this project paper. He lived and worked with Thika community for 14 years

²¹ The Kenya Times, September 30th, 1991 Pp. 32

The industrial pollution was serious that work at Polysack Limited, Kenya Paper Mill and Kenya Taitex Mill had to be stopped by the Thika District officer. One hundred (100) workers walked off the premises between 1.20.to 3.30 p.m. on June 1991 to go for the medical treatment as result of gas leak from KEL Chemical plant and this made companies to complain about huge losses due to work stoppages. The gas leak from KEL plant was so powerful that it caused vegetables and flowers in the vicinity to wither.

Two distinct designs features characterize the housing in Thika and especially Makongeni estate. About 80 percent of the houses consist of single 8-12 rooms in an all-round built block and no provision for ventilation and chimney.

The defined cooking place is provided. 20 percent are self-contained units with kitchen facility. Indoor and outdoor pollutants are highly correlated due to housing design.

This means, people and especially children and women who are at home (Most of men are working in industries) are living in a crowded, poor ventilated, using fossilized fuels for lighting and cooking are exposed to risk of the ambient air which is contaminated with sulphur dioxide. Due to a lot of public uproar, the government decided to do major screenings to establish pollution effects on the residents. The government still concluded that the chemical plant was safe.

As a result, Kenya Energy and Environmental Organization (Kengo), Kenya Medical Research Institute (KEMRI) and the Catholic Archdiocese of Nairobi²² made an attempt to assess the environmental situation as it affects Thika Municipality residents. The report provided was based on air quality assessment, biomedical investigations and community programmes. Among the major findings of this report, (Wafula et al. 2000; 17) the air quality assessment revealed that the mean ambient sulphur dioxide was at 6mg/m^3 per annum while the indoor ones was at 106mg/m^3 . Nitrogen dioxide stood at 30mg/m^3 and 52mg/m^3 in ambient and indoor levels respectively.

Suspended aerosols also stood at 68mg/m^3 and 82mg/m^3 in both ambient and indoor levels. The toxic industrial emission was mainly from air-borne emission with the most common pollutants being sulphur dioxide (SO_2), nitrogen oxide (NO_x). The complaints from the communities were ranging from cough and chronic cough, respiratory disease in children, skin disease, and stress-related problem to corrosion of the roofs. A team of 18 doctors had examined 14,000 residents of Makongeni estate and found that 800 of them suffering from ailments related to the factory's emissions.²³ On the perspective of biomedical, investigations the report yielded that, there was an increase in lung related health complications among the residents whom lived close to the factory, especially children. The project report indicates that air pollution is evident in Thika Municipality.

²² The Kenya Energy and Environmental Organization, Kenya Medical Research Institute and the Catholic Archdiocese of Nairobi were the collaborators of the Environmental Assessment Project for nine years

²³ Ngweni Hilary, The Weekly Review, October 11, 1991

The levels of Nitrogen dioxide and Sulphur dioxide are higher than the prescribed normal levels by the World Health Organization. The major sources of this pollution are in the industrial emissions however; localized pollution from indoors as a result of kerosene and fuel wood use in houses cannot be excused. Passive smoking, Nitrogen dioxide (No₂) from gas cooking and smoke from biomass fuels are the sources of indoor pollution. Natural gas cooking and heating stove increase exposure of the household members to No₂ ²⁴

Most common fuel used in Thika for cooking is paraffin and charcoal. According to Wafula et al. (2000:87) Industrial fuel use in Thika is 1,400,000 of litres of fuel oil consumed every month when all the 28 industries are operating. This translates into a release of 500kgs of So₂ from entire industrial area daily. In Thika, the estimated average consumption of kerosene for cooking and lighting per month in Makongeni Estate alone, which has some 14,000 households, this translate into emission of about 200 tonnes daily as sulphur dioxide (So₂) .As such the pollution has led to an increase in many respiratory infections among the residents. Community wise, only suggestions were made on how to form community-based programmes to help manage environmental pollution.

This study has made an attempt to follow up and assess the effects and activities of the community groups in pollution prevention. This will provide a sociological perspective about pollution control and management in Thika, which is prevalently missing in the available and existing literatures

²⁴ op. cit. Pp. 87



Jane Njeri, claimed skin disease was caused by effluents from the chemical factory

(Standard Newspaper picture)



James Okuta, with sulphuric acid burns

(Ndikaru picture)



**Njuguna, two and half years old who became ill
when the chemical factory is in full blast.
Njuguna is held by the mother**

(Standard newspaper picture)



**Francis Njoroge, a kiosk operator shows tomatoes
which he claims were ruined by the toxic fumes.**

(Standard newspaper picture)



At the gate of the chemical factory Fr. Ndikaru conducts prayers

(Daily Nation newspaper picture)



Marching against the chemical factory in Thika.

(Daily Nation Newspaper picture)



Thika Residents carrying a cross led by Fr. Ndikaru to protest against the KEL chemical factory.

(Daily Nation Newspaper picture)



Fr. Ndikaru giving a sermon at the KEL chemical factory gate

(Daily Nation Newspaper picture)



Residential houses opposite the factory with corroded iron sheets

(Daily Nation Newspaper picture)



on the background: The controversial KEL factory

(Standard newspaper picture)

Lack of Comprehensive Environmental Policy Guidelines

For effective and results-oriented policies, proper capacity in the drafting process is needed. Kenya is faced with major problem of lacking sufficient human resource to undertake this kind of work. This may be possibly due to the integrated nature of these policies. As such, the drafting process is long often requiring the input of expert support from the developed world. Therefore, most policies in Kenya are not as comprehensive as they ought to be. This leads to gaps in implementation phase of these policies thus the described and expected results of the policy objectives and goals are not adequately met.

Poor Policy Implementation

There is a very big gap between policy formulation and policy implementation. Most of the formulated policies are not effectively implemented. This is mainly attributed to the fact that governments have not been able to promulgate comprehensive legislation to deal with environmental protection.

There exist crippled legislative and institutional frameworks for policy implementation.

According to Silengo (1998) *"...Lack of enforcement legal provisions ...and lack of institutional capacity to implement their rules negates all efforts of environmental policy..."* For proper implementation of these policies, there needs to be legal and institutional frameworks in place. This is a must.

Poor funding of policy objectives implementation is one of the serious problems affecting environmental management efforts in Africa and Kenya is no exceptional (Agunwamba, 1998). Due to economic depression in Kenya: Kenya government allocates little funds towards environmental protection. Despite donor funding, the finances are not adequately sustainable. This discourages efforts made to protect the environment through the proposed policy instruments. On the other hand, corruption and misuse of public funds, a characteristic of Kenya government aggravated this problem further. A major rethinking is required for successful environmental implementation. More emphasis is being directed towards private sector involvement.

Lack of Political Will and Government Attitude

Silengo (1998) argues that lack of political will has been recognized as the main reason for non-implementation of good environmental regulations in many developing countries. He further asserts that commitment to the as expressed in the policy documents should fully support initiatives to protect the environment. Currently, this is lacking in Africa. Many African countries, Kenya is not exceptional are battling with other problems such as civil wars, drought, HIV/AIDS and so on. Attention has been lifted from environmental issues for more pressing problems and this has consequently affected Kenya environmental policy implementation.

Public Attitude and Lack of Awareness

Agunwamba (1998) has indicated that the Africa general public attitude towards environmental protection is poor. In Kenya, the structural problems of poverty and unfavorable social attitudes can militate against well inter-tuned efforts in environmental protection. The general lack of information to the public due to insufficient institutional support for sustained research and monitoring compounds the situations. Public involvement in environmental protection can act as a good springboard for the success of the implementation of environmental policy in Kenya.

Mitigation Measures.

According to Ojwang' (April 2002), a lecturer in University of Nairobi, Faculty of Law. The Kenya government policy is to utilize the natural resources efficiently without destroying the environment. There are several pieces of legislation being enforced by various ministry departments all aimed at controlling pollution. Public Health act protects the public from any hazards, which can be harmful to their health, and Municipal Council by-laws- protect the municipal sewers from untreated liquid effluent from industries

The above section has provided an account of the general problem that has so far been affecting pollution management in Kenya. However, these have not at all elucidated any problems that communities may face in the bid to control pollution. This shows that the community component in pollution prevention has not been given its right attention in Kenya. This study has made an attempt to spear head this issue by providing lacking information on the problem of pollution

2.2 THEORETICAL FRAMEWORK

Theory is the axis around which the research revolves. According to Allan Swingewood (2000), he describes sociological theories as devoted to mapping, describing and explaining social relations as they actually are, as they actually occurred, rather than they ought to be. Further a theory is a set of interrelated constructs (variables) definition and propositions that represent a systematic view of a phenomenon, by specifying relations between variables, with the purpose of explaining natural phenomena (Kerlinger, 1964). Theory establishes a cause and effect relationship between variables with the purpose of explaining and predicting phenomena and may indicate missing ideas, or links to the kind of data required. Our theoretical framework will apply the following:

2.2.1 Functional Theory

According to Ritzer (1992:239), Functional Theory explains social institutions primarily in terms of the functions. Today the names of Emile Durkheim (1858-1917) and Talcott Parsons (1902-74) are synonymous with functionalism. Parsons and Durkheim's views are that a society is that is as a set of interconnected parts, which together form a whole. Durkheim emphasis the importance of viewing society as whole and inter-relationship of society in terms of the functions they perform. According to Parsons, (1951:153) every society in order to exist must solve four problems: adapting to the environment; that is, the community that cannot feed its member is bound to collapse. Secondly providing a decision-making process, which is a goal-attainment, each society must have a means to deciding how it will be organized. It is necessary to motivate members of the community

to want to do what they have to do. The community must define and attain its primary goals.

Thirdly integrating the various institutions to specific need of the community, this means that a community regulates the interrelationship of its component parts. And fourthly, the pattern maintenance (latency) that the community must furnish, maintain and renew both motivation of individual and create cultural patterns that create and sustain the motivation. What Talcott is saying is that, to coping with the psychological demand of the community member, which are the needs to motivate the individual to remain within the society (Ibid. 156). He calls them " functional pre-requisites" that is the necessary conditions of the existence of the community. (In order to maintain the society) .The basic unit of the analysis is society and its various parts are understood primarily in terms of their relationship to the whole. Parts of society are functional in so far as they maintain the system and contribute to its survival institutions like family, religion and stratification is seen as beneficial and indispensable.

With this functional theory, it will help us to understand the Makongeni community in Thika Municipality. They live as one community, which is an institution of a families and have stratified community. The Makongeni community consisting of employers and employees. The communities are maintained by their religion, which is indispensable. We have Catholics, Anglican, Presbyterians, Muslims, Hindus and traditionalists. They live by their faith. In summary, the communities in Thika lives in institution of family, religion and have their classes of their own which make the, survive.

2.2.2 Exchange Theory

We considered also the exchange theory; this is where people transfer economic goods or services. It is when any social interaction on aspect of exchange of goods and services, that is serve the purpose of social bounding. In analyzing exchange theory, Georg Simmel (1858-1918) describes it in the context of social systems. These are contacts among people for giving and returning the equivalence (Ritzer, 1992:414). He articulate in his book: 'Conflict and the Web of the Group Affiliations" (1955) that the medium of exchange is money. Simmel presented society as a "Web of interactions, people interact due to what the do, especially due to economical factors.

Simmel looks at exchange as universal form of interaction, not all interactions is exchange, so he talks on economic exchange meaning money exchange involves money but money remains historically a major medium of exchange. George Homans (1910-1989) who is the leading exchange theorist integrated the theory into his largely behaviorist approach. Exchange theory constitutes an effort to take the principles of behaviorism, fuse them with other ideas²⁵. Society plays a variety of roles in exchange process, where there is scarcity; Society must intervene to provide roles to conduct so as survive. Homans views, an individual enters into a social exchange in relation with the primary purpose of profiting from it.

²⁵ Ibid. Pp. 156

The communities in Thika are from different parts of the Republic of Kenya. They have come to Thika looking for employment. As such the workers have to exchange their services for wages and other employment benefit. The employers need their service in exchange of money. It is through exchange of service and money that the industries in Thika have survived. The owners of Capital and the Producers have to agreement on what to give and what to get. There is a mutual understanding of both, the employers and employees. So longer as there is a mutual understanding and both parts interests are addressed, there is always good relationship and no conflict or crisis is experienced.

2.2.3 Conflict Theory

According to Karl Marx (1818-83) all social systems reveals inequalities in the distribution of resources. The class-consciousness eventually transforms into class conflict. To him, foundation of class is the division of society into the have and the have notes. These are the owners and non-owners of the society's productive instruments. It was the class conflict between bourgeoisie (owners of the capital) and the proletariat (exploited), which was to propel society on to its next historical stage-socialism. Strain development between owners and workers and conflict-in form of class struggle cannot be avoided. Conflict takes people into the heart of sociological injuries and allows us to think how and why patterns of societies are created, maintained and changed.

Marx formulated the idea of thesis, which conflict with antithesis resulting in synthesis, which will result to change. Conflict according to Marx is natural, because it is a normal and cannot be avoided as means of change. It should be noted that Marx dwelt so much on material aspect, saying that people behave that way due to material. But there are

other factors, which makes people behave the way they behave, like education or religion.²⁶

According to Dahrendorf was concern with the role of power in maintaining order in society. He agrees (1956, 1968) that community has two faces, that is conflict and consensus and that sociological theory should be divided into two parts, conflict theory and consensus theory. Conflict theory examines value integration in society while consensus theory examines conflict of interest and coercion that hold society together in the times of stresses. The result of consensus is conflict. Dahrendorf reasoned that the ideas of latent and manifest interests of small group, interest groups and conflict groups were basic to elucidation of social conflict. The change in social structure is due to conflict group emerging in action. The radical change is result of intensive conflict. The authority attached to position is the key element in Dahrendorf's analyses. Authority always implies both super-ordination and subordination. Those who are in authority are expected to control subordination. (Ratzer, 1992:264) It is evidence that According to Dahrendorf, every community (society) is subject to process of change.

The communities in Thika Municipality are mostly workers in the industries. The employers have their own interest, which is to make the maximum profit, while the workers need money for their survival. Since the two parts have different interest, they're bound to conflict. Each group wants to get the most of their interests from the other. The employers and workers will have conflict that will result with disagreements.

²⁶ Karl Marx. *The Capital*. 1962, Pp. 209

In September 14, 1991, over 3,000 peoples staged a demonstration to go against the KEL Chemical factory that was producing the chemical. The community health (interest) was at risk while the factory was interested in making profit from the chemical produced.²⁷ Parts of the social system will fight to ensure that their interests are taken care of and their survival is maintained.

2.2.4 Conceptual Framework

According to Mutai (2000:104), A conceptual framework is derived from theory. It identifies the concepts included in the complex phenomenon and shows their relationships. The study will borrow from the hazard management model of the events occasioning consequences, so that pollution for instance results into far reaching repercussions (Quarantelli.1988). A model is viewed as a likeness of something. It is an explanation device or a scheme having a conceptual framework. Therefore, a model is representation of a reality²⁸.

The conceptual framework provided in this paper focused on the interplay of forces that would result in pollution management in Thika Municipality. The theoretical foundation of this study emphasizes social change, conflict and functional theories. Social exchange explains the relationship between the major players as for as pollution management is concerned.

²⁷ The Daily Nation: "Mass demonstration Against Pollution" September 15th, 199, Pp. 1

²⁸ Op. cit. Pp.105

For as pollution management to succeed, proactive exchange of ideas and materials is necessary between the stakeholders. Conflict then addresses the fact that, when social exchange fails conflicts which otherwise would jeopardize successful approach on the other hand addresses the importance of the part each stakeholder in existing effective social exchange, and minimization of conflicts in order to achieve speedy environmental health.

Due to the effects of the industrialist, industrial firms and others are produces, which causes different kinds of pollutions. On the other hand, domestic assumption of resources to contributed to the pollution of the environment. A polluted environment creates awareness in all the stakeholders. The key, players therefore face the role of investing and participating in the cycle to achieve pollution management via minimization of pollution.

2.2.5 Concepts and Operationalization Of Variables

The study addressed the dependent and independent variables. Variable is a measurable characteristic that assumes different values among the subjects. Kerlinger (1964) defines a variable as a discrete phenomenon that can be measured in two or more categories. It is a symbol to which we assign numerical values. Variable is a concept, which can take on different quantitative values (Kothari: 42). The dependent variable is the variables predicted to, whereas the independent variable is predicted from. The dependent variable is the expected outcome of the independent variables. The awareness of pollution in Thika municipally is dependent on education level, age and exposure to information about environmental issues. Effects of pollution in the area influence the attitudes.

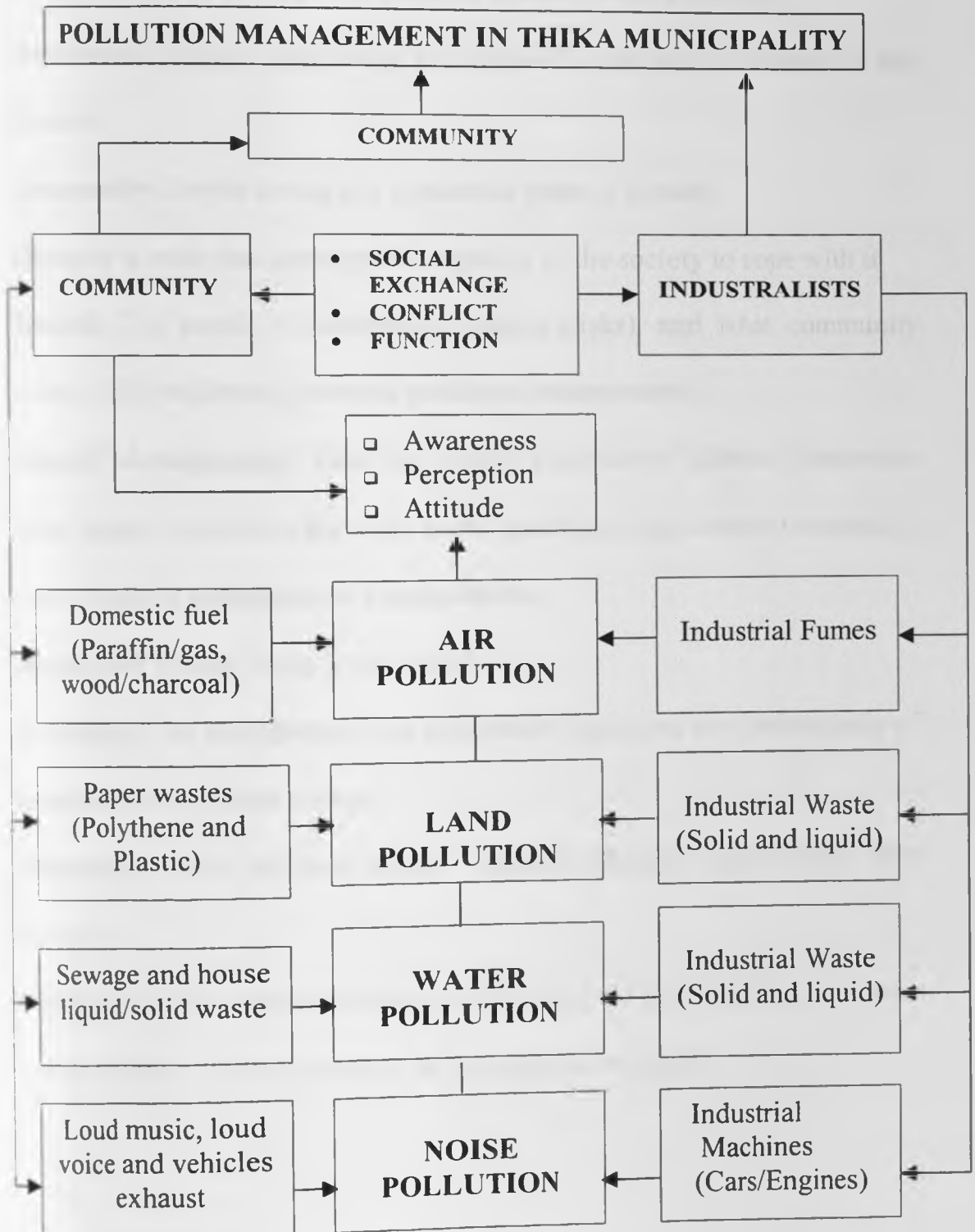
Awareness levels and attitude generate perceptions. Control mechanisms are usually determined by participation in community based organization and pollution management project.

2.3 Study's Hypotheses

In order to accomplish the above objectives, this study will be guided by the following hypotheses: -

- H₁** The levels of awareness of pollution problem in Thika Municipality are high that there are established facts that relate to perceptions and attitudes towards the same.
- H₂** Community response and action to pollution in urban towns is attributable to high-level awareness among town residents brought about by community activism.

CONCEPTUAL FRAMEWORK



2.4 Definition of Key Terms

Attitudes: Learned prediction to act favorably or unfavorably towards an event, a person, or a thing. It is a settled opinion, way of thinking.

Awareness: Having knowledge (information) and well informed of the situation.

Community: People living in a residential place in a town.

Disaster: A crisis that outstrips the capacity of the society to cope with it

Hazard: The aspect of community threats (risks), and what community value in life (wellbeing, material goods and environment)

Hazard Management: Task, by which community informs themselves about hazards, decides what to do about hazard and implements measures to control them or mitigate their consequences.

Household: People living in one family.

Perception: An interpretation or impression based on one understands of something. It is mental picture.

Protestant: Other religion except Catholic, Muslim and Seventh Day Adventist

Ventilation: These are the airways in the household like windows in a room

Vulnerability: It the capacity to be damaged or wounded

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Site description of the study area

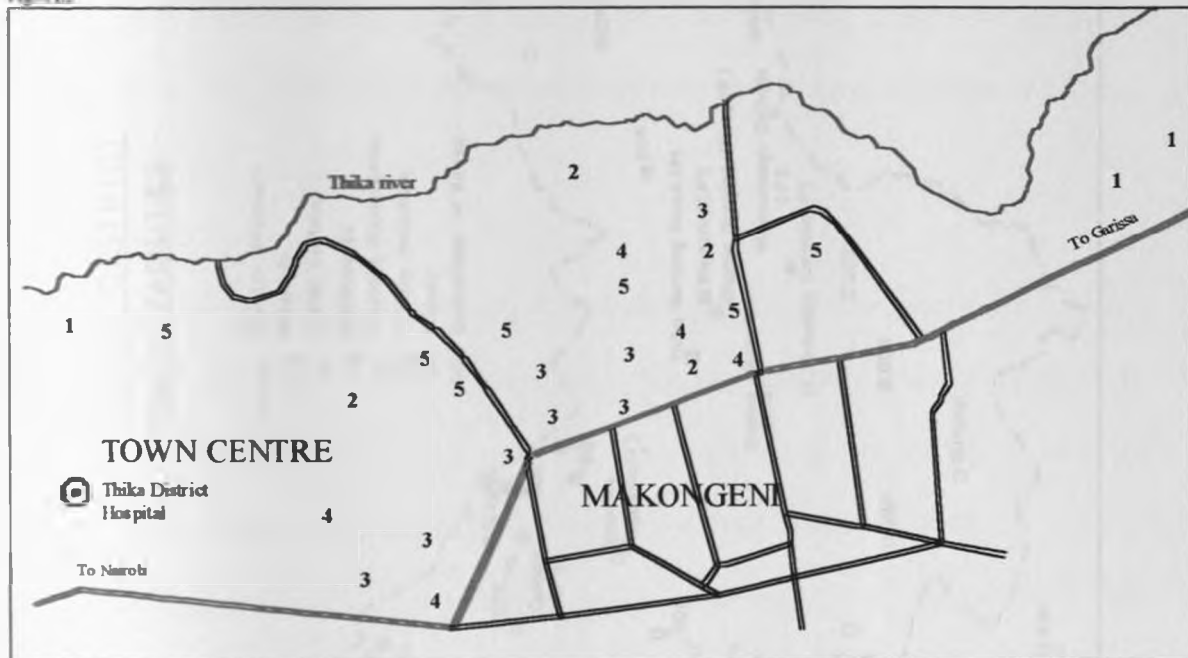
The Makongeni communities residing around the Thika Municipality formed the target of study. Thika district has a population size of 647,000 with majority living in Thika Municipality. Thika town has 120,000 people from various ethnic groups. Thika Municipality is located 1°05' North of the equator. Thika Municipality is 45 kilometers away from Nairobi Kenya's capital and lies North East of the same. In 1910, the British Settlers who eventually established coffee and sisal plantations initially used this spot as a stopover. A railway line was later built to facilitate transportation of the farm produce. Makongeni Estate is located to the west of Thika Municipality and chosen as the study area due to its proximity to the industrial belt. (Thika District Development Plan, 1997)

Thika Municipality covers an area of 272 km². It comprises of 2 locations and 7 sub-locations all being headed by the Divisional Commissioner. As a wing of the local government, it has 12 wards being headed by Councilors. Thika town has seven hospitals and sixteen dispensaries serve this population.

Thika town lies in Thika District, Central Province at 1480 metres altitude above sea level. The climate is moderate at 15 - 25 degrees centigrade. It is fertile agricultural land and with two rivers, Thika and Chania, serve as the main sources of water supply.

About twenty-eight major industries and over fifty minor industries are within easy reach from town center. These include Del Monte (K) Ltd. (Pineapple industry), Thika Cloth Mill, British American Tobacco (K) Ltd. Polysack Industry, Kenya Textile Mills, Pharmaceutical and chemical manufacture, Bulleys tanneries, BIDCO, Kenya Paper Mill, Leather Industry, KEL Chemicals, Kenya Vehicle Manufacturers and Food Processing Industries etc. (Thika Development Plan.2000). All these create an adverse wealth environment for the inhabitants of Thika Municipality.

Fig. 13 **MAP SHOWING THE LOCATION OF INDUSTRIES WITHIN THIKA MUNICIPALITY**



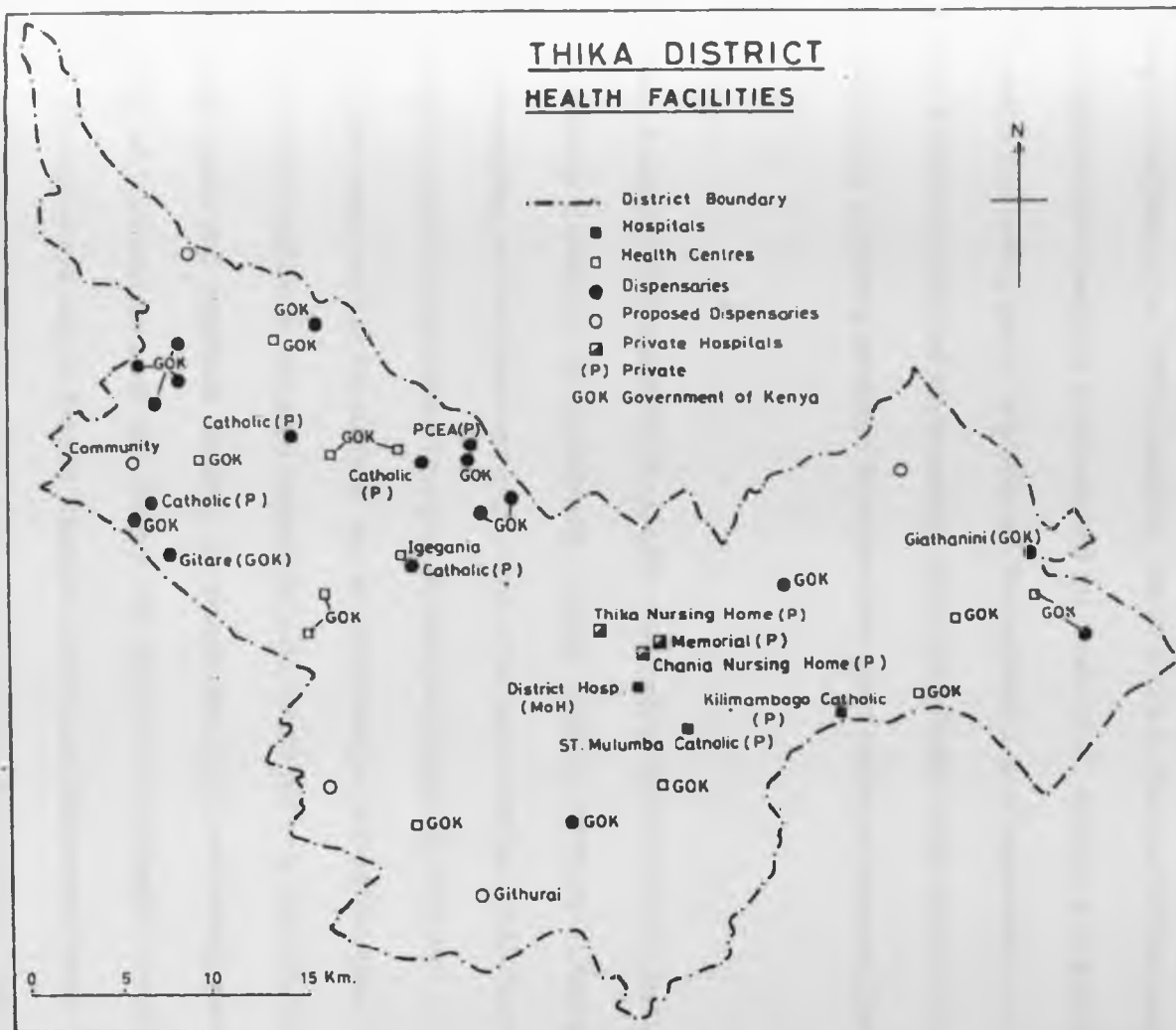
LEGEND

- 1. Tannery
- 2. Textile & Paper
- 3. Food Processing
- 4. Chemicals
- 5. Others.
-  Thika District Hospital



KENGO- ST MULUMBA ENVIRONMENTAL QUALITY ASSESSMENT PROJECT by K.G.O. WAFULA AND D. OTEKO.
Cartographic Work by G.J.O. Tokro

Map 2



3.2 Sampling

According to Singleton et al (1985), sampling design refers to that part of the research plan that indicates how cases are to be selected for observation. According to Kerlinger (1964), sampling is taking part of a portion of the population as a representative of the population. Sampling serves the main purpose of avoiding biases in the selection of the sample and to help achieve a maximum accuracy for a given outlay of resources (Bailey, 1987).

In this study, a simple random sampling procedure was used to determine which family is going to provide person to be interviewed. Simple random sampling (Chance or Probability sampling) is where each and every item in the population has equal chance of inclusion in the sample and each one of the possible samples. (Kothari, 1985:19)

The family has been used in the study to aid in establishing a respondent pool. This method was used to obtain an unbiased respondent pool, which not only was reliable but also offered quick and organized method for constructing the interviewing process. Further still, at least one member of a family was going to be randomly selected for interview. The key areas will be Central Business District and Makongeni Estate. This generally represented Thika Municipality region. This was due to limitation of resources and time factor consideration. We used a Kish grid in order to randomize the selected respondents.

The kish grid is a table of random number that was used to randomly select an appropriate respondent from survey that are based at household levels. The procedure Kish grid used was as follows:

- a) Listed all adults aged 15 and above living in the household together whether present or not in a descending order. (Starting oldest and work down to the youngest)
- b) Took the last figure of a pre-serialized questionnaire and find the number in the top line of the Kish Grid.
- c) Looked down that column and take the number from the grid that corresponds to the last person in the list
- d) The number at the intersection indicated the number of the person in the list to be interviewed
- e) When the person was not present, the researcher called back of up to 3times was made. If the respondent is still not available, we picked the next number above the one at the intersection as long as it is not similar
- f) When the respondent was not present, the interviewer went to the next household.

The researcher also used purpose sampling; this will be based on the assumption that the researcher is capable of getting the respondents who will supply the required information. These were chiefs, headmen, and managers, local leaders and church leaders who in their opinion was able to supply the required information

The unit of analysis and unit of observation were explained as follows: According to Kothari, (1985:78) the unit of analysis is the general level of social phenomena that is the

object of observation. Singleton et al (1988) describes the unit of analysis as the entity, which enables a researcher to seek facts to make generation

Baker (1985) defines unit of analysis, as social entities whose social characteristics are the focus of the study. There were collections of person that was studied, thus the primary units of analysis for the proposed study is the community in Thika Municipality.

In order to arrive at the targeted sample of 60 households, the researcher visited the community. Therefore, the units of analysis were the individual units about which descriptive or explanatory statements were made. Individual community members were the most typical units for our research. We centered our analysis on the community who are working in the factories and tenants, to help us generate more evaluative data. This was more on their awareness, perception and attitude of the pollution in their locality.

According to Mugenda et al (1999: 17), a unit of observation is the subject, object or item from which we measure the characteristic or obtain the data required in the research study. In our study, we used the local leaders (Church leaders, District commissioner, District environmental officer, councilors, chiefs and headmen) and employers (Managers and Administrators) as the units of observation. And since we used families as units, the fathers and mothers were the units of observation. The information got from the heads of families was related to the family as a whole.

3.3 Methods of Data Collection

This section aimed at appraising the diverse methods, which the researcher used in this study to collect, analyzes and reports the findings

Primary data was collected by the use of interview-administered questionnaire to the respondents of Thika Municipality residential estates who formed the tool of respondents needed for this study

In-depth interview and focus group discussion (FGD) the researcher used extensively to elucidate the major ideas obtained from the quantitative phase (questionnaires). The questionnaire was a set of questions of open or closed types together with spaces for filling the responses. The use of the questionnaires guaranteed confidentiality and control over the interview environment. A focus group discussion was convened to obtain further qualitative data to support existing gaps in the quantitative data collected. The focus group discussion is important because, the respondents showed point of agreement and disagreement covering the study variables that was not well captured in the in-depth interview. The in-depth interviews (face-to face) consisted of discussions on specific topic with selected key informants (elders, headmen, councilors, chairmen of various groups) to obtain more information. Discussion with key informants entailed formal and informal interviews. These interviews was important because; they generated individual opinion, feeling and perception about the topic of pollution, which might not have been captured in the structure interview.

The secondary sources was reviewed from various books, Internet data, newspapers, video, magazines, journals, periodicals and reports, especially from United Nations, World Bank and World Health Organization. The Library research will also involve the analysis of historical records that are recorded notes; photographs, tapes and films will be analyzed.

The Information or data on perceptions, awareness levels and attitudes were measured using 5-point Likert scales. A Likert scale is a rating scale and used to measure perception, attitude, values and behavior. Rating scales consist of numbers and descriptions, which are used to rate or rank the subjective and intangible components in research. The items that are used in Likert scales are usually declarative in form. The numbers in Likert scale are ordered such that they indicate the presence or absence of the characteristic being measured (Mugenda et al. 1999:75). Data on community involvement required general true or false questions; closed ended and open-ended questions were used to generate sufficient data in this regard.

3.4 Data Analysis

After the fieldwork, the data collected was categorized under quantitative and qualitative data. The quantitative data contained information on numerical values of respondents while qualitative data will consist of respondents' views and opinion on study. Having collected data from the primary sources, quantitative data was put into a spreadsheet manually and then exported to Statistical Package for Social Science (SPSS) programs.

SPSS was used to organize, interpret and present statistical data. These packages are designated to provide high-speed statistical analysis of data by the computer.

In quantitative data analysis, the descriptive statistic was applied. These are simple statistical methods concerned with organizing and summarizing data to make it intelligible (Singleton et al, 1998). The data was checked for consistency and accuracy. Afterwards, the statistical analysis was followed. This was expected to yield frequency counts, percentages, means, and cross tabulation, which was interpreted, and then the results will be reported. The use of tables, graphics, charts and frequencies will be of great use.

The qualitative data analysis seeks to make general statements on how categories of data are related (Baker, 1985:113). The descriptive statistical analysis helped researchers to identify the existing relationships and variation between the dependent and independent variables of the study. According to Baker (1985:378), descriptive statistics refer to simple statistical methods, which do not support or falsify a relationship between variables but supply help in the description. The inferential statistics made the researcher give true characteristics and to test the truth and falsify the hypotheses. Inferential statistics allowed a researcher to make decisions about characteristics of population based on observation from samples taken from the population.

3.5 Problems Encountered

Various uncertainties were encountered during the data collection period, some respondents who were not sampled raised doubt as to why they were not interviewed. The group of youth and the jobless adult felt ignored as only 60 household were interviewed. They did not understand the criterion of the people sampled. Some of the jobless persons thought that they could get job when they saw us sampled. The researcher elucidated to them the procedure of sampling, which they understood.

There was a misrepresentation and untrustworthy of the researcher from the respondents. During the discussion with various groups, some government officials refused to have their interview tape (recorded). The respondents thought that the researcher was a government spy on them and later they would be followed up on their views. However, researcher had to do with short notes written during the interviews and the respondents were afterwards convinced that the study was purely for academic purposes.

In some cases, the respondents thought that researcher had been sponsored by some church organization to carry out research and therefore demanded for payment.

The weather conditions of the area were also problematic due to frequent rains that slowed down the work. Generally, all the questions put to the respondents were promptly answered.

The study was faced by a number of limitations, First most target group were widely spread all over field. For example, the workers in Del Monte, a pineapple factory lived in Makongeni Estate and other in Kiganjo village, which are 5 Kms and 15 Kms

respectively. This meant that the researcher had to travel to there respectively areas so that the Focus Group could be organized for fruitful data.

Secondly, some of the respondents had low literacy and did not understand english language, which resulted to a lot of time being spent to translate and then elucidate respondents if that was what they meant. However, because of all the research assistants who were recruited on the ground and were familiar with Kikuyu, Kiswahili and English this challenge did not negatively affect the research process.

Thirdly, the researcher limited financial resources influenced the sample size. In the addition, this limitation dictated the amounts of time days the researcher and researcher assistants could spend in the field.

The researcher did everything possible to ensure collections of high quality, valid and reliable data.

CHAPTER FOUR: DATA PRESENTATION

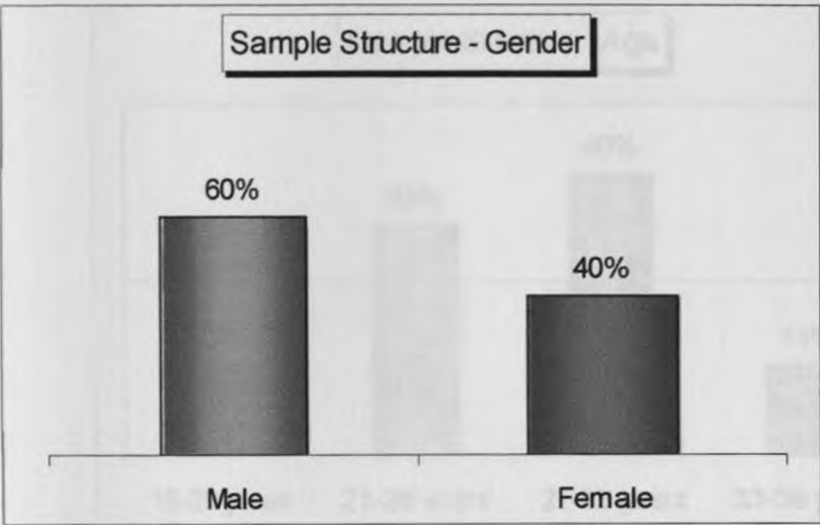
4.1 Sample Characteristics

This chapter aims at presenting the results and discussions of the main objectives guiding this study. In this chapter, the quantification and the approach used for pollution awareness creation are presented. In addition, the study appraises the communities' mechanisms and capacity to spearhead local pollution prevention in a bid to prevent any disaster-related after effects. The following subsection details the demographic characteristics of the sample with a view to look at the possible causes of variations in views and response as far as pollution prevention is concerned.

Sex distribution

This study, carried out of a random sample of 60 households, 60% and 40% were males and females respectively. This proportion does not differ very much from the 57% - 43% distribution by gender data provided by the Central Bureau of Statistics on the results of the 1999 Kenya population and housing census. However the sex ratio indicates that the Thika Municipality is predominantly male.

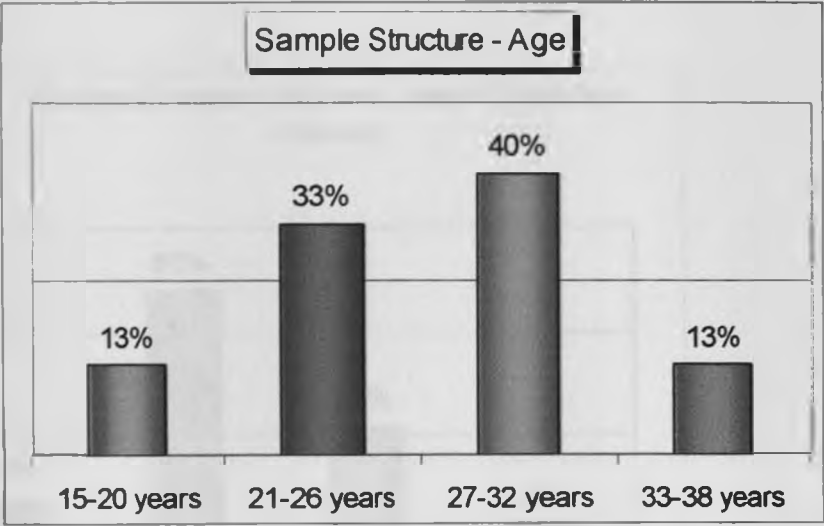
Figure 1: Sex distribution



4.2 Age groups

From the sample characteristics achieved from this survey, 13% of the respondents constituted those who were 15-20 years of age at the time. 33% were between 21 and 26 years. 40% ranged between 27 and 32 years while another 13% were between 33-38 years.

Figure 2: Age

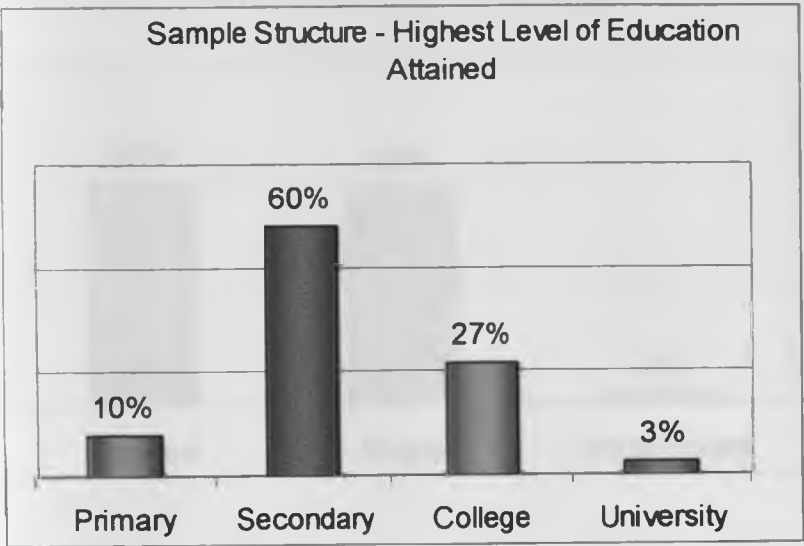


As such, the Thika Municipality constitutes a young population. From the random sample no person over 50 years was randomly included in the sample frame.

4.3 Educational Attainment.

Literacy levels indicated were fairly high with respect to the level of educational attainment. For example, 10% of all the respondents had primary school education certification. 60% had either not finished or finished high school. A further 27% had pursued post secondary education in polytechnics and diploma offering colleges. Only 3% had university education.

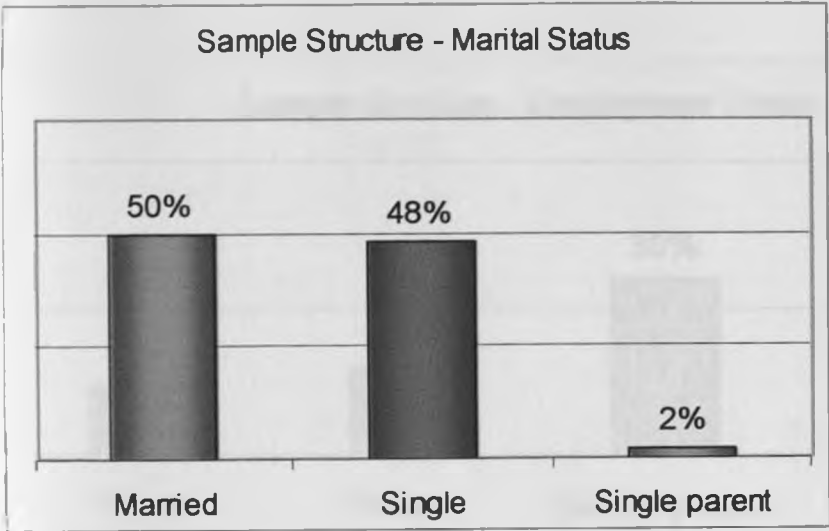
Figure 3: Highest Level of Education



4.4 Marital Status

From the findings of this study, 50% of the respondents were married, 48% were single. Only 2% indicated that were single parents.

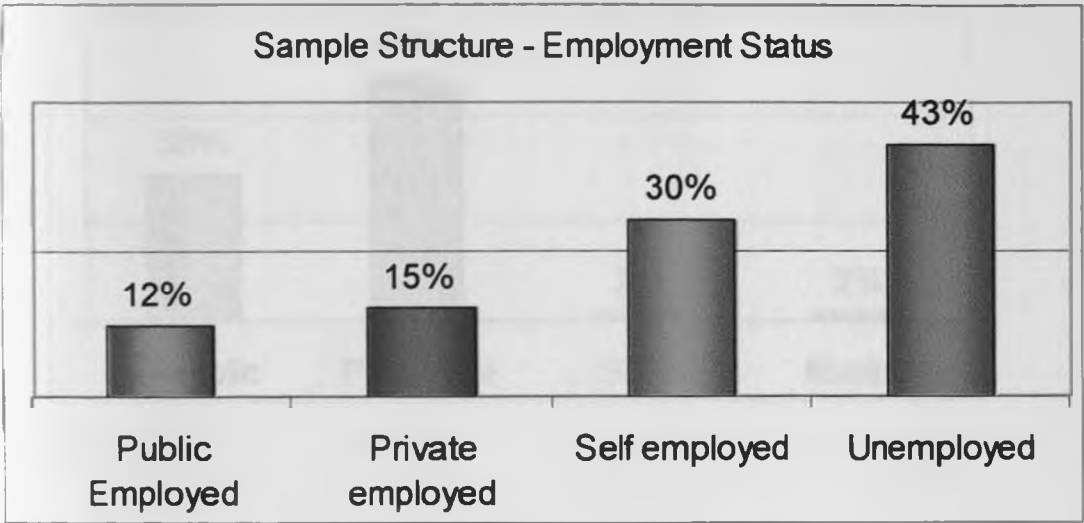
Figure 4: Marital Status



4.5 Employment

Irrespective of Thika Municipality being an industrial town, unemployment still looms heavily. In essence 12% of all interviewed respondents were employed in the public sector. 15% were private employed. A further 30% were self-employed while the majority (43%) was unemployed.

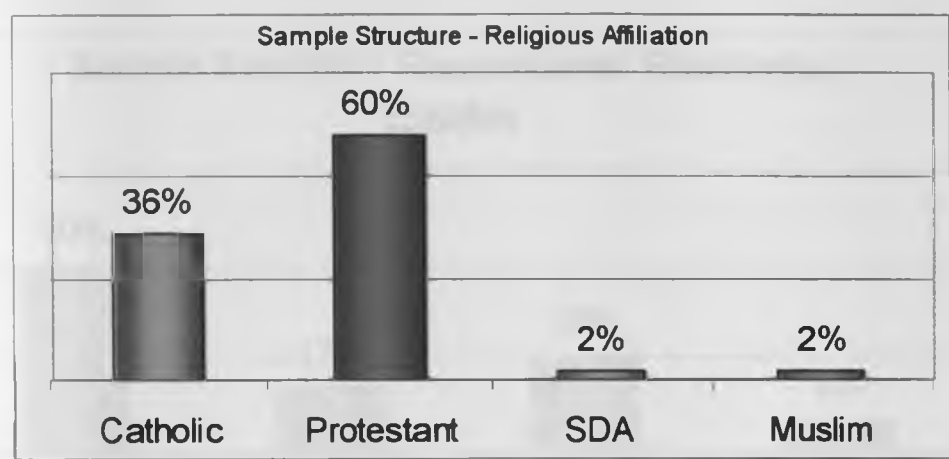
Figure 5: Employment Status



4.6 Religious Affiliation

The religious affiliation of the sample is not very diverse, considering the fact the majority are Christians (96%). Actually 36% stated that they were catholic, 60% Protestants. 2% indicated that were Seventh Day Adventists while another 2% indicated that were Muslims.

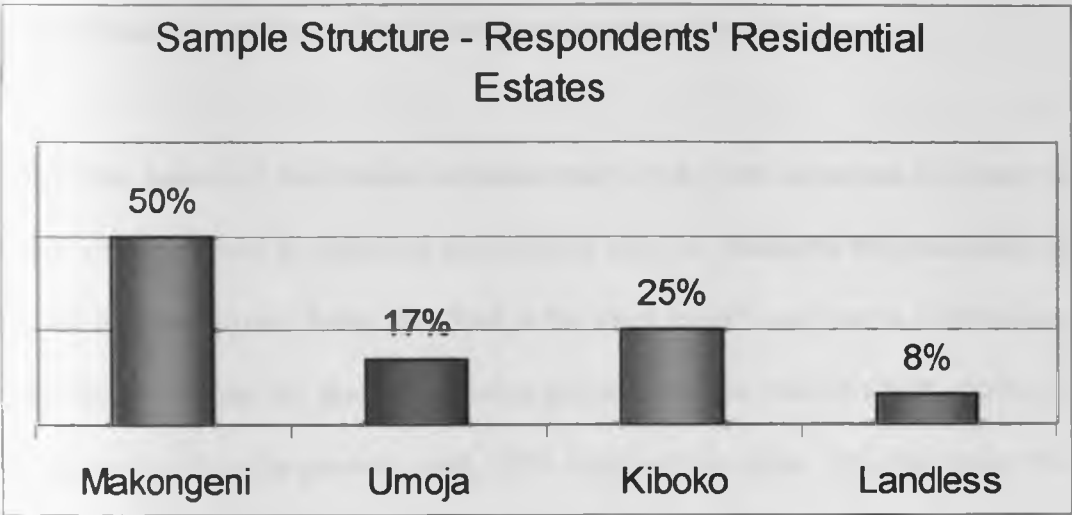
Figure 6: Religious affiliation



4.7 Residence

Thika Municipality consists of several residential estates having different population sizes. For example, this study achieved a 50% sample representation of Makongeni estate residents. 17% were from Umoja, 25% were from Kiboko while only 8%resided in Landless.

Figure 7: Residential Estates



4.8 Assessment of available information

Information is critical in any decision making process in any society. There are various channels by which the community can gain access to vital information. This study evaluated the sources of information available of Thika Municipality residents with a view of establishing a link between their perception and actions as it concerns the pollution problem.

Residents of Thika Municipality are quite diverse in the way they obtain general information. In this case general information constitute daily news and events and other informative issues. They rely mainly entirely to the mass media for information. A total of, 78% of the respondents stated that they obtained information form watching programs on the television, which largely included current affairs programs and daily news. 97% actually indicated that they obtain information via the use of radios. 73% of the

respondents interviewed indicated that they have access to newspapers, which provide them with current information. 25% indicated that magazines also constituted their source of general information. Only 12% mentioned that attended barazas regularly at the local administrative offices to be briefed about community related issues.

In terms of the source of information obtained most often, 28% answered in favour of television, 73% answered in favour of radios while only 3% indicated the readership of newspapers and magazines. Radio therefore is the most relied upon media of obtaining current information than the use of television and print media. Asked which source of information was used in the previous week, 32% indicated television, 65% radios and 2% newspapers.

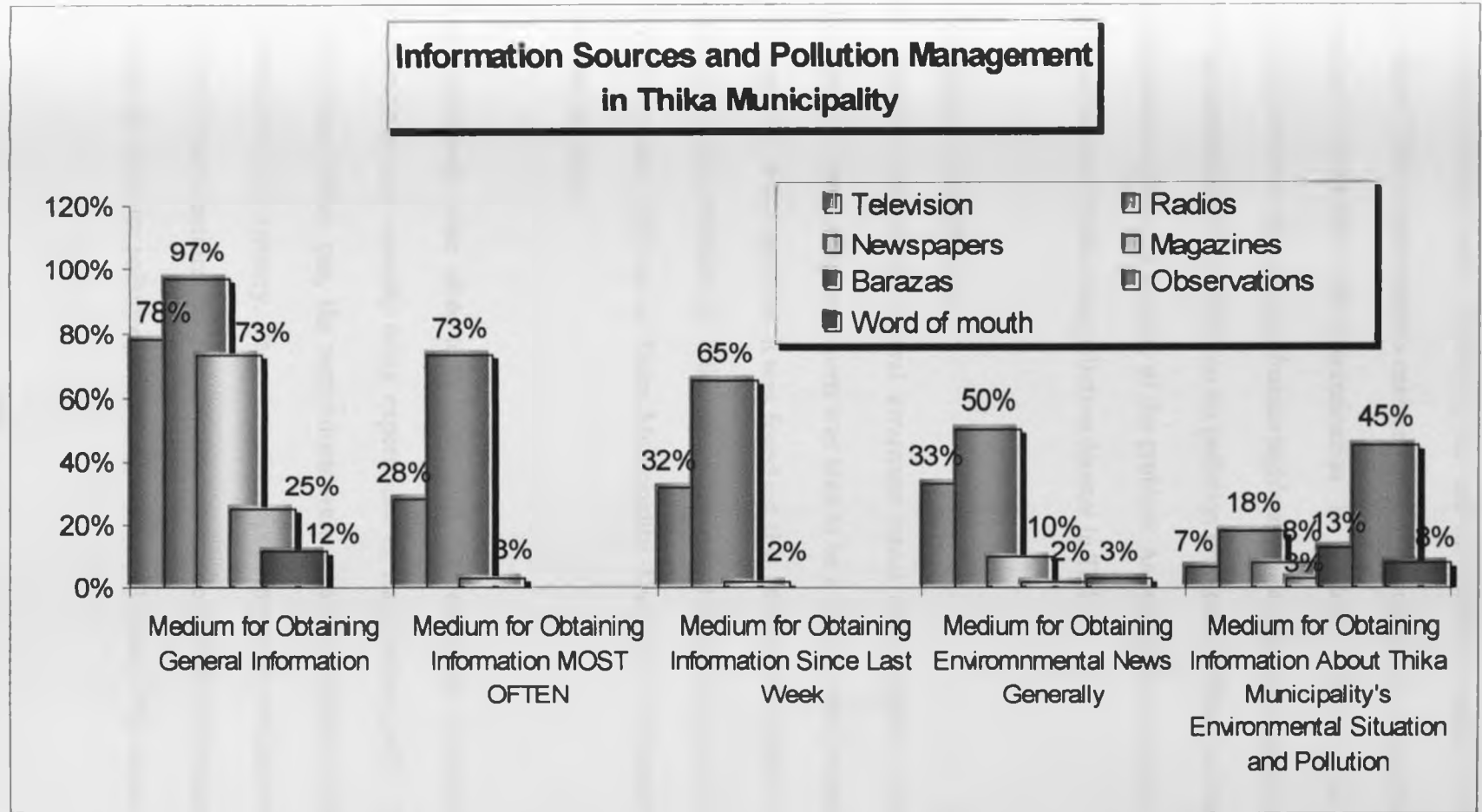
This study was also interested in establishing the major sources of information on environmental news generally. This was important in assessing whether the information obtained had any environmental utility. About 33% indicated that they obtained general environmental information via the televisions. 50% indicated in favour of radio while 10% indicated the readerships of newspapers. Those who obtained information via other methods only constituted 5%. These constituted magazines (2%) and general observations (3%).

In addition, the respondents were asked to mention the major source of information they considered to be key in informing them about Thika Municipality environmental situation and pollution. 7% indicated that television viewership informed them about Thika's

environmental situation. 18% answered in favour of the radio. 8% polled for newspapers while 13% mentioned local barazas as key information sources. 8% attributed their information availability via the use of word of mouth. The majority of the respondents indicated that observations accounted for the major source of obtaining information about Thika Municipality environmental situation. This accounted for 45% of all responses given. In the past years due to an uprising of local community and clergy the situation of Thika Municipality featured prominently in the media, thus causing more awareness via this method.



Figure 8: Information Sources and Pollution Management



The audience of radios emerged to be the most popular mode of obtaining information even about environmental news. However, the use of electronic media in obtaining information about Thika Municipality's environmental situation is low. A new dimension in information availability and dissemination is evident. This is via verbal communication. However this does not feature highly amongst other information sources. Altogether, the availability of information on pollution problems in Thika is a key factor in awareness creation about the severity of the problem. As such this is expected to yield high awareness levels of the looming pollution disaster in Thika.

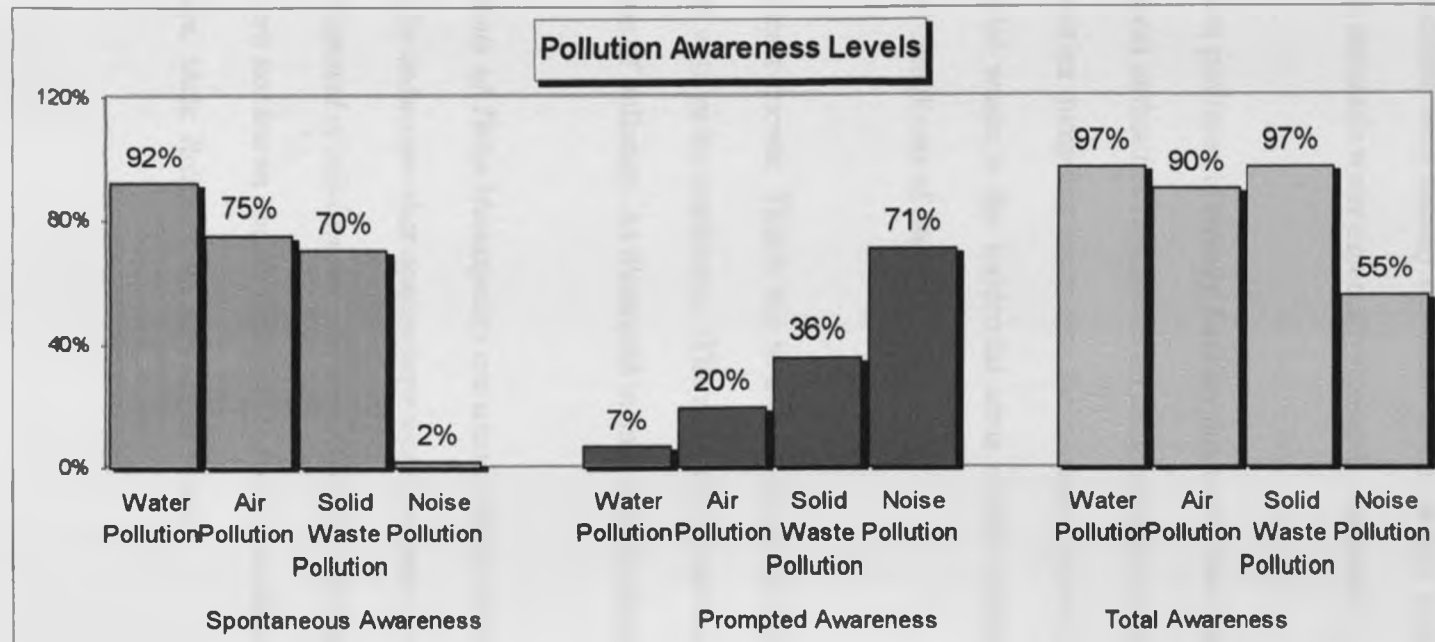
4.9 Pollution Awareness

This study aimed at quantifying general awareness issues as it concerns pollution in Thika Municipality. Awareness assessment was seen to be a major factor in establishing community response to this problem. It was found out that, 98% of the residents claimed to be aware of pollution problems in Thika. Only 2% indicated that they were not aware of any pollution related problems in Thika Municipality. The latter may constitute new residents within the town.

In addition respondents were asked to indicate what different types of pollution they knew about and the ones currently being experienced in Thika Municipality. This was done in two phases. Phase one, the respondents were asked to mention the types of pollution direct from their memory. Phase two, the respondents were provided with a list of the types for further identification. For spontaneous mentions, 92% of the respondents answered in favour of water pollution, 75% indicated air pollution, 70% indicated solid

waste pollution and only 2% indicated noise pollution. For prompted mentions 7% mentioned water pollution, 20% mentioned air pollution 36% mentioned solid waste pollution while 71% mentioned noise pollution. Further computations were made to obtain the overall total awareness of pollution types in Thika Municipality. The results indicate that 97% of the respondents are aware of water pollution problems, 90% are aware of air pollution, 97% are aware of solid waste pollution while only 55% are aware of noise pollution.

Figure 9: Pollution Awareness Levels



From the results provided above, water pollution emerges to be the most familiar type of pollution, together with solid waste from the residents' perspective. Air pollution is also known but by a slightly lower percentage of residents. Noise pollution is the least known. Water pollution is known due to industrial activities in Thika. For example, most leather industries release their tannery effluence in the nearby rivers, which supply the local residents with domestic water especially during dry seasons.

Likewise solid waste pollution is equally familiar due to the fact that, most industries do not adhere to the local authorities regulations on dumping solid waste at designated areas. Instead, some industries dump this waste near the residential areas. In addition, there is a lot of domestic solid waste in the residential areas mostly polythene bags. This has affected the general cleanliness of estates.

Noise pollution is least known. This is due to the fact that very few residents live next to heavy industries with noisy machinery. The residents do not consider motor vehicle noise as being a type of pollution. As illustrated in one of the focus group discussions:

"The residents of Thika Municipality are usually aware that their environment is basically polluted by industries that contaminate water, release poisonous gases to the air and improper disposal of solid waste... Noise pollution is not considered as pollution because its effects are not known and do not affect the residents directly..."

(Mr. Elias Wambugu, Male, Retired Civil Servant, 61 years).

4.10 Perceptions towards different types of pollution

In addition to establishing the awareness levels of different types of pollution, in Thika Municipality, this study also established how the residents perceived the problems related to them. In terms of the perception with respect to the worst type of pollution in Thika, the respondents answered as follows: water pollution (32%), air pollution (42%), while 23% were in favour of solid waste pollution. A further 3% indicated that noise pollution was the worst in the area. Air pollution once was considered as being very detrimental: to public health in the region as mentioned extensively in FGDs.

On the other hand when the respondents were asked to mention what they perceived as less problematic. 13% indicated water pollution, 12% indicated air pollution while 17% indicated solid waste pollution. Noise pollution is perceived to be less problematic (58%).

Concerning the type of pollution that affected the respondents most, 77% mentioned water pollution, 60% air pollution while 62% thought that it was solid waste pollution that affected them most. Only 3% indicated that noise pollution affected them.

The respondents were asked to indicate the type of pollution that required immediate attention. A total 55% mentioned water pollution, 57% mentioned air pollution, 53% solid waste pollution while only 3% indicated that noise pollution required immediate attention. The following statement in supports this verbatim from the focus group.

"...at some point in time, air pollution was considered to be the greatest problem in Thika. However, this has seemingly reduced. What concerns us currently is the fact that our main river channels are now polluted more than they were before. Most residents are afraid of using the water due to the fact that a lot of industrial chemicals are being released to the water..."

(Mr. Philip Ochieng, Male, 48 years, Chairman of St. Mulumba Environmental Group).

In terms of severity of the types of pollution in Thika, the respondents were asked to rate the severity along a 5-point semantic differential scale ranging from not severe (scores 1) to very severe (score =5). Water pollution was seen to be the most severe with a mean rank of 3.15. Air pollution was second with a mean of 3.05. Solid waste pollution had 2.75 while noise pollution had 1.19. Water and air pollution have emerged as the most severe. This is consistent with the views shared in the focus group discussions.

Air pollution on the other hand is viewed as the worst type of pollution while solid waste pollution affects the residents most. Water pollution was viewed to be the one that requires immediate attention. The perceptions on pollution indicate that the different types affect the residents differently. Water pollution however, is seen to be the one that require immediate attention. Lack of frequent tap water for domestic purposes is seen as a major drawback for social capital development of the residents due to lack of alternatives due polluted rivers.

4.11 Sources of pollution

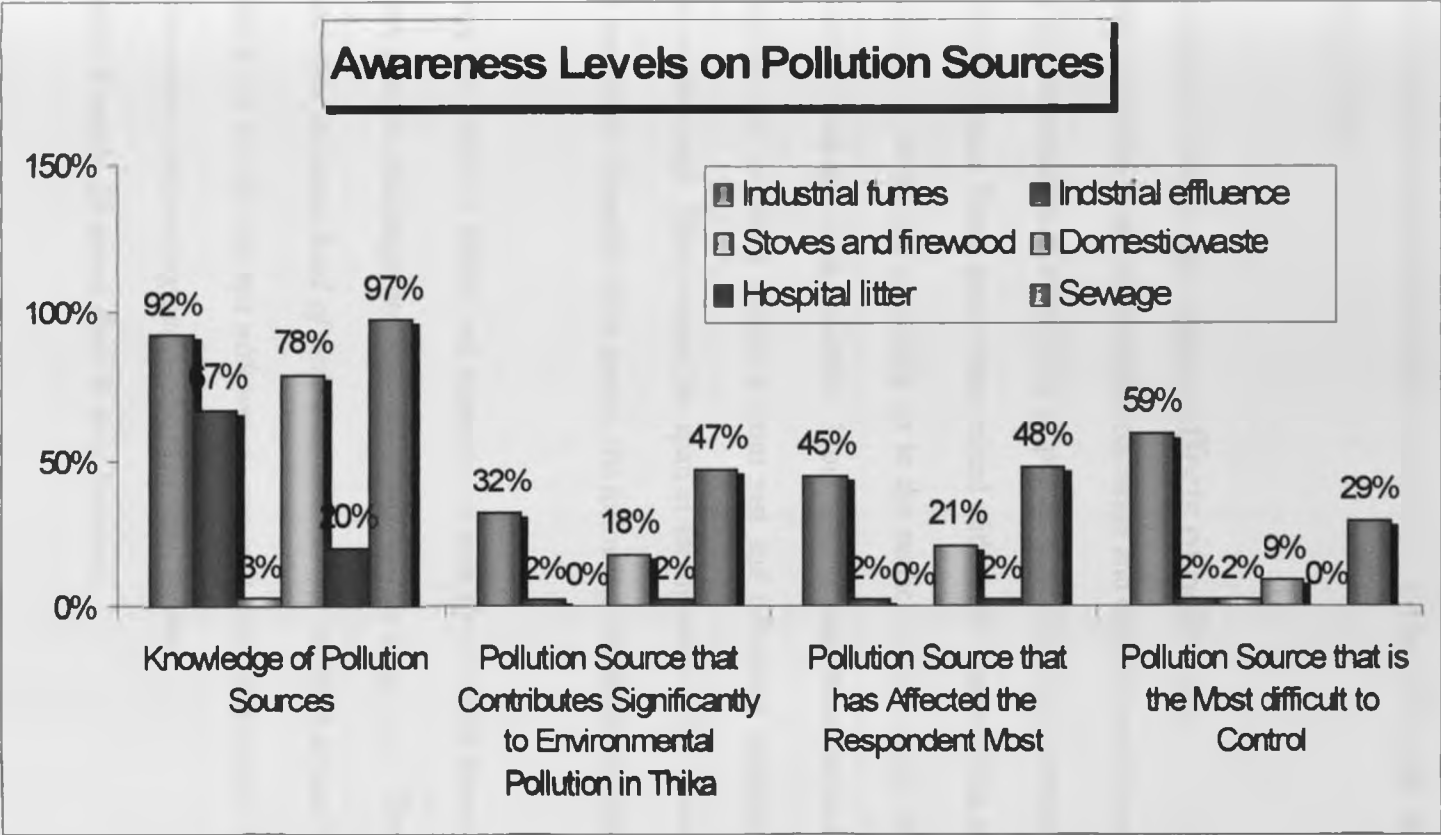
Pollution awareness goes hand in hand with the knowledge on the sources of the pollution. The residents showed varied responses and ideas when asked about the sources of pollution they knew of. An overwhelming majority of 92% knew about industrial fumes, 67% mentioned industrial effluence, 3% mentioned stoves and firewood, 78% mentioned domestic waste, 20% knew of hospital refuse while 97% mentioned sewage wastewater.

In addition, the respondents were asked to indicate what they considered to be the source that contributes highly to environmental pollution in Thika. The respondents answered as follows: 32% indicated that industrial fumes were most lethal. 12% mentioned industrial effluence, 18% indicated domestic waste while only 2% mentioned sewage as the one that contributes highly to environmental pollution in Thika municipality.

Concerning the pollution sources, the ones considered to have affected the respondent the most were as follows. 45% indicated industrial fumes, 2% indicates industrial effluence, and 21% mentioned domestic waste while only 2% mentioned hospital litter. Sewage was mentioned by 48% of all respondents as one that most affected the respondents.

In terms of perspectives about the difficulties in controlling pollution sources, 59% indicated that industrial fumes were the most difficult to control while industrial effluence was mentioned by only 2% of all respondents. Likewise, the same proportion of respondents (2%) mentioned stoves and firewood. Domestic waste was mentioned by 9% of all responses while sewage was mentioned by 29% of all respondents.

Figure 10: Awareness Levels of Pollution Sources



It is clear that industrial fumes and sewage appear to be the prominent sources of pollution in Thika municipality. This is due to malpractices with severe environmental consequences by some of the industries. On the other hand, indoor pollution caused by domestic fuel consumption is not considered to be a major source. KENGO studied this and reported that domestic fuel consumption accounts for at least 5% of all air pollution sources (KENGO, 2000).

4.12 Perceptions about the major effects of pollution

The respondents reported several problems as corrosion and destruction of structures. About 30% of the respondents indicated that air pollution in Thika is characterized by the emission of noxious gases. These gases when mixed with water vapour in the atmosphere form different kind of acids that rain back on to the surface of the earth. These acidic droplets land on tin roofs and other structures. From observations, most tin roofs of Thika municipality are brown in colour resulting from rust and corrosion resulting from the acidic droplets on the roofs. This reduces the span of the tin roofs. This view accounted for 30% of all responses. From the focus group, the following statement was made:

“...when you arrive in Thika, one thing that is seen first are the brown tin roofs. One might think that the buildings are very old. However this is not true. There is a big reason to blame this on some kind of acid that falls on the roofs. It is said that when industrial fumes go to the air and mix with water vapour, it falls back as acid that reacts with the roofs to cause rapid rusting and hence the brown colour...”

(Agnes Wamaitha, Female, 28 years, High School Teacher).



The corroded iron sheets roofing on a school building opposite KEL Chemical Factory
(Daily Nation Picture)

4.13 Increase in the incidence of human URTI'S and other infections

The residents mentioned that they suspect a relationship between respiratory illnesses and incidence of air pollution. 92% of all respondents report this. A study from KENGO indicated that for the last 15 years, medical records have shown an increase in outpatients suffering from respiratory disorders, which is attributed to both domestic (indoor) and industrial (outdoor) pollution. The following statement was obtained from the focus group:

"...there is a time when some people came to do research here after the Catholic people demonstrated in the streets. We heard that the researchers claimed that due to poisonous gases released in the air many people started to have chest related diseases. It is true because children especially started to cough at night... and many other people also coughed as if an outbreak of coughing had occurred..."

(James Kamau, Male, 36 years, Businessman)



**Njeri 36 year old, suffering from skin rash as a result of the toxic emission from the factory
(Daily Nation picture)**

General demographic information from Thika municipality indicates an increase in mortality rates both for human beings and livestock, which is generally associated with pollution. For example, 17% mentioned livestock mortality, 12% human mortality and 5% infant mortality to have increased with all types of pollution being perceived as the major drive forces that increase the mortality rates. Diseases and ailments that directly emanate from pollution such as cholera outbreaks, significantly impacts on mortality rates (human). On the other hand, industrial effluence releases a lot of eutrophic nutrients into the dams and rivers causing algal blooms that in turn produce poisonous toxins that are harmful to livestock.

"...at a point in time, some livestock died and we suspected that this could be due to water poisoning. Since the water in the river started to change smell, we have always suspected that when the cows take this water the chances of dying are very high..."

(Joseph Mwangi, Male, 18 years, Unemployed)

4.14 Destruction of Crops and Vegetation

This view was registered by only 2% of all the respondents. They claimed that pollution in Thika has had an impact on agricultural production and other vegetation. This effect is negative. Some respondents even claimed that some vegetation near the chemical industries withered and dried possibly due to the effluence. This is quoted as follows:

“When you look at some plants near some industries, they are usually withered and dry. Could the industrial waste cause this? If so what could the effect of this on the crops we plant...”

(Peninah Njeri, female, 21 years, Housewife)



Two kiosk operators at Makongeni estate showing how the green avocado turns black overnight due to exposure of toxic fumes

(Standard Newspaper picture)

4.15 Institutional Capacity for pollution prevention in Thika Municipality

Due to the increase in pollution levels in Thika Municipality attempts have been made by relevant organizations to control and manage it. This study was interested in obtaining the perceptions of the respondents in relation to the relevance of the existing institutions in pollution prevention control and management.

4.15.1 Awareness of Institutional Organizations

The respondents were asked to mention what organizations they were aware of, that operated public related functions in the areas. As high as 98% were aware of the local authorities as represented by the municipal council. 37% acknowledged knowing women and youth interest groups. Another 7% indicated their knowledge about active community based organizations in the area. 3% identified some non-governmental organizations active in the area. 8% were aware of a few international organizations that ran projects within the municipality. 52% indicated religious groups while a further 13% mentioned other small private organizations. In reference to the awareness of the above institutions that play key developmental roles in the community, this study further investigated how the residents perceive their participation in pollution control among other important activities.

4.15.2 Perception of Institutional involvement in Pollution control.

In terms of aiding in pollution control 90%, of the respondents acknowledged the efforts made by the local authorities. However the satisfaction levels of the service provided by the council are very low as pointed in one of the FGDs. *"...Council tries to come up with ideas to clean the town but they do it after a long time, they cover very few areas..."*

(Joseph Mwangi, Male, 18 years, Unemployed)

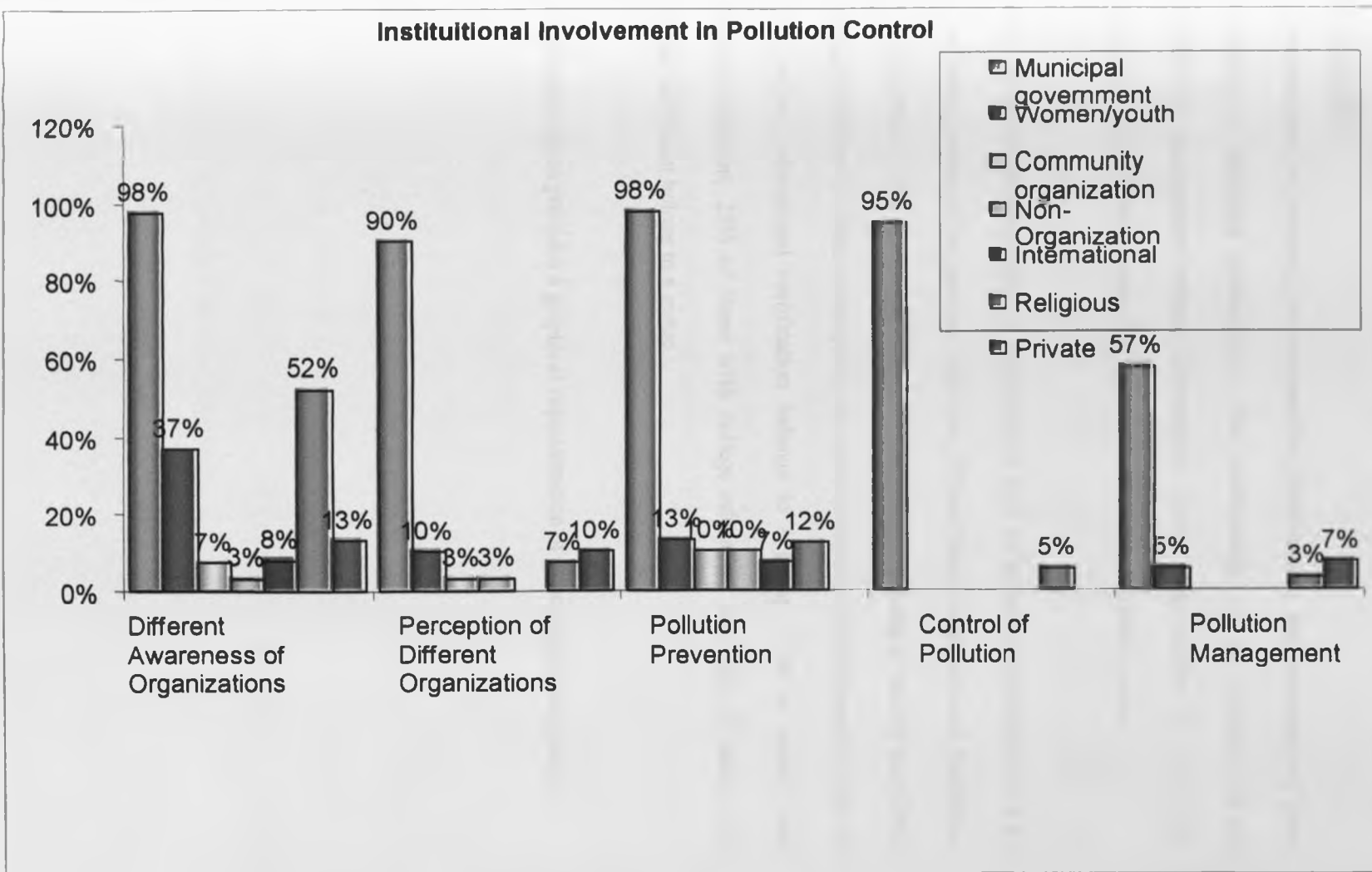
Additional findings from this study indicate that only 10% thought that women and youth interest groups make significant contribution to pollution prevention on management in the area. 3% felt that community based organizations in the area made efforts to aid in pollution management. The same proportion (3%) felt the same way for NGOs. Religious groups contribution was only cited by 7% of all responses given while 10% indicated that small private organizations made the attempts to positively contribute to pollution management.

Asked to state the institutions, which they felt should be in charge of pollution management in Thika Municipality, 98% (majority) indicated that municipal council should be in charge. 13% mentioned women and youth groups, 10% mentioned NGOs, 7% mentioned international institutions, while 12% thought that religious groups should take an upper hand. In relation to the organizations that have been given mandate to manage pollution, 95% indicated that local authorities are the governments' wing in providing basic social capital such as clean living environments and other services. Only

5% thought that this mandate rested on other institutions other than the Municipal Council.

In addition to the perceptions reported above the respondents were also asked to indicate which organization had so far made the greatest efforts in pollution control and prevention. 57% indicated that local authorities had so far made the greatest efforts. Women and youth groups were only mentioned by 5%, of all respondents. Religious groups were thought to have made great efforts by 5% of all respondents. 7% of all respondents indicated private organizations. Municipal Council was seen to be the major institution that has the responsibility of ensuring that the municipality was free from pollution. This may be attributed by the fact that the government to ensure proper sanitation has established the local authorities. However the involvement of other organization is acknowledged but to a lesser extent.

Figure 11. Respondents awareness and perceptions of organisations in Thika Municipality.



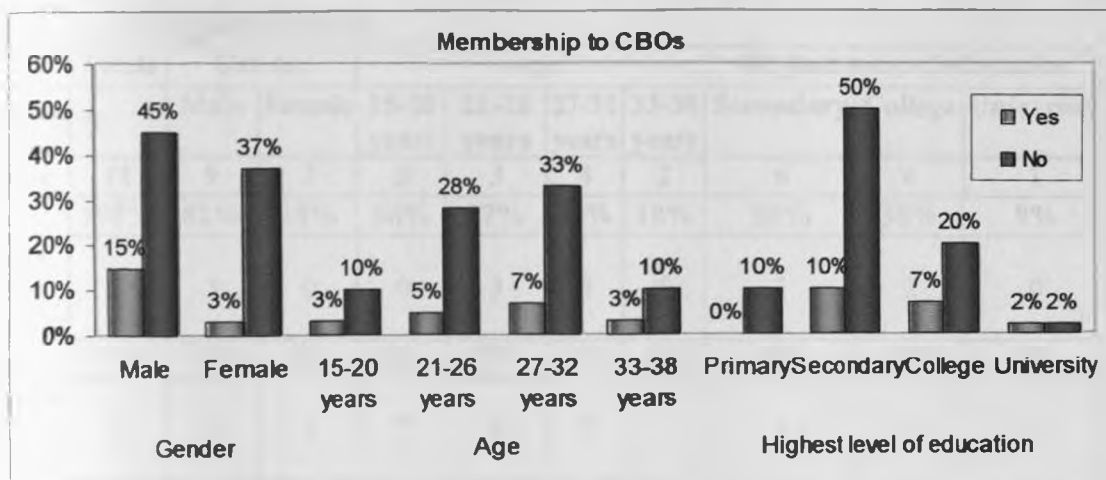
4.16 Community Participation in pollution prevention in Thika Municipality

This section aims at assessing the communities' involvement and perception of their involvement in pollution management. The membership of the residents to an environmental management related Community Based Organization is very low. Actually, only 18% of the residents belong to one of the five available groups.

In terms of gender representation in membership, 25% of all males and only 8% of all females belong to one of the groups. Age wise, 25% of people aged between 15-20 yrs, 15% of 21-26yrs, 17% of 27-32yrs and 25% of 33-38yrs belong to one of the CBOs managing pollution in Thika Municipality. In terms of educational background, none of primary school educational certification belongs to a group. 17% of people with secondary education, 25% of those with college education and 50% of those with university education belong to a group.

The following figure provides a graphical representation of educational background.

Figure 12: Membership of Community Based Organizations



The poor membership levels have been attributed to the following reasons: -

- ❑ Lack of proper awareness and advocacy (18%)
- ❑ No knowledge existing groups (37%)
- ❑ In effective groups (7%)
- ❑ Other commitments (20%)
- ❑ No particular reason (18%).

Majority of the respondents who claimed to be members of a Community Based Organizations has been involved in them for a considerably long time. 27% of them have been members for less than 1 year. 45% have been involved in a period ranging from 1 to 3 years. A further 27% have been in the groups for over 4 years.

Table 4: Duration of Involvement with a Community Based Organizations

	Totals	Gender		Age				Highest level of education		
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	Secondary	College	University
Total	11	9	2	2	3	4	2	6	4	1
	100%	82%	18%	18%	27%	36%	18%	55%	36%	9%
Less than one year	3	3	0	0	3	0	0	1	2	0
	27%	27%	0%	0%	27%	0%	0%	9%	18%	0%
Between 1 and 3 years	5	3	2	2	0	2	1	4	1	0
	45%	27%	18%	18%	0%	18%	9%	36%	9%	0%
Between 4 and 6 years	3	3	0	0	0	2	1	1	1	1
	27%	27%	0%	0%	0%	18%	9%	9%	9%	9%

The table 4 above shows the variation in the duration of involvement with a CBO between gender, age and highest level of education. It seems that more male than females have been involved in the CBOs. Another finding is that people between age 21 and 32 seem to be the most active in CBO participation. Also education level seems to influence participation in the sense that more years in school are related to less involvement in Community Based Organizations.

Most members of the Community Based Organizations do not play any key role in the activities of the group. This is evidenced by high numbers of members mentioned in non-official positions. The 73% mentioned that they are just normal members of the CBOs. The rest official positions like chairman, treasures and secretary each how less than 10% of the respondents

Table 5: Position of Membership

	Totals	Gender		Age				Highest level of education		
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	Secondary	College	University
Total	11	9	2	2	3	4	2	6	4	1
	100%	82%	18%	18%	27%	36%	18%	55%	36%	9%
Chairman	1	1	0	0	1	0	0	0	1	0
	9%	9%	0%	0%	9%	0%	0%	0%	9%	0%
Secretary	1	0	1	0	0	1	0	1	0	0
	9%	0%	9%	0%	0%	9%	0%	9%	0%	0%
Treasurer	1	0	1	1	0	0	0	1	0	0
	9%	0%	9%	9%	0%	0%	0%	9%	0%	0%
Member	8	8	0	1	2	3	2	4	3	1
	73%	73%	0%	9%	18%	27%	18%	36%	27%	9%

As shown in the table above the male dominates the official positions. Age does not seem to offer any large variations as far as positions held are concerned. Further still, education level is loosely associated with position held within the Community Based Organizations.

4.17 Community participation in Pollution management

When asked to rate according to their own opinion, 85% thought that community participation in management is very important. 10% thought that it was important while 2% did not have an opinion. A further 2% thought that it was slightly important. Basically according to findings, community participation is viewed as being very important.

Table 6: Importance of Community Participation in Pollution Management

	Totals	Gender		Age				Highest level of education			
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	Primary	Secondary	College	University
	60	36	24	8	20	24	8	6	36	16	2
	100%	60%	40%	13%	33%	40%	13%	10%	60%	27%	3%
Very important	51	29	22	8	18	19	6	5	29	15	2
	85%	48%	37%	13%	30%	32%	10%	8%	48%	25%	3%
Important	6	4	2	0	0	5	1	1	5	0	0
	10%	7%	3%	0%	0%	8%	2%	2%	8%	0%	0%
Neutral	2	2	0	0	2	0	0	0	1	1	0
	3%	3%	0%	0%	3%	0%	0%	0%	2%	2%	0%
Slightly important	1	1	0	0	0	0	1	0	1	0	0
	2%	2%	0%	0%	0%	0%	2%	0%	2%	0%	0%
Mean Rank	1.22	1.31	1.08	1.00	1.20	1.21	1.50	1.17	1.28	1.13	1.00

The mean rating on the importance variable for all groups is less than 1.5. This means that community participation is ranked highly as being a very vital component in community welfare.

4.18 Mechanisms employed by Community Based Organizations

This study also aimed at establishing the views of the residents as it concerns the mechanisms used for pollution prevention and managed by the Community Based Organizations. The 45% of the respondents identified estate cleanups. 28% mentioned peaceful demonstrations against the industrialists who are key sources of pollution. 20% indicated that awareness creation and advocacy for environmental protection was another mechanisms. 12% indicated giving environmental education services to schools and other institutions, While 5% mentioned environmental projects design and implementation and soliciting for environmental development funds respectively.

In so far as the respondents were concerned, they made observations that some mechanisms were not fully utilized. As such, they observed that a few improvements are needed in place to offer better environmental management services. 88% of the respondents thought that estate cleanups needed to be co-coordinated well to cover most parts of the municipality. 17% thought that tree planting was needed to alleviate pollution (air). 55% thought that if there were more peaceful demonstrations, this would force the industries to produce more efficiently to reduce industry-generated pollution. 88% also thought that if more schools were reached in terms of educating the children on environmental matters would bring forth a community that is environmentally. 87% of the respondents also said that if the CBOs would have elaborate advocacy and awareness programs for the residents.

This would not only increase memberships to the groups but also would change anti-environment behaviour in the community such as solid waste pollution by the residents as well. 43% also noted that if the CBOs were active in soliciting of environmental funding from willing donor agencies this would ensure that most of the environmental protection projects designed are effectively implemented.

Asked to rate the community mechanisms in terms of their importance to the community using a 7-point likert scale (from most important (7) to least important (1). Environmental education emerged first in the rank (means 65.3) followed by awareness creation and advocacy (5.70). Estate clean ups were third (mean = 4.77). Environmental projects design and implementation became fourth (means 23.53) while peaceful demonstration became fifth (mean= 3.48). Soliciting for environmental development funds was sixth (means 2.75%) while tree planting was last (means 1.25).

Providing information to the community about how to take care of the environment and the trade-off benefits for such is highly regarded by the community.

4.19 General attitudes of pollution problem in Thika Municipality

In this study, some general statements were developed to measure the attitudes of Thika Municipality’s residents on pollution of their environment. The table below shows the attitude measurements and the mean ranks of the respondents.

	Strongly agree	Agree	Disagree	Strongly disagree	Mean rank
1. Pollution is a big problem in Thika Municipality	10	15	5	0	1.88
2. The government should take more measures to control pollution	12	18	8	0	1.94
3. The private sector should be encouraged to adopt cleaner technologies	8	10	12	0	1.75
4. The community should be more involved in environmental protection	15	20	5	0	2.00
5. The media should play a role in raising awareness about pollution	10	15	10	0	1.88
6. The government should enforce stricter regulations on polluting industries	12	18	8	0	1.94
7. The private sector should be encouraged to adopt cleaner technologies	8	10	12	0	1.75
8. The community should be more involved in environmental protection	15	20	5	0	2.00
9. The media should play a role in raising awareness about pollution	10	15	10	0	1.88
10. The government should enforce stricter regulations on polluting industries	12	18	8	0	1.94

Table 4.19: Attitudes of Thika Municipality residents on pollution

Table 7: Attitude Measurement on Selected Pollution Issues in Thika Municipality

	Total	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean Rank
Pollution is a big problem in Thika Municipality	60	46	9	3	2	0	1.35
	100 %	77%	15%	5%	3%	0%	
Industries are major polluters	60	34	17	7	2	0	1.62
	100 %	57%	28%	12%	3%	0%	
Pollution is also got from domestic fuel consumption	60	9	20	22	9	0	2.52
	100 %	15%	33%	37%	15%	0%	
Thika is polluted because the local government does nothing	60	29	11	14	4	2	1.98
	100 %	48%	18%	23%	7%	3%	
If pollution in Thika is not checked it could be a disaster	60	56	3	1	0	0	1.08
	100 %	93%	5%	2%	0%	0%	
Pollution problem in Thika Municipality is still increasing	60	43	13	3	1	0	1.37
	100 %	72%	22%	5%	2%	0%	

Attitude 1: Pollution is a big problem in Thika Municipality

Some respondents from the Focus Group Discussions indicated that actually pollution in Thika is a matter of immediate concern. They expressed the following views:

“...apart from lack of money for daily use, I consider pollution of the environment the greatest problem I encounter in Thika...”

(Lawrence Omolo, Male, 32 years, Jua Kali Artisan)

“...pollution has caused great problems than before. Earlier nobody in Thika worried about any kind of pollution but now...”

(Philip Ochieng, Male, 48 years - Chairman of St. Mulumba Environment group)

In as much as it is hard to quantify pollution in Thika, it is clear that it has unwanted effects to the local residents. This evidenced by the fact that the mean rank to this attribute was 1.35 (Strongly agree) across the five point Likert scale..

Attitude 2: Industries are major polluters.

Industries were also seen to be major polluters due to the link between emissions of industrial waste fumes to the air. The mean rank for this attribute was 1.62 (agree). From one of the FGDs,

"...the industries control their emissions during the day but at night they release the fumes unconditionally with the aim of evading already laid down legislation on pollution control by the government..."

(Philip Ochieng, Male, 48 years - Chairman of St. Mulumba Environment group)

This attitude is agreed upon by many of the residents who live especially in Makongeni area than the other estates.

Attitude 3: Pollution is from domestic fuel consumption.

A study by KENGO indicated that air pollution is not only linked to industrial fume emission. Domestic fuel consumption also plays a very major role in indoor air pollution. The local residents have always neglected this. The mean rank for this attribute was 2.52 (neutral). However according to KENGO,

"...this study demonstrates clearly that there is a common pollution problem in the indoor environments of Makongeni Community where there is cooking with biomass and fossil fuels in open fires and unvested stoves Indoor exposure to the classical pollutants ultimately becomes an important cause of ill health..."
(KENGO, 2000).

Attitude 4: Thika is polluted because the local government does nothing.

This study established the fact that the residents perceive that the local government should take a leading role in environmental: protection of the municipality. However the local government is seen to be performing way too poorly than expected. The mean rank for this attribute was 1.98 (agree). This was also reflected from one of the responses from the FGDs:

"... the council has the mandate from the government to provide services that would reduce pollution in the municipality. However the council does not seem to perform the way they should. How come those private organizations are seen to do more pollution prevention activities especially in Makongeni than the council? ..."

(Njeri, female, 21 years, Housewife)

"... the other day we approached the council officials to assist us with their equipment to help us clean Makongeni estate. Imagine they did not reply to our requisition. We had to do it in our own way..."

(Philip Ochieng, Male, 48 years, Chairman of St. Mulumba Environment group)

The municipal council has not yet achieved its objective of providing some services to the local residents. This is seen in the light of the unwillingness of the local government in participating in the development of its area of jurisdiction.

Attitude 5: If pollution is not checked in Thika, it could be a disaster.

During the period when KEL chemical industry used to emit industrial fumes unchecked, the residents protested saying that the pollution was causing adverse health effects to them. The situation got worse to a point that it became a public affair. At that time the situation was so bad that it was actually reaching disaster levels. The mean rank for this attribute was the highest of all at 1.08 (strongly agree). One of the FGDs reported;

"...there was a time we had a lot of chest diseases and other skin infections. Our children especially had this perennial coughs and colds. We discovered that mainly the industrial fumes caused this. The situation worsened to a point that people stated to have skin irritations and we knew that if something is not done quickly the situation would get out of hand and be like other areas in the world affected by chemical pollution like the Chernobyl disaster. We feared that this could cause untold calamities to the residents..."

(Agnes Wamaita, Female, 28 years, High School Teacher)

Attitude 6: Pollution problem in Thika is still increasing.

After the government intervened in the pollution problem in Thika Municipality the situation improved a little bit. The industrialists tried to adjust the ways by which they emitted industrial waste. This was short-lived and the situation is slowly worsening

again. This attribute also was ranked highly at 1.37 (strongly agree). This was also supported by one of the comments made by a panelist in one of the FGDs;

"...when the government came in to save the situation of pollution a few years ago, things became a little better than they were before. Nowadays the situation is still changing for the worst. These days the industrialists are getting clever. They usually emit poisonous fumes at night. The air in the houses is usually heavy and smelly at night. If this is not checked, pollution will continue to increase in Thika..."

(Joseph Mwangi, Male, 18 years, Unemployed)

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusion

This section aim at providing a summary of the findings that emanated from this study and subsequent conclusions and recommendations made.

Awareness of general pollution in Thika Municipality is generally high (98%) basically due to observation of current pollution events in the area. However new residents in the community could possibly account for the rest 2% that are unaware. Water, air, and solid waste pollution are highly known. This is due to the fact they affect the residents directly. On the other hand noise pollution is little known. Noise pollution is embedded in people lives as a way of life and perceived as a mild disturbance but not as a kind of pollution. Many residents do not consider noise to be pollution.

In terms of the major sources of pollution in Thika, industrial fumes featured prominently. Municipal sewage on the other hand is equally known. Industrial effluence likewise is also known. Domestic waste also featured but not as prominently as the ones stated above. Very few of the residents were aware of any kind of pollution from hospital sources.

Water pollution on the other hand is the one that is causing a lot of concern currently even though air pollution also featured prominently. Historically, air pollution was seen to be the key issue of main concern. However shifts in perceptions have occurred since.

Noise pollution on the other hand is not perceived as a problem to the residents. It seems that noise pollution in the area is tolerated and is also seen to have no adverse effects to

the residents. According to the residents, water pollution requires immediate attention more than air pollution possibly due to the fact during draught, polluted rivers become the only alternative source of domestic water. In this regard, air pollution comes second in the list as far as different types of pollution are concerned. Solid waste pollution on the other hand also featured prominently. Both industrial and domestic wastes characterize this type of pollution. Industrial wastes dumped near residential areas also are a case for concern. However, domestic solid waste is the one that affects many of the residents. In particular polythene waste is seen to be very problematic due to the fact that it is non-biodegradable.

Community involvement in combating pollution is very minimal. With high awareness levels it was expected that this would translate into more involvement of the community in efforts geared towards pollution management. This has been attributed towards lack of proper awareness and advocacy of groups that would provide this kind of opening to the residents, lack of knowledge about existing groups operating in the area, ineffective groups and other commitments.

The major mechanisms employed in pollution management in Thika municipality has been mainly estate clean ups. A few years ago, public demonstrations took a center stage in efforts provided by the community in alleviating pollution related problems. Formal programmes directed towards awareness and advocacy on pollution management coupled together with environmental education in the area was seen to offer better sensitization for increased participation in pollution management by the community.

5.2 Recommendations

Awareness creation as it concerns noise pollution is needed. This is supposed to help workers who work with noisy machines in the industries to have quality occupational health and safety.

The Municipal Council should initiate new and effective programmes needed to manage pollution in the area. This should also include an increase in the frequency by which these programmes are executed. This institution should also be ready and available to aid any local initiatives geared towards pollution management in the area.

There is need to improve the local setting of environmental situation in Thika Municipality. This calls for collective responsibilities by all stakeholders who should initiate collaborative partnerships that would benefit the local residents. These stakeholders include the government, local authorities, local community, industrialists, local religious leaders and other leaders in the area.

More research should be undertaken to provide more information that would lead to the inception of new, affordable and sustainable programmes that would not only manage the pollution but would benefit the local residents in ways more than one.

Kenya is currently undergoing major political and economic changes that require the introduction of new policies.

Environmental pollution has reached crisis level in Kenya and effort to making new policies from the International community, local authorities, local authorities, Kenya government, non-governmental organizations and churches. The new efforts of making a new policy are required to achieve the ultimate goal – which is protection of the environment.

Thika Municipality, with help of Kenya government should aim to increase efficiency of resource utilization, which includes increasing the reuse and recycling of residue and to reduce the quantity of waste discharge (solid waste). The political and economic reforms taking place in Kenya are source of new challenges to local authorities, non-governmental and churches.

The institutions as should be the agent of protecting of the environment. They should start to self-evaluation and change to be able to address the future the country, where their future will be free of environmental pollution. The industries in Thika Municipality should be encouraged to undertake programmes for improved environmental awareness and responsibility at communities' levels to be dedicated to the task of improving environmental performance. Another recommendation is that, the employees of industries should participate in decisions making. Many problems of pollution starts at the work place and employees are often the first to be affected by poor environmental performance. This will create a forum to give the (employees) Directors and employees the chance to discuss and resolve the issues affecting industrial performance.

The local communities in Thika Municipality should revealed and even to have more public demonstrations and make more public information about environmental pollution through statements and the publication of reports and data about pollution, especially the industries which are major pollutant. The public should enhance the health relations between communities and media at large. The network regularity exchanges information and coordinates actions in the communities in Thika Municipality. When there is not direct links with government, the media, (both print and electronic media) are an

important channel to inform government and general public about the danger of continuous polluting the environment.

Some media like Daily Nation the East African Standard, Kenya Times and Magazines in the country have published important stories about environmental pollution.

The media could be the “eye” of the government to expose the industries who pollutes the environment and for not following the already laid policies.

The collaboration between Kenya government and communities should be promoted. The communities should not wait the government to do all the aspects, which are related to pollution. The communities should be the first to fight against environmental pollution starting from their areas where they live. The industries and the government of the day should foster and promote communities' participation in the protecting environmental pollution. The various political and economic reforms taking place in Kenya offer new opportunities for communities in Thika Municipality to have capacity to contribute to change. The government has to introduce the measures that ensure the community has right to know and participate in policy making through their representatives. The communities should do a good research on their problems on pollution. Policy research is a useful tool to help the government in the conduct of policy matters.

The churches and non-government organizations have a pool of persons with the capacity to contribute to policy research as well as policy-making and implementation.

There is a need to research further on better ways of curbing pollution in major towns in Kenya and to focus on those avenues that the community can exploit in order to achieve sustainable environmental health. Further research is also needed for the identification, formulation and implementation of proper policy frameworks that would not only institutionalize pollution management but also will create legal framework for punishing defaulters.

APPENDIX I: BIBLIOGRAPHY

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APPENDIX II: QUESTIONNAIRE

Introduction

Hallo, I am John Ndungu Ndikaru, I am current a student at University of Nairobi collecting information on pollution in Thika.
I will use the information for research on awareness levels, perception and attitudes towards air pollution in Thika Municipality.
I will ask questions about pollution and I promise that all information will be treated with total confidentiality.

Name:.....

... (You can omit your name, if you wish)

Kindly tick (✓) where applicable

PART ONE - RESPONDENTS DEMOGRAPHICS	
Q1. Gender ☐ Male ☐ Female	Q2. Age (in years) ☐ 15 – 20 ☐ 21 – 26 ☐ 27 – 32 ☐ 33 – 38 ☐ 39 – 44 ☐ 44 – 49 ☐ 50 and above
Q3. Highest level of education attained ☐ No formal schooling ☐ Primary ☐ Secondary ☐ College ☐ University	
Q4. Marital status ☐ Single ☐ Single parent ☐ Married ☐ Separated ☐ Divorced ☐ Widowed Q4a. How many children do you have? ☐ None ☐ 1-5 ☐ 6-10 ☐ Over 10 Q4b. Household Status ☐ Household head ☐ Household member Q4c Occupational status ☐ Public employed ☐ Private employed ☐ Self employed ☐ Unemployed ☐ Other (specify)	Q5. Religion ☐ Catholic ☐ Protestant ☐ SDA ☐ Muslim ☐ No religion ☐ Other (specify) Q5a. How much do you earn per month? ☐ Below 5,000 ☐ 5001 - 10,000 ☐ 10001- 15000 ☐ 15001 and above Q6. Estates ☐ Makongeni ☐ Huruma ☐ Kiboko ☐ Landless ☐ Kiboko ☐ Biafra] ☐ Ofafa ☐ Kiandutu ☐ Kimathi ☐ Kiangombe ☐ Ziwani ☐ Majengo ☐ Starehe ☐ UTI ☐ USAID

PART TWO

BACKGROUD INFORMATION ASSESSMENT

Q7a. Which of the following do you use to get general information?

- ☐ Television ☐ Radio ☐ Newspapers ☐ Magazines ☐ Barazas
☐ Others ----- (specify)

Q7b. Which of the following do you use to obtain information **OFTEN**?

- ☐ Television ☐ Radio ☐ Newspapers ☐ Magazines ☐ Barazas
☐ Others ----- (specify)

Q7c. Which of the following do you use to obtain information **HANDLY**?

- ☐ Television ☐ Radio ☐ Newspapers ☐ Magazines ☐ Barazas
☐ Others ----- (specify)

Q7d. Which of the following have you used to obtain information since last week?

- ☐ Television ☐ Radio ☐ Newspapers ☐ Magazines ☐ Barazas
☐ Others ----- (specify)

Q7e. Which of the following have you used to obtain environmental news generally?

- ☐ Television ☐ Radio ☐ Newspapers ☐ Magazines ☐ Barazas
☐ Others ----- (specify)

Q7f. Which of the following has helped you to get information about Thika Municipality's environmental situation and pollution?

- ☐ Television ☐ Radio ☐ Newspapers ☐ Magazines ☐ Barazas
☐ Others ----- (specify)

PART THREE
POLLUTION AWARENESS, ATTITUDES AND
PERCEPTIONS

Q8. Are you aware of any pollution problems in Thika? ☐ Yes ☐
No

Q8a. Which pollution types do you know about in Thika?

☐ Water pollution ☐ Air pollution ☐ Solid waste pollution ☐ Noise
pollution ☐ Others(specify)

Q8b. Which pollution types do you know about in Thika?

☐ Water pollution ☐ Air pollution ☐ Solid waste pollution ☐ Noise
pollution ☐ Others(specify)

Q8c. Which pollution type do you think is **WORST in Thika?**

☐ Water pollution ☐ Air pollution ☐ Solid waste pollution ☐ Noise
pollution ☐ Others(specify)

Q8d. Which pollution type do you think is **LESS problematic in Thika?**

☐ Water pollution ☐ Air pollution ☐ Solid waste pollution ☐ Noise
pollution ☐ Others(specify)

Q8e. Which pollution type(s) according to you affects the residents most?

☐ Water pollution ☐ Air pollution ☐ Solid waste pollution ☐ Noise
pollution ☐ Others(specify)

Q8f. Which pollution type(s) require immediate attention in Thika?

☐ Water pollution ☐ Air pollution ☐ Solid waste pollution
☐ Noise pollution ☐ Others(specify)

Q8g. Rank the pollution types in terms of severity.

(Very severe - 5 Not severe 1)

☐ Water pollution ☐ Air pollution ☐ Solid waste pollution
☐ Noise pollution ☐ Others(specify)

POLLUTION AWARENESS, ATTITUDES AND PERCEPTIONS

Q9a. Which sources do you know of pollution?

- ☐ Industrial fumes ☐ Industrial effluence ☐ Stoves and firewood
☐ Domestic waste ☐ Hospital litter ☐ Sewage
☐ Other(specify)

Q9b. Which source contributes **SIGNIFICANTLY** to environmental pollution in Thika ?

- ☐ Industrial fumes ☐ Industrial effluence ☐ Stoves and firewood
☐ Domestic waste ☐ Hospital litter ☐ Sewage
☐ Other(specify)

Explain how

Q9c. Which source has affected you personally?

- ☐ Industrial fumes ☐ Industrial effluence ☐ Stoves and firewood
☐ Domestic waste ☐ Hospital litter ☐ Sewage
☐ Other(specify)

Explain how

Q9d. Which source has been the most difficult to control?

- ☐ Industrial fumes ☐ Industrial effluence ☐ Stoves and firewood
☐ Domestic waste ☐ Hospital litter ☐ Sewage
☐ Other(specify)

Explain how

PART FOUR
INDICATE ACCORDINGLY TO POLLUTION PROBLEM IN
THIKA MUNICIPALITY.

Q10-1 Pollution is a big problem in Thika Municipality

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Q10-2 Industries are the major polluters

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Q10-3 Pollution is also got from domestic fuel consumption and garbage waste

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Q10-4 Thika is polluted because the government does nothing

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Q10-5 If pollution in Thika is not checked it could be a disaster

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Q10-6 Pollution problem is still increasing

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Q10-7 Pollution has caused some diseases to residents

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

**INDICATE ACCORDINGLY TO POLLUTION PROBLEM IN
THIKA MUNICIPALITY.**

Q10-8 Community participation can help prevent pollution

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Q11. Are you a member of any community based organization dealing with Environmental activities

☐ Yes ☐ NO

Q12. If NO please indicate the reason why?

Q13. If YES when, for how long have you been involved in one?

☐ Less than 1 year ☐ Between 1 and 5 years ☐ Between 4 and 6 years
☐ Over 6 years

Q14. What position do you hold?

☐ Chairman ☐ Secretary ☐ Treasurer ☐ Member ☐ Others. (specify)

Q15. Please rate how you evaluate the importance of community participation in pollution management and prevention in Thika Municipality.

☐ Very important ☐ Important ☐ Neutral ☐ Slightly important
☐ Not important at all

PART FIVE
COMMUNITY PARTICIPATION IN POLLUTION PREVENTION

Q16a. Which areas do you think that the community has done so far to prevent pollution?

- ☐ Estate cleanups ☐ Tree planting ☐ Peaceful demonstrations
☐ Environmental education ☐ Awareness creation and advocacy
☐ Project design and implementation
☐ Soliciting for environment development funds ☐ Others(specify)

Q16b. Which critical areas do you think community participation can help in pollution management?

- ☐ Estate cleanups ☐ Tree planting ☐ Peaceful demonstrations
☐ Environmental education ☐ Awareness creation and advocacy
☐ Project design and implementation
☐ Soliciting for environment development funds ☐ Others(specify)

Q16c. Which of the following mechanism is the most important in pollution prevention in Thika?(Please rate them from most important to least important, 1, 2, 3, 4, 5, 6, 7, 8 insert where applicable)

- ☐ Estate cleanups ☐ Tree planting ☐ Peaceful demonstrations
☐ Environmental education ☐ Awareness creation and advocacy
☐ Project design and implementation
☐ Soliciting for environment development funds ☐ Others(specify)

**** End ****

Thank you for your time for this interview.

Time interview started ... and ended ... Total time taken ...

SELECTION OF RESPONDENTS FOR INTERVIEW

1. List the all of the adults aged **15 years and above** living in the household together with their ages whether or not they are in at present. Start with the oldest and work down to the youngest.
2. Take the last figure of the questionnaire number and find the same number in the top line of the **Kish Grid** below
3. Look down that column and read off the number opposite the total number of adults in the household who should be interviewed
4. Refer back to the list of family members and ask to speak to the person whose number is the same as the one you have taken out of the **Kish Grid**
5. If that person is not at home, **YOU MUST** arrange to call a second time and a third time to interview that individual. *Calls may be spread over two days.* If the person is not there on the third occasion, you should select another adult in the household by taking the number in the **Kish Grid DIRECTLY ABOVE** the number you took. Originally on even number dates or **DIRECTLY BELOW** on odd number dates
6. If that person is also not available, go to another household
7. Record call details on front of questionnaire

NO.	NAME LIST	AGE
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Last digit on Questionnaire Number

Number of Adults in Household	Age	1.	2.	3.	4.	5.	6.	7.	8.	9.	0.
1.		1	1	1	1	1	1	1	1	1	1
2.		2	1	2	1	2	1	2	1	2	2
3.		1	2	3	1	2	3	1	2	3	2
4.		1	2	3	4	1	2	3	4	1	2
5.		4	5	1	2	3	4	5	1	2	3
6.		4	5	6	1	2	3	4	5	6	1
7.		3	4	5	6	7	1	2	3	4	5
8.		3	4	5	6	7	9	1	2	3	4
9.		2	3	4	5	6	7	8	9	1	2
10.		1	2	3	4	5	6	7	8	9	1

SAMPLE OF RESPONDENTS FOR INTERVIEW - NO 32

1. List the all of the adults aged **15 years and above** living in the household together with their ages whether or not they are in at present. Start with the oldest and work down to the youngest.
2. Take the last figure of the questionnaire number and find the same number in the top line of the **Kish Grid** below
3. Look down that column and read off the number opposite the total number of adults in the household who should be interviewed
4. Refer back to the list of family members and ask to speak to the person whose number is the same as the one you have taken out of the **Kish Grid**
5. If that person is not at home, **YOU MUST** arrange to call a second time and a third time to interview that individual. *Calls may be spread over two days.* If the person is not there on the third occasion, you should select another adult in the household by taking the number in the **Kish Grid DIRECTLY ABOVE** the number you took. Originally on even number dates or **DIRECTLY BELOW** on odd number dates
6. If that person is also not available, go to another household
7. Record call details on front of questionnaire

NO.	NAME LIST	AGE
1.	James Ngugi	45
2.	Joyce Wanjiru	40
3.	Catherine Watiri	22
4.	Peter Ngugi	18
5.	Alice Wanja	16
6.		
7.		

		Last digit on Questionnaire Number										
Number of Adults in Household		Age	1.	2.	3.	4.	5.	6.	7.	8.	9.	0.
1.	James Ngugi	45	1	1	1	1	1	1	1	1	1	1
2.	Joyce Wanjiru	40	2	1	2	1	2	1	2	1	2	2
3.	Catherine Watiri	22	1	2	3	1	2	3	1	2	3	2
4.	Peter Ngugi	18	1	2	3	4	1	2	3	4	1	2
5.	Alice Wanja	16	4	5	1	2	3	4	5	1	2	3
6.			4	5	6	1	2	3	4	5	6	1
7.			3	4	5	6	7	1	2	3	4	5

The person who was interviewed was.....

APPENDIX III - DATA

tab1/q1: Sample Structure-Gender

Total	60
	100%
Male	36
	60%
Female	24
	40%

tab2/q2: Sample Structure-Age

Total	60
	100%
15-20 years	8
	13%
21-26 years	20
	33%
27-32 years	24
	40%
33-38 years	8
	13%

tab3/q3: Sample Structure-Highest Level of Education Attained

Total	60
	100%
Primary	6
	10%
Secondary	36
	60%
College	16
	27%



University	2
	3%

tab4/q4: Sample Structure-Marital Status

Total	60
	100%
Single	29
	48%
Single parent	1
	2%
Married	30
	50%

tab5/q5: Sample Structure-Household Status

Total	60
	100%
Household head	30
	50%
Household member	30
	50%

tab6/q6: Sample Structure-Respondents' Residence

Total	60
	100%
Makongeni	30
	50%
Umoja	10
	17%
Kiboko	15
	25%
Landless	5
	8%

tab7/q7: Sample Structure-Occupational Status

Total	60
	100%

Private employed	14
	23%
Self employed	28
	47%
Unemployed	18
	30%

tab8/q8: Sample Structure-Religious Affiliation

Total	60
	100%
Catholic	22
	37%
Protestant	36
	60%
SDA	1
	2%
Muslim	1
	2%

tab9/q7a: Medium for Obtaining General Information

	Total	gender		age				highest level of education			
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Television	47	28	19	8	14	18	7	5	26	14	2
	78%	78%	79%	100%	70%	75%	88%	83%	72%	88%	100%
Radios	58	34	24	8	19	23	8	6	34	16	2
	97%	94%	100%	100%	95%	96%	100%	100%	94%	100%	100%
Newspapers	44	28	16	5	15	18	6	4	26	13	1
	73%	78%	67%	63%	75%	75%	75%	67%	72%	81%	50%
Magazines	15	7	8	1	10	4	0	0	8	6	1
	25%	19%	33%	13%	50%	17%	0%	0%	22%	38%	50%
Barazas	7	3	4	0	3	4	0	1	6	0	0
	12%	8%	17%	0%	15%	17%	0%	17%	17%	0%	0%

tab10/q7b: Medium for Obtaining Information MOST OFTEN

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Televisi on	17	12	5	3	5	6	3	0	10	7	0
	28%	33%	21%	38%	25%	25%	38%	0%	28%	44%	0%
Radios	44	25	19	5	15	18	6	6	27	9	2
	73%	69%	79%	63%	75%	75%	75%	100%	75%	56%	100%
Newspa pers	2	2	0	0	2	0	0	0	1	1	0
	3%	6%	0%	0%	10%	0%	0%	0%	3%	6%	0%

tab11/q7c: Medium for Obtaining Information Since Last Week

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Television	19	13	6	3	7	7	2	1	10	8	0
	32%	36%	25%	38%	35%	29%	25%	17%	28%	50%	0%
Radios	39	22	17	5	13	16	5	5	25	7	2
	65%	61%	71%	63%	65%	67%	63%	83%	69%	44%	100%
Newspapers	1	1	0	0	0	0	1	0	0	1	0
	2%	3%	0%	0%	0%	0%	13%	0%	0%	6%	0%
QNA	1	0	1	0	0	1	0	0	1	0	0
	2%	0%	4%	0%	0%	4%	0%	0%	3%	0%	0%

tab12/q7d: Medium for Obtaining Envirommental News Generally

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Television	20	14	6	3	6	8	3	2	9	7	2
	33%	39%	25%	38%	30%	33%	38%	33%	25%	44%	100%

Radios	30	18	12	2	9	14	5	3	22	5	0
	50%	50%	50%	25%	45%	58%	63%	50%	61%	31%	0%
Newspapers	6	1	5	2	4	0	0	1	3	2	0
	10%	3%	21%	25%	20%	0%	0%	17%	8%	13%	0%
Magazines	1	0	1	0	0	1	0	0	1	0	0
	2%	0%	4%	0%	0%	4%	0%	0%	3%	0%	0%
Observations	2	2	0	0	1	1	0	0	1	1	0
	3%	6%	0%	0%	5%	4%	0%	0%	3%	6%	0%
QNA	1	1	0	1	0	0	0	0	0	1	0
	2%	3%	0%	13%	0%	0%	0%	0%	0%	6%	0%

tab13/q7e: Medium for Obtaining Information About Thika Municipality's Environmental Situation and Pollution

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Television	4	2	2	3	0	1	0	0	1	3	0
	7%	6%	8%	38%	0%	4%	0%	0%	3%	19%	0%
Radios	11	8	3	1	4	3	3	2	6	3	0
	18%	22%	13%	13%	20%	13%	38%	33%	17%	19%	0%
Newspapers	5	2	3	1	3	1	0	1	0	4	0
	8%	6%	13%	13%	15%	4%	0%	17%	0%	25%	0%
Magazines	2	1	1	0	0	2	0	0	1	0	1
	3%	3%	4%	0%	0%	8%	0%	0%	3%	0%	50%
Barazas	8	4	4	0	4	4	0	1	6	1	0
	13%	11%	17%	0%	20%	17%	0%	17%	17%	6%	0%
Word of mouth	5	3	2	1	0	3	1	0	3	0	2
	8%	8%	8%	13%	0%	13%	13%	0%	8%	0%	100%
Observations	27	18	9	2	9	12	4	2	19	6	0
	45%	50%	38%	25%	45%	50%	50%	33%	53%	38%	0%

tab14/q8x: Awareness Levels of Pollution Problems in Thika Municipality

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2

Yes	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
tab15/q8a: Knowledge of Pollution Types in Thika - Unprompted											
	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pollution	55	33	22	7	16	24	8	5	33	15	2
	92%	92%	92%	88%	80%	100%	100%	83%	92%	94%	100%
Air Pollution	45	29	16	7	13	19	6	5	28	10	2
	75%	81%	67%	88%	65%	79%	75%	83%	78%	63%	100%
Solid Waste Pollution	42	24	18	6	10	20	6	4	27	10	1
	70%	67%	75%	75%	50%	83%	75%	67%	75%	63%	50%
Noise Pollution	1	1	0	0	0	0	1	0	1	0	0
	2%	3%	0%	0%	0%	0%	13%	0%	3%	0%	0%
tab16/q8b: Knowledge of Pollution Types in Thika - Prompted											
	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	45	25	20	5	17	17	6	3	26	14	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pollution	3	1	2	0	3	0	0	0	2	1	0
	7%	4%	10%	0%	18%	0%	0%	0%	8%	7%	0%
Air Pollution	9	5	4	1	5	1	2	1	5	3	0
	20%	20%	20%	20%	29%	6%	33%	33%	19%	21%	0%
Solid Waste Pollution	16	10	6	1	9	4	2	1	8	6	1
	36%	40%	30%	20%	53%	24%	33%	33%	31%	43%	50%
Noise Pollution	32	19	13	3	10	16	3	2	20	8	2
	71%	76%	65%	60%	59%	94%	50%	67%	77%	57%	100%
tab16/q8b: Knowledge of Pollution Types in Thika - Total Mention											
	Total	estate Makongeni	Umoja	Kiboko	Landles						

						s					
Total	60	30	10	15	5						
	100%	50%	17%	25%	8%						
Water Pollution	58	29	9	15	5						
	97%	48%	15%	25%	8%						
Air Pollution	54	26	9	15	4						
	90%	43%	15%	25%	7%						
Solid Waste Pollution	58	29	9	15	5						
	97%	48%	15%	25%	8%						
Noise Pollution	33	14	5	12	2						
	55%	23%	8%	20%	3%						
tab17/q8b: The WORST Pollution Type in Thika											
	Total	gender		age				highest level of education			
		Male	Female	15-20	21-26	27-32	33-38	primary	Secondary	College	University
				years	years	years	years				
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water pollution	19	9	10	5	6	5	3	3	10	5	1
	32%	25%	42%	63%	30%	21%	38%	50%	28%	31%	50%
Air pollution	25	16	9	3	7	12	3	1	17	6	1
	42%	44%	38%	38%	35%	50%	38%	17%	47%	38%	50%
Solid waste pollution	14	10	4	0	7	6	1	2	8	4	0
	23%	28%	17%	0%	35%	25%	13%	33%	22%	25%	0%
Noise pollution	2	1	1	0	0	1	1	0	1	1	0
	3%	3%	4%	0%	0%	4%	13%	0%	3%	6%	0%
tab18/q8d: The LESS Problematic Pollution Type In Thika											
	Total	gender		age				highest level of education			
		Male	Female	15-20	21-26	27-32	33-38	primary	Secondary	College	University
				years	years	years	years				
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water pollution	8	6	2	1	1	4	2	1	5	2	0
	13%	17%	8%	13%	5%	17%	25%	17%	14%	13%	0%
Air pollution	7	5	2	1	3	3	0	1	4	2	0
	12%	14%	8%	13%	15%	13%	0%	17%	11%	13%	0%

Solid waste pollution	10	6	4	1	6	1	2	0	7	3	0
	17%	17%	17%	13%	30%	4%	25%	0%	19%	19%	0%
Noise pollution	35	19	16	5	10	16	4	4	20	9	2
	58%	53%	67%	63%	50%	67%	50%	67%	56%	56%	100%

tab19/q8e: The Pollution Type that Affects the Residents of Thika Most

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water pollution	46	27	19	5	13	21	7	5	31	8	2
	77%	75%	79%	63%	65%	88%	88%	83%	86%	50%	100%
Air pollution	36	23	13	3	12	16	5	1	25	8	2
	60%	64%	54%	38%	60%	67%	63%	17%	69%	50%	100%
Solid waste pollution	37	21	16	5	13	15	4	5	24	8	0
	62%	58%	67%	63%	65%	63%	50%	83%	67%	50%	0%
Noise pollution	2	1	1	0	1	1	0	0	2	0	0
	3%	3%	4%	0%	5%	4%	0%	0%	6%	0%	0%

tab20/q8f: The Pollution Type that Needs Immediate Attention

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water pollution	33	19	14	6	10	11	6	4	20	7	2
	55%	53%	58%	75%	50%	46%	75%	67%	56%	44%	100%
Air pollution	28	18	10	2	9	13	4	1	19	8	0
	47%	50%	42%	25%	45%	54%	50%	17%	53%	50%	0%
Solid waste pollution	20	11	9	1	9	7	3	3	12	5	0
	33%	31%	38%	13%	45%	29%	38%	50%	33%	31%	0%
Noise pollution	2	1	1	0	1	1	0	0	2	0	0
	3%	3%	4%	0%	5%	4%	0%	0%	6%	0%	0%

tab21/q8g: Mean Rank of Pollution Types in Terms of their Perceived Severity

Not severe Slightly Severe Severe Very severe

Water Pollution	0	13	24	22
	0%	22%	41%	37%
Air Pollution	5	13	15	26
	8%	22%	25%	44%
Solid Waste Pollution	2	24	16	14
	4%	43%	29%	25%
Noise Pollution	41	5	2	0
	85%	10%	4%	0%

tab21/q8g: Mean Rank of Pollution Types in Terms of their Perceived Severity

	Overall Mean	gender		age				highest level of education			
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	primary	Secondary	College	University
Water Pollution	3.15	3.09	3.25	3.38	3.05	3.13	3.29	3.33	3.14	3	4
Air Pollution	3.05	3	3.13	2.75	2.9	3.25	3.14	2.5	3.14	3.07	3
Solid Waste Pollution	2.75	2.74	2.77	2.63	3.06	2.61	2.57	3.17	2.65	2.93	2
Noise Pollution	1.19	1.28	1.05	1.25	1.33	1.1	1	1	1.19	1.31	1

tab22/q9a: Knowledge of Pollution Sources-Unprompted

	Total	gender		age				highest level of education			
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	55	34	21	8	19	20	8	6	33	14	2
Industrial fumes	92%	94%	88%	100%	95%	83%	100%	100%	92%	88%	100%
Industrial effluence	40	26	14	7	12	15	6	5	23	10	2
	67%	72%	58%	88%	60%	63%	75%	83%	64%	63%	100%
Stoves and firewood	2	2	0	1	0	0	1	1	1	0	0
	3%	6%	0%	13%	0%	0%	13%	17%	3%	0%	0%
Domesticwaste	47	30	17	5	17	19	6	5	28	13	1
	78%	83%	71%	63%	85%	79%	75%	83%	78%	81%	50%
Hospital litter	12	8	4	4	1	6	1	2	8	2	0
	20%	22%	17%	50%	5%	25%	13%	33%	22%	13%	0%

Sewage	58 97%	35 97%	23 96%	8 100%	19 95%	23 96%	8 100%	6 100%	36 100%	14 88%	2 100%
tab23/q9b: Pollution Source that Contributes Significantly to Environmental Pollution in Thika											
	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education primary Secondary College University			
Total	60 100% 19	36 100% 12	24 100% 7	8 100% 1	20 100% 7	24 100% 9	8 100% 2	6 100% 0	36 100% 14	16 100% 5	2 100% 0
Industrial fumes	32%	33%	29%	13%	35%	38%	25%	0%	39%	31%	0%
Industrial effluence	1 2%	1 3%	0 0%	0 0%	0 0%	1 4%	0 0%	0 0%	0 0%	0 0%	1 50%
Domesticwaste	11 18%	7 19%	4 17%	2 25%	7 35%	2 8%	0 0%	1 17%	6 17%	4 25%	0 0%
Hospital litter	1 2%	1 3%	0 0%	0 0%	0 0%	0 0%	1 13%	0 0%	0 0%	1 6%	0 0%
Sewage	28 47%	15 42%	13 54%	5 63%	6 30%	12 50%	5 63%	5 83%	16 44%	6 38%	1 50%
tab24/q9c: Pollution Source that has Affected the Respondent Most											
	Total	Gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education primary Secondary College University			
Total	56 100% 25	32 100% 14	24 100% 11	8 100% 4	18 100% 8	23 100% 10	7 100% 3	6 100% 3	33 100% 15	16 100% 7	1 100% 0
Industrial fumes	45%	44%	46%	50%	44%	43%	43%	50%	45%	44%	0%
Industrial effluence	1 2%	1 3%	0 0%	0 0%	0 0%	0 0%	1 14%	0 0%	0 0%	1 6%	0 0%
Domesticwaste	12 21%	9 28%	3 13%	1 13%	5 28%	5 22%	1 14%	0 0%	6 18%	6 38%	0 0%
Hospital litter	1 2%	0 0%	1 4%	1 13%	0 0%	0 0%	0 0%	0 0%	1 3%	0 0%	0 0%
Sewage	27	14	13	3	7	11	6	4	17	5	1

	48%	44%	54%	38%	39%	48%	86%	67%	52%	31%	100%
tab25/q9d: Pollution Source that has the Most difficult to Control											
	Total	Gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education primary Secondary College University			
Total	56	34	22	8	18	23	7	6	34	14	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	33	21	12	4	9	15	5	2	25	5	1
Industrial fumes	59%	62%	55%	50%	50%	65%	71%	33%	74%	36%	50%
Industrial effluence	1	1	0	0	0	1	0	0	0	0	1
	2%	3%	0%	0%	0%	4%	0%	0%	0%	0%	50%
Stoves and firewood	1	1	0	0	1	0	0	0	0	1	0
	2%	3%	0%	0%	6%	0%	0%	0%	0%	7%	0%
Domesticwaste	5	3	2	1	3	1	0	0	0	5	0
	9%	9%	9%	13%	17%	4%	0%	0%	0%	36%	0%
Sewage	16	8	8	3	5	6	2	4	9	3	0
	29%	24%	36%	38%	28%	26%	29%	67%	26%	21%	0%
tab26/q9e: Major Effects of Pollution in Thika Municipality											
	Total	Gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education primary Secondary College University			
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	18	11	7	2	4	11	1	1	12	5	0
Corrosion and destruction of building structures	30%	31%	29%	25%	20%	46%	13%	17%	33%	31%	0%
Increase in livestock mortality	10	4	6	0	3	5	2	2	5	3	0
	17%	11%	25%	0%	15%	21%	25%	33%	14%	19%	0%
Increase in incidence of human URTIs and other infections	55	33	22	8	19	20	8	6	32	15	2
	92%	92%	92%	100%	95%	83%	100%	100%	89%	94%	100%
Incidence of high infant mortality	3	2	1	0	1	2	0	0	2	1	0
	5%	6%	4%	0%	5%	8%	0%	0%	6%	6%	0%

High human mortality levels	7	4	3	0	1	5	1	0	5	1	1
	12%	11%	13%	0%	5%	21%	13%	0%	14%	6%	50%
Destruction of vegetation and crops	1	0	1	0	0	1	0	0	1	0	0
	2%	0%	4%	0%	0%	4%	0%	0%	3%	0%	0%
QNA	1	1	0	0	1	0	0	0	1	0	0
	2%	3%	0%	0%	5%	0%	0%	0%	3%	0%	0%

tab27/q10a: Respondents Awareness of Different Organizations Operating in Thika Municipality

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	59	35	24	8	19	24	8	6	36	15	2
Municipal councils/local government	98%	97%	100%	100%	95%	100%	100%	100%	100%	94%	100%
Women/youth groups	22	16	6	5	6	10	1	2	13	6	1
	37%	44%	25%	63%	30%	42%	13%	33%	36%	38%	50%
Community based organization	4	3	1	1	1	1	1	0	2	1	1
	7%	8%	4%	13%	5%	4%	13%	0%	6%	6%	50%
Non-Governmental Organizations	2	1	1	0	2	0	0	0	2	0	0
	3%	3%	4%	0%	10%	0%	0%	0%	6%	0%	0%
International institutions	5	5	0	1	1	3	0	0	3	1	1
	8%	14%	0%	13%	5%	13%	0%	0%	8%	6%	50%
Religious groups	31	21	10	5	8	13	5	2	19	9	1
	52%	58%	42%	63%	40%	54%	63%	33%	53%	56%	50%
Private organization	8	2	6	1	2	4	1	0	4	4	0
	13%	6%	25%	13%	10%	17%	13%	0%	11%	25%	0%

tab28/q10b: Respondents Perception of Different Organizations that Aid in Pollution in Thika Municipality

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	54	33	21	8	17	23	6	4	35	13	2
Municipal councils/local government	90%	92%	88%	100%	85%	96%	75%	67%	97%	81%	100%
Women/youth groups	6	5	1	0	3	2	1	0	3	3	0
Community based organization	10%	14%	4%	0%	15%	8%	13%	0%	8%	19%	0%
Non-Governmental Organizations	2	2	0	0	1	1	0	0	1	1	0
Religious groups	3%	6%	0%	0%	5%	4%	0%	0%	3%	6%	0%
Private organization	2	2	0	0	1	1	0	0	1	1	0
	3%	6%	0%	0%	5%	4%	0%	0%	3%	6%	0%
	4	3	1	0	1	2	1	0	1	2	1
	7%	8%	4%	0%	5%	8%	13%	0%	3%	13%	50%
QNA	6	1	5	1	2	3	0	0	4	2	0
	10%	3%	21%	13%	10%	13%	0%	0%	11%	13%	0%
	2	1	1	0	1	0	1	2	0	0	0
	3%	3%	4%	0%	5%	0%	13%	33%	0%	0%	0%

tab29/q10c: Respondents Perception of the Organizations that should take Charge in Pollution Prevention in Thika Municipality

	Total	gender		age				highest level of education			
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	59	35	24	8	19	24	8	6	35	16	2
Municipal councils/local government	98%	97%	100%	100%	95%	100%	100%	100%	97%	100%	100%
Women/youth groups	8	4	4	2	2	4	0	1	5	2	0
Community based organization	13%	11%	17%	25%	10%	17%	0%	17%	14%	13%	0%
Non-Governmental Organizations	6	4	2	0	2	4	0	1	5	0	0
International institutions	10%	11%	8%	0%	10%	17%	0%	17%	14%	0%	0%
Religious groups	6	4	2	1	1	4	0	1	4	1	0
	10%	11%	8%	13%	5%	17%	0%	17%	11%	6%	0%
	4	3	1	0	1	3	0	1	3	0	0
	7%	8%	4%	0%	5%	13%	0%	17%	8%	0%	0%
	7	4	3	0	3	4	0	1	6	0	0
	12%	11%	13%	0%	15%	17%	0%	17%	17%	0%	0%

tab30/q10d: Respondents Perception of the Organizations that have the Mandate to Check Pollution in Thika Municipality

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	57	33	24	8	18	24	7	6	35	14	2
Municipal councils/local government	95%	92%	100%	100%	90%	100%	88%	100%	97%	88%	100%
Religious groups	3	3	0	0	2	0	1	0	1	2	0
	5%	8%	0%	0%	10%	0%	13%	0%	3%	13%	0%
tab31/q10e: Respondents Perception of the Organizations that have made the Greatest Effort in Pollution Management in Thika Municipality											
	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	34	19	15	7	10	13	4	2	23	8	1
Municipal councils/local government	57%	53%	63%	88%	50%	54%	50%	33%	64%	50%	50%
Women/youth groups	3	2	1	1	1	1	0	1	1	1	0
	5%	6%	4%	13%	5%	4%	0%	17%	3%	6%	0%
Religious groups	2	2	0	0	0	1	1	0	0	1	1
	3%	6%	0%	0%	0%	4%	13%	0%	0%	6%	50%
Private organization	4	2	2	0	2	2	0	0	1	3	0
	7%	6%	8%	0%	10%	8%	0%	0%	3%	19%	0%
QNA	17	11	6	0	7	7	3	3	11	3	0
	28%	31%	25%	0%	35%	29%	38%	50%	31%	19%	0%
tab32/q11: Membership to a Community Based Organization											
	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Yes	11	9	2	2	3	4	2	0	6	4	1
	18%	25%	8%	25%	15%	17%	25%	0%	17%	25%	50%

No	49	27	22	6	17	20	6	6	30	12	1
	82%	75%	92%	75%	85%	83%	75%	100%	83%	75%	50%
tab33/q12: Reasons for Non-Membership to a Community Based Organization											
	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	11	4	7	2	4	4	1	0	10	1	0
Lack of proper awareness and advocacy	18%	11%	29%	25%	20%	17%	13%	0%	28%	6%	0%
No knowledge of existing groups	22	11	11	1	8	9	4	4	12	6	0
	37%	31%	46%	13%	40%	38%	50%	67%	33%	38%	0%
Ineffective groups	4	2	2	1	1	2	0	1	2	1	0
	7%	6%	8%	13%	5%	8%	0%	17%	6%	6%	0%
Other commitments	12	10	2	2	4	5	1	1	6	4	1
	20%	28%	8%	25%	20%	21%	13%	17%	17%	25%	50%
QNA	11	9	2	2	3	4	2	0	6	4	1
	18%	25%	8%	25%	15%	17%	25%	0%	17%	25%	50%
tab34/q13: Duration of Involvement with a CBO											
	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								Second ary	College	Universi ty	
Total	11	9	2	2	3	4	2	6	4	1	
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
	3	3	0	0	3	0	0	1	2	0	
Less than one year	27%	33%	0%	0%	100%	0%	0%	17%	50%	0%	
Between 1 and 3 years	5	3	2	2	0	2	1	4	1	0	
	45%	33%	100%	100%	0%	50%	50%	67%	25%	0%	
Between 4 and 6 years	3	3	0	0	0	2	1	1	1	1	
	27%	33%	0%	0%	0%	50%	50%	17%	25%	100%	
tab35/q14: Position of Membership											
	Total	gender		age				highest level of education			

	Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	Second ary	College	Universi ty	
Total	11	9	2	2	3	4	2	6	4	1
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	1	1	0	0	1	0	0	0	1	0
Chairman										
	9%	11%	0%	0%	33%	0%	0%	0%	25%	0%
Secretary	1	0	1	0	0	1	0	1	0	0
	9%	0%	50%	0%	0%	25%	0%	17%	0%	0%
Treasurer	1	0	1	1	0	0	0	1	0	0
	9%	0%	50%	50%	0%	0%	0%	17%	0%	0%
Member	8	8	0	1	2	3	2	4	3	1
	73%	89%	0%	50%	67%	75%	100%	67%	75%	100%

tab36/q15: Importance of Community Participation in Pollution Management

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	51	29	22	8	18	19	6	5	29	15	2
Very important	85%	81%	92%	100%	90%	79%	75%	83%	81%	94%	100%
Important	6	4	2	0	0	5	1	1	5	0	0
	10%	11%	8%	0%	0%	21%	13%	17%	14%	0%	0%
Neutral	2	2	0	0	2	0	0	0	1	1	0
	3%	6%	0%	0%	10%	0%	0%	0%	3%	6%	0%
Slightly important	1	1	0	0	0	0	1	0	1	0	0
	2%	3%	0%	0%	0%	0%	13%	0%	3%	0%	0%

tab37/q16a: Community's Activities in Pollution Management

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	27	16	11	7	7	10	3	2	14	11	0
Estate cleanups	45%	44%	46%	88%	35%	42%	38%	33%	39%	69%	0%
Tree planting	3	3	0	1	2	0	0	1	1	1	0
	5%	8%	0%	13%	10%	0%	0%	17%	3%	6%	0%
Peaceful demonstrations	17	11	6	3	3	7	4	0	12	4	1
	28%	31%	25%	38%	15%	29%	50%	0%	33%	25%	50%
Environmental education	7	3	4	3	2	2	0	1	4	2	0
	12%	8%	17%	38%	10%	8%	0%	17%	11%	13%	0%
Awareness creation and advocacy	12	8	4	4	2	5	1	1	6	4	1
	20%	22%	17%	50%	10%	21%	13%	17%	17%	25%	50%
Project design and implementation	3	3	0	0	1	1	1	1	0	2	0
	5%	8%	0%	0%	5%	4%	13%	17%	0%	13%	0%
Soliciting for environmental development funds	3	1	2	2	0	1	0	0	1	2	0
	5%	3%	8%	25%	0%	4%	0%	0%	3%	13%	0%
QNA	27	14	13	0	12	11	4	3	18	5	1
	45%	39%	54%	0%	60%	46%	50%	50%	50%	31%	50%

tab38/q16b: Critical Areas the Community can Help in Pollution Management

	Total	gender		age				highest level of education			
		Male	Female	15-20 years	21-26 years	27-32 years	33-38 years	primary	Secondary	College	University
Total	60	36	24	8	20	24	8	6	36	16	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	53	32	21	4	20	23	6	3	32	16	2
Estate cleanups	88%	89%	88%	50%	100%	96%	75%	50%	89%	100%	100%
Tree planting	10	8	2	1	5	4	0	1	8	1	0
	17%	22%	8%	13%	25%	17%	0%	17%	22%	6%	0%
Peaceful demonstrations	33	21	12	3	9	16	5	4	23	5	1
	55%	58%	50%	38%	45%	67%	63%	67%	64%	31%	50%
Environmental education	53	31	22	7	20	20	6	5	35	13	0
	88%	86%	92%	88%	100%	83%	75%	83%	97%	81%	0%
Awareness creation and advocacy	52	31	21	6	18	22	6	5	34	11	2
	87%	86%	88%	75%	90%	92%	75%	83%	94%	69%	100%

Project design and implementation	39	24	15	3	13	18	5	4	29	5	1
	65%	67%	63%	38%	65%	75%	63%	67%	81%	31%	50%
Soliciting for environmental development funds	26	16	10	3	10	11	2	2	16	7	1
	43%	44%	42%	38%	50%	46%	25%	33%	44%	44%	50%

tab39/q16c: Mean Rank for the MOST important Pollution Prevention Mechanism in Thika

Estate Clean Up	4.77
Tree Planting	1.25
Peaceful Demonstrations	3.48
Environmental Education	6.53
Awareness Creation and Advocacy	5.7
Project Design and Implementation	3.53
Soliciting for environment development funds	2.75

tab40/q17: Attitude Measurement on Selected Pollution Issues in Thika Municipality

	Total	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Pollution is a big problem in Thika Municipality	60	46	9	3	2	0
	100%	77%	15%	5%	3%	0%
Industries are major polluters	60	34	17	7	2	0
	100%	57%	28%	12%	3%	0%
Pollution is also got from domestic fuel consumption	60	9	20	22	9	0
	100%	15%	33%	37%	15%	0%
Thika is polluted because the government does nothing	60	29	11	14	4	2
	100%	48%	18%	23%	7%	3%
If pollution in Thika is checked it could be a disaster	60	56	3	1	0	0
	100%	93%	5%	2%	0%	0%
Pollution problem in Thika Municipality is still increasing	60	43	13	3	1	0
	100%	72%	22%	5%	2%	0%
Pollution has caused some diseases to the residents	60	49	4	7	0	0
	100%	82%	7%	12%	0%	0%
Community Participation can help prevent and manage pollution	60	46	12	2	0	0
	100%	77%	20%	3%	0%	0%

tab41/q17: Mean Rank for Selected Pollution Issues in Thika Municipality

Pollution is a big problem in Thika Municipality	1.35
Industries are major polluters	1.62
Pollution is also got from domestic fuel consumption	2.52
Thika is polluted because the government does nothing	1.98
If pollution in Thika is checked it could be a disaster	1.08
Pollution problem in Thika Municipality is still increasing	1.37
Pollution has caused some diseases to the residents	1.3
Community Participation can help prevent and manage pollution	1.27

tab42/q18: Other initiatives that all stakeholders could do for Pollution Prevention in Thika

	Total	gender Male	Female	age 15-20 years	21-26 years	27-32 years	33-38 years	highest level of education			
								primary	Secondary	College	University
Total	60 100% 6	36 100% 5	24 100% 1	8 100% 1	20 100% 1	24 100% 3	8 100% 1	6 100% 1	36 100% 4	16 100% 1	2 100% 0
Relocation of heavy polluting industries	10% 5	14% 4	4% 1	13% 1	5% 3	13% 1	13% 0	17% 0	11% 4	6% 1	0% 0
Encouragement and implementation of local hygiene	8% 16	11% 9	4% 7	13% 1	15% 7	4% 7	0% 1	0% 1	11% 10	6% 4	0% 1
Initiation of more environmental based community organization	27% 15	25% 10	29% 5	13% 1	35% 5	29% 7	13% 2	17% 2	28% 8	25% 5	50% 0
Provision of grants for environmental protection projects	25% 35	28% 20	21% 15	13% 3	25% 11	29% 15	25% 6	33% 3	22% 23	31% 8	0% 1
More participation by the local government	58% 12	56% 9	63% 3	38% 1	55% 2	63% 6	75% 3	50% 0	64% 9	50% 2	50% 1
Introduction of strict legislation rules against pollution	20% 6	25% 9	13% 3	13% 1	10% 3	25% 9	38% 13	0% 0	25% 9	13% 5	50% 2

Active participation by the whole community	27	14	13
	45%	39%	54%
Improvement of the emissions standards by the industries	9	7	2
	15%	19%	8%
Environmental education by the Ministry of Health and other	8	8	0
	13%	22%	0%
Introduction of garbage collection points bins and vehicles	8	5	3
	13%	14%	13%
QNA	1	1	0
	2%	3%	0%

4	8	11	4	2	16	8	1
50%	40%	46%	50%	33%	44%	50%	50%
3	1	4	1	2	3	3	1
38%	5%	17%	13%	33%	8%	19%	50%
1	3	2	2	3	2	3	0
13%	15%	8%	25%	50%	6%	19%	0%
0	3	3	2	0	6	1	1
0%	15%	13%	25%	0%	17%	6%	50%
1	0	0	0	1	0	0	0
13%	0%	0%	0%	17%	0%	0%	0%

APPENDIX IV: COMMUNIQUE

THE DIOCESAN CLERGY OF THE CATHOLIC ARCHDIOCESE OF NAIROBI

Telephone : 441919

P.O. Box 14231
NAIROBI

Press Release

15 July 1992

THE ARCHDIOCESE OF NAIROBI MEETING HELD AT RIARA ON 14-7-1992

In view of grave environmental degradation facing our country; an in view of apparent government insensitivity towards that environmental abuse; and in view of the current suffering of Kenyans and the inescapable suffering of future Kenyan generations from the commissions and omissions of the Kenyan authorities with regard to environmental issues.

Further, in view of the international concern on environmental issues as exemplified by the recently concluded United Nations Conference on Environment and Development (UNCED), which aptly Christened the "Earth Summit", the recently released World Development Report 1992 entitled "Development and the Environment" by the World Bank and other reports compiled by international environmental agencies including the Nairobi based United Nations Environment Programme (UNEP);

Also in view of the fact that some members of Kenya's delegation to the aforementioned "Earth Summit" reflected nothing short of a mockery of the world's concern for environmentalists that the Kenyan authorities' view of the said "Earth Summit" was just another opportunity for a leisure trip abroad for people who, even if they could grasp the elementary rudiments of environmental issues were they to take interest, could, however, not begin to get a grasp of the loaded agenda of the said summit;

Priests of the Catholic Arch-Diocese of Nairobi held a meeting at Riara on 14-7-92 which was chaired by Father Dominic Wamugunda Wa Kimani and observed that due to the insensitivity towards, mockery of, and cynicism portrayed by Kenyan authorities on, environmental issues, the authorities have refused to accept the following incontrovertible facts:-

MORE

...../2

1. That tests carried out in Kenya and elsewhere have revealed that the KEL Chemicals Factory based at Thika in the Nairobi Arch-Diocese emits sulphuric acid fumes and other toxic effluents.
2. That people of Thika continue to suffer while the investigations done by the government at the factory are kept secret by the same government.
3. That the provincial administration have continued to behave as if the problem does not exist and have not thought it necessary to meet the affected residents of Thika.

Consequently, the priests resolved that:-

1. If by August 9, 1992, the report of the problem committee appointed by the government to vet the toxicity of effluents from the KEL Chemical factory will not have been made public.
2. That if appropriate remedial measures will not have been taken to stop the pollution.

The affected community and friends of a healthy environment, led by the clergymen, will have no other resource but to call mass demonstration against the owners of the KEL PLANT and the governments

The priests were dismayed to note that while Kenya was represented by a high-powered delegation at the "Earth Summit", led by His Excellency the President, basic but pertinent environmental issues at home remained unresolved.

ENDS

Fr Stephen Karing'u Mutunga

Fr Patrick Gachomba

Fr James M. Kimuthia

Fr Joseph Mwengi Rugano

Fr Josephat Wanyoike

Fr Peter Njoroge

Fr W. Mwangi Wa Kimani

Fr Boniface Kariuki

Fr Peter Njau

Fr Raphael Kibugi

11. Fr Steven Kungu

12. Fr William Muthema

13. Fr Raphael Gucko Ngure

14. Fr Francis Ndungu

15. Fr Francis Kariuki

16. Fr John Klongo

17. Fr Paul Gachar

18. Fr Gregory Macharia

19. Fr Francis Mburu

20. Fr Francis Mduro

21. Fr George Nambu

22. Fr Josephat Wanyoike

23. Fr Geoffrey Muriuki

24. Fr Vincent Kamiri

25. Fr Dominic Kiandema

26. Fr Michael M. Ndungu

27. Fr David Mjuguna

28. Fr Felis D'Souza

[Handwritten signatures and initials]

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[Handwritten signature]

29. Fr Anthony Karauja Wamukani

30. Fr Edikatu Wa Teresia

31. Fr Augustine Kariuki

33. Fr Samuel Ng'ang'a

35. Fr Francis Kahureni

36. Fr David Temau

37. Fr Gabriel Kimotho

38. Fr James Kinuthia

40. Fr Peter Njau

41. Fr Alphonse Mungai

42. Fr Elias Mwangi

43. Fr Cletus Mugi

44. Fr Josef Rackl

45. Fr Michael Schrode

46. Fr Max Slatter

47. Fr Joseph Mokaya

48. Fr Daniel Ngure

49. Fr Lawrence Njoroge

50. Fr Michael Mungai

51. Fr Saldanha Luis-Jose

~~52. Fr Vincent Macharia~~

53. Fr Joseph Mukui

54. Fr. George M. Gallager

55. FR ALFRIED CIKORBE

56. FR. JOHN KIMANI

Kariuki
Edikatu
Kariuki

Kimotho

Alphonse Mungai
Mugi

Fr. C. M. Mugi
J. Rackl

Njoroge

Macharia

John Kimani

ST MULUMBA CATHOLIC CHURCH
P.O.BOX 3395
THIKA

AND

ST MARIA MAGDALINE
P.O.BOX 3396
THIKA

13/3/91

MR VICTOR MUSOGA
PROVINCIAL COMMISSIONER
CENTRAL PROVINCE
PRIVATE BAG
NYERI

Tel 2211

Dear sir,

Greetings from christians in the above mentioned Catholic Churches. We congratulate you for the nice work you are doing. Thank you for your letter of advice you sent us. We take this chance to thank you deeply for the step you had taken into looking at our problems in Thika and Munyu as far as industrial pollution and dumping waste is concerned.

Some of the Industries (factories) and Hospitals had given us up to 10/3/91 as a deadline to have met our demand. (They had three months to adjust themselves about their dumping waste and pollution). The Municipal Council of Thika had also agreed to the fencing of Kangoki dumping area and to do away with the already existing waste in the area.

Sir, to our surprise, none of these promises has been implemented. The Kangoki dumping area has gone from bad to worse everyday and the pollution from factories, especially K.E.L has deteriorated. The lives of our children and people in our estates are in danger, and our future days are numbered.

We would like you to know that many of Thika factories are polluting the Chania/Thika river and the life inside the river is difficult for the living creatures and food for human being. i.e fish. We have witnessed our children collecting dead fish as food. These dead fish is a result of chemical dumped into river Chania.

We have already notified our Bishop, His Eminence Michael Cardinal Otunga of Nairobi Archdiocese. He is following our outcry keenly.

We are now writing to you again, kindly requesting you to come to our assistance. Our lives and of future leaders (children) are now at stake. We are now on Lenten Period and are infact carrying this big cross - industrial waste and pollution in our daily life.

We look forward to hearing from you soon, before things come out of our hands. Feel free to come and see for yourself. We need your help.

We wish you all the best and have a nice Easter.

c.c His Eminence Cardinal Maurice Otunga
D.C - Kiambu
D.O - Thika
Mayor - Thika
District Environmental Officer - Thika

Yours humbly sufferers.

Aug Box 394 Thika

Hotel Box 581 Thika

Boys Box 423 Thika

Handy Box 861 Thika

Magical Box 874 Thika

ffo Box 240 Thika

Sel Box 3395 Thika.

Cricket Box 3395 Thika.

Box 120 Thika.

Box 581 Thika.

Box 3395, Thika.

Makongeni Residents
c/o Box 240,
Thika.

25th August, 1989.

To The Town Clerk,
Municipal Council of Thika,
P.O. Box 240,
Thika.

Dear Sir,

RE: MAKONGENI ESTATE POOR ENVIRONMENT:

On 30th April, 1989, our honourable M.P. Mr. Muhoho happened to join Makongeni residents in one of their Sunday services in the estate. After the service, he wished to find out if his flock had any problem; and they many of them which are still unsolved despite our airing them to your office on 2nd May, 1989, as advised by the M.P.

During our visit to the Town Hall, we talked with the Acting Town Engineer and the Town's Deputy Public Health Officer. All we went home with, were promises which have not been fulfilled to any degree.

Our intention is not to narrate our discussion with your officers, but to bring to your notice, why we had come to your office, while awaiting to see the promises fulfilled.

The problems being faced by the residents are as follows:

1. The problem of the gas being emitted by KEL CHEMICALS FACTORY:-

This is a long story well known to your office and the authorities concerned. The matter as such begun in 1985, when the residents of Makongeni started complaining about this factory, and the 'Daily Papers' carried out the stories as they came up (cf. DAILY NATION: 5th Dec, 1985; 12th Feb, 1986; 13th Feb, 1986; 23rd Feb, 1986; 10th March, 1986...; THE STANDARD: 6th Dec, 1985; 7th Dec, 1985; 10th Dec, 1985; 12th Dec, 1985; 27th Jan, 1986; 4th Feb, 1986; 9th Feb, 1986; KENYA TIMES: 7th Dec, 1985; 12th Feb, 1986; 13th Feb, 1986; WEEKLY REVIEW: 13th Dec, 1985). Despite the complains and facts finding - even the management admitting the faults, they continue to emit this strong gas into the air at night.

We strongly suggest a re-allocation of this factory, for incase of any accident (e.g. Bhopal case) we the residents will be the victims.

The harm this factory is causing to our environment and to the residents is a mockery to the stand taken by our beloved President His Excellency Hon. Daniel arap Moi against Pollution and Destruction of the environment internationally.

- to. 1. Kana Chairman; Thika Location
2. D.O. Thika
3. D.C. Kiambu District
4. District Environmental Office Thika
5. National Environmental Secretariat.
6. E Area M.P. Hon. Muhoho
7. Permanent Secretary, Ministry of Local Government

[Signature] Box 240 THIKA
 [Signature] Box 782 THIKA
 [Signature] K.V.M. Hd, Box 1436, THIKA.
 [Signature] K.V.M. Box 1436 THIKA
 [Signature] P.O. Box 268 THIKA
 [Signature] Box 240 THIKA
 [Signature] Box 1314 THIKA
 [Signature] P.O. Box 199, THIKA
 [Signature] Box 240
 [Signature] Box 240 THIKA
 [Signature] Box 782 THIKA
 [Signature] Box 147 THIKA
 [Signature] Box 782 THIKA
 [Signature] Box 120 THIKA
 [Signature] Box 374 THIKA
 [Signature] Box 1286 THIKA
 [Signature] Box 782 THIKA
 [Signature] Box 782 THIKA
 [Signature] Box 782 THIKA
 [Signature] Box 782 THIKA
 [Signature] Box 120, THIKA Odhar
 [Signature] P.O. Box 147 THIKA
 [Signature] Leather Industries Box 17 THIKA
 [Signature] P.O. Box 571 THIKA
 [Signature] P.O. Box 581, THIKA
 [Signature] P.O. Box 120 THIKA



Kenya Energy
and Environment
Organizations



10TH ANNIVERSARY
1982-1992

Mwanzi Road, Westlands
P.O. Box 48197
Nairobi, Kenya
Tel: 749747 / 748281
Telex: 25222 KENGO KE
Telefax: 2542 749 382

**The
1991/92
Environmental Achievement Award
for
exemplary achievement in promoting
environmental consciousness.**

**Awarded to
*Father Ndikaru wa Teresia***

**on this 29th day of October 1992
for defending environmental rights
of poor urban communities
in Thika town.**

Executive Director

Chairman

10 Years in Pursuit of Environmental Conservation and Improved Quality of Life

APPENDIX V: THIKA RESIDENTS VS KEL CHEMICALS LIMITED

By Ndikaru Wa Teresia

Kel Chemicals Limited (KCL) is a heavy manufacturing company located in Thika, an industrial town 42 Kms North of Nairobi.

It manufactures, among other things, sulphuric acid, single super phosphate (SSP) fertilizers, aluminium sulphate (Alum) and sodium sulphate.

It's interesting to note that the KCL products are all very important in a developing economy like ours. Fertilizer is a vital agricultural input, our economy's mainstay. KCL is one of the few local companies that manufacture fertilizers commodity whose importation takes up a big chunk of our foreign exchange.

Alluminium Sulphate, is another vital chemical from the KCL. It is used in water treatment works to help sediment dirt and other impurities in water before using chlorine. The Country's authorities water treatment works and others in the former Preferential Trade Area (PTA) rely heavily on aluminum sulphate from KCL. The company has multi-million supply contracts for the chemical with many civic authorities.

KCL also produces Sodium Sulphate, a "salt" used extensively in the industrial manufacture of soaps and detergents. This compound is obtained in the neutralization reaction between Sulfuric acid (another KCL product) and Sodium Hydroxide (Brine). The company produces this compound in very large quantities for both the local and export market, especially to the PTA countries.

The Thika-based Company produces sulfuric acid, a corrosive chemical whose per capita consumption is usually seen as an indicator of a country's industrial activity.

Sulfuric Acid is a vital chemical in numerous industrial processes. It is manufactured through the burning of elemental sulphur (a yellow compound) in air and under

pressure to yield gaseous Sulphur Dioxide (SO_2). This gas is then exposed to air at high pressure and temperature in the presence of Vanadium Pentoxide - acting as a catalyst to yield Sulphur Trioxide gas (SO_3).

The final product, Sulfuric Acid, is obtained by dissolving the highly soluble gas (sulphur trioxide) in either water or concentrated Sulfuric Acid. There are two industrial processes in the Manufacture of Sulfuric Acid namely, the now obsolete Chamber process and the contact process used at the KCL plant.

One would be left wondering why KCL, vital industrial concerns manufacturing seemingly harmless and useful compounds should be embroiled in controversy. What is the contentious process within the company that makes its peaceful co-existence with residents of Makongeni Estate untenable?

Before we attempt to answer these questions, it would be wise to have a look at the nature of Makongeni Estate residents, their grievances and why all the hue and cry about KCL.

Makongeni is a sprawling estate of over 65, 000 inhabitants. It is located on the right hand side of the Thika-Garissa road, while several industrial complexes brace the left flanks of this major highway. The estate is divided into 12 phases/sections. It is a modern site and service project now favored by many municipalities and local authorities.

Like in all such projects, countrywide, town-planning regulations exist only in the council by-laws, resulting in a sudden rise in the number of illegal structures. This leads to overpopulation, thus straining to a breaking point, the social infrastructure and amenities provided by the council e.g. water supply, roads, schools, health facilities, electricity etc. It is important to note that this sprawling concrete jungle, housing thousands upon thousands of residents, is situated only a stone throw away from the industrial concerns. Who designated industrial plots for human habitation? The very nature of the location of the estate was a sure recipe for disaster as a report in the "Weekly Review" of October 11, 1991 indicated "When all is said and done, the Thika

problem is the result of poor land use planning. Ironically, Kel Chemicals LTD came into existence long before Makongeni estate was set up".

This raises an interesting point, that in most rapidly growing towns in Kenya, as indeed in many other developing countries, the proliferation of slums is a painful reality. Usually, these illegal and unplanned for structures come up in areas which the local authorities had set aside for other amenities, be they industrial, social, educational etc. The question thus is if this slum is situated near an industrial concern whose effluent poses a danger its dwellers, then who has more rights than the other, the factory or the slum dwellers.

Many would argue that this is a very theoretical question but it raises also some very pertinent fundamental questions like what is the moral obligation of an industrial concern to protect and maintain its environment. Isn't the Thika Municipal council a morally obliged to protect the lives of those living within her boarders, whether they are in planned structures or not?

THE CRADLE OF THE PROBLEM OF KEL

The origin of the problem at Kel Chemicals Limited (KCL) and Nature of complaints from Makongeni residents.

Makongeni's Phase 10 resident's complaints on KCL date back to October 16, 1987. When they first wrote to the local authorities lamenting the company was discharging gases that adversely affected their health. They were very specific, that starting at around 10 p.m., the discharge of these gases to the atmosphere drastically increased and continued throughout the night. They also alleged that this contentious process was deliberately set into motion under the cover of darkness as most of them would be asleep.

Similar complaints against a neighboring, Kenya Taitex Mill (KTM) were lodged.

President Moi ordered an interministerial committee "to be formed and give him a comprehensive report on the complaints by Thika residents that the company was dislodging harmful gases to the atmosphere"(weekly Review, October 4, 1991). Consequently a seven-man committee composed of officials from the Ministry of

Labour inspectorate of factories section, water quality and control division in the Water Ministry, the government chemist and the National Environment Secretariat (NES) was formed.

This committee carried out investigations at monitoring several sections around KCL and interviewed Makongeni residents. It is understood that this report was handed over to the President but its contents have never been made public to date.

An October 11 1991 report in the Weekly Review, "Questionable verdict", however shed light on the nature of this report to the President, its findings and the remedial actions that the company took on the Makongeni residents' complaints. The story says that KCL closed down an older Sulfuric Acid manufacturing plant, which they had used for 12 years. Were there leakages or what were the serious faults with this old plant to warrant the commissioning of a new structural and equipment purchase from the United States? However, one thing is clear, this old plant was relying obsolete technology.

The company also installed additional scrubbing devices - used to trap Sulphur Dioxide and Sulphur Trioxide from escaping to the atmosphere - at the instigation of this inter-ministerial report. It is at this point in time that monitoring of gaseous emissions from the company started. The fact that the company undertook such expensive structural and equipment adjustments implies that the inter-ministerial committee that investigated it passed a verdict and no doubt guilty the company had a case to answer. Since the report is not available, this is just a conjecture. One can also only speculate as to the facts leading to its closure at this point in time.

With the re-opening of the factory, complaint after complaint continued to be lodged through the mass media, indicating that the residents of Makongeni still felt that their health was being threatened by the emissions from the factory. The Sunday Nation of May 28, 1991 indicated that the authorities launched an investigative exercise on February 25, 1989, which established that the Sulfuric Acid plant had developed problems leading to a release of toxic gases into the atmosphere.

"On March 8, 1989, a joint inspection was carried out and established (that) a fertilizer plant had been installed at the premises and was not known to the authorities. It was also contributing to air pollution;" the paper's reported.

"Sulphurous gases were leaking at the old and new acid plants and the management was urged to stop the air pollution." Many screening exercises at the factory and the environs established that complaints by Makongeni residents had some element of truth. The factory was revisited on June 5, 1989, (The World Environmental Day) and asked to take environmental matters seriously.

But continued to be received from various quarters and this included two officials of the St. Mulumba Catholic Parish on June 13 and 14, 1989. This went on until February 11th, 1991 when a joint inspection was carried out and the recommendations made which were required to be implemented in 14 days.

This, however, was not to be and things reportedly got worse on the nights of March 21 and 22, 1991. The factory inspector it closed. A committee chaired by the Kiambu Environmental Officer Nakhali Wa Opembe was charged with the responsibility to look into the Makongeni resident's complaints against the factory, first raised in 1986. At one of the meetings of this Technical Evaluation Committee, the labour Ministry's, assistant Director (now director) of the Occupational Health and Safety Services, Mr. H. A. Onyolyo, said that the factory had been re-opened in 1986 "before complying with all recommendations of the residential probe technical committee". Other government sources said the factory was re-opened then due to the importance of its products, especially in water treatment chemicals.

An inspection team established that the company had installed an incomplete acid production plant, which had not incorporated a pollution control system (Sunday Nation May, 28 1991). The closure order, which was handed over to the factory manager at 10.30, A.M. by Mr. Onyolyo preceded an inspection, which established that: -

1. The new acid plant had severe gas leaks due to corroded materials and that the emission of fumes through the chimney indicated the release of toxic gases.

2. A government analyst confirmed fears that a Sulphur pond near the factory's entrance contained acidic effluent and was drained by a series of open trenches.
3. The fertilizer unit continued to emit huge amounts of dust in the working environment and the neighborhood posing danger to the employees and nearby residents.
4. Noise from the fertilizer plant had reached unpleasant/intolerable levels. This noise could be heard nearly a kilometer away at night. (Daily Nation March 26, 1991).

The inspection report had the following short-term recommendation to be fulfilled immediately and without fail: -

1. Correct the dumping situation the company had encouraged in the surrounding area:
2. An explanation why a Sulphur storage shed was converted into a fertilizer manufacturing plant without the approval and licensing procedure by either the Thika Municipal Council or the Ministry of Labour (or Commerce for that matter); and
3. That the management institutes immediate remedial steps to overhaul all worn out parts in the factory's plants. (Daily Nation March 3, 1991).

THE KEL FACTORY IS TEMPORARY CLOSED

As expected, following this closure order, high level communication channels were set into motion between the firm and senior government officials in the Ministry of Labour and the Provincial Administration to have the factory opened. It is not very clear what actually transpired but a statement by the Central Provincial Commissioner Victor Musoga after an inspection tour of the company premises gave some insight.

Mr. Musoga said any attempts by the KCL management to have the factory re-opened through the use of "backdoor" means would not be condoned for this had proved hazardous to the lives of thousands of residents in Thika and to the environment (Standard May 4, 1991). Did this imply that there had been other situations when the

authorities were prevailed upon to keep the factory open even though there was overwhelming evidence to the contrary?

Noting that the firm had been given ample time to put its house in order, the PC said the KCL management had opted to ignore the recommendations by the Kiambu environment Technical Evaluation Committee, thus leading to its closure. He vowed that the company would remain closed until it complied with the conditions set.

The PC's warning indicated the level of KCL's political patronage. Incidentally, certain events and remarks made only two weeks after Musoga's firm assertion only went ahead to prove that there was a certain amount of high-level patronage that KCL enjoyed. This statement is given the background that it had earlier taken a presidential order to have matters to do with KCL investigated and this notwithstanding; the factory was re-opened (1986) before "complying with all recommendations".

As I said earlier, let's look at events, which took place barely two weeks after, the PC's assurance that KCL will remain closed until it fully complies with recommendations put before it.

There was a "premature" lifting of the production ban imposed on KCL. This was done on May 16, 1991. This order apparently came from the Ministry of Labour's factory inspectorate department, only to be revoked 24 hours later by the Thika District Officer (1) "after consultations with higher authorities".

What however are of interest are statements made during this very volatile period. Allegations and counter-allegations were made. When interviewed by the Sunday Nation the Permanent Secretary in the Ministry of Labour Mr. Jonathan Birir said, "The Company was closed for infringing the Factory's Act and the management had fulfilled the requirements up to a certain point...after that, the order to re-open was given in accordance with the Factory Act. It was not my directive but an application of the Act."

The Director of the department, Mr. Stephen Kiara sided with his boss at NSSF House. He said: "The order to close the factory was made under the Factory Act and we have lifted the order under the same Act": As far as the Act is concerned, they (KCL Manage-

ment) have fulfilled the requirements" What raised eye brows further is that these two very senior Ministry of Labour Officials claimed that they were not aware of the committee sitting in Thika to evaluate the complaints lodged by the area residents against KCL.

This became clear because the two were very quick to mention an ambiguous authority like the Factory Act for the shoddy work they had done by lifting the ban pre-maturely. The order to close the KCL factory was issued by a senior Factory Inspector after a thorough investigation into the factory operations and was done in the presence of learned peers. Mr. Onyolyo's actions could not have been malicious but the actions of his bosses characterized arrogance and total lack of common decency in the management of public affairs.

For both Mr. Birir and Mr. Kiara to say that they were not aware of the operating committee and the work it was doing in Thika is either the height of ignorance or just lack of seriousness on the part of these public servants, this is because, Mr. Onyolyo, as Mr. Kiara's assistant and technical man, sat in that committee. So, is it that Onyolyo never used to report to his boss on his activities in Thika? Is it that Kiara did not use to brief the PS accordingly on the workings of his department in Thika? What do these officers want us to believe?

Kel Chemicals Limited factory, remained closed in May. However, according to the acting Kiambu DC Francis Ongaki, the plant was set to re-open on June 11. He noted that the Technical evaluation officer was satisfied with the amount of rehabilitation work the KCL management had instituted and that the threat to the environment and the lives of Makongeni residents was brought down to an acceptable level.

While addressing a public baraza convened in Makongeni to assure the estate's residents that all was well, Mr. Ongaki vowed that the government would not hesitate to close down the factory or any other in Thika or elsewhere that violated the environment pollution control regulations. "We want development not destruction," he asserted.

To show the level of resentment to the factory, a group of Makongeni residents led by their clergy were up in arms over the announcement that the company was to be re-

opened. They petitioned the Central Provincial Administration and went further to request the Kiambu DC to issue them with a license to demonstrate against the company and the re-opening of the KEL factory, which was denied.

Things did however settle down to an uneasy co-existence between the factory and the Makongeni estate residents. The factory was opened and the residents responded by complaining about the recurrence of their ailments. They said the contentious smell was back. Workers in the nearby KTM were also up in arms and the management of this company complained to the Thika divisional administration over gaseous effluent from the KCL factory.

All hell broke loose in September 11, 1991 following a mass demonstration organized by me in Makongeni estate. We were widely covered by the local press. I led over 2,000 parishioners in a peaceful march from the church to the KCL factory along the Thika-Garissa road. The placard waving and crucifix bearing demonstrators took the authorities by surprise and before they could galvanize themselves into action against the demonstrators, the whole affair over the issue of KCL were thrown right back on to the media headlines. I argued that all their complaints about the chemical factory had fallen on deaf ears. I had gone on a two day fast to try and draw attention of the government on the plight of the Makongeni Estate residents. While holding an emotional mass at the gates of the factory. I (accompanied by Fr Gregory Macharia and Deacon Mike Owuor) charged that the authorities had signed a death warrant for 65,000 residents by re-opening the factory (Daily Nation August 16, 1991).

In my sermon, I also took issue with the numerous social evils that existed in Kenya then and said Thika residents went without essential services while they paid service charge; that it was not fair for Makongeni residents to live right next to a garbage dump commonly known as Kangoki. I vowed to fight to the bitter end. On my agenda was also demonstration against the then Minister for Transport and Communication (now Education Minister) Joseph John Kamotho over a 65 acre plot allocation to a company the he had interests in (Kenya Times, September 17 1991).

My seemingly loaded agenda made many quarters accuse me of harbouring ulterior motives in my advocacy against the factory...many politicians accused me of using the

Kel saga to further my political ambitions. The chairman of KCL was on record claiming that my political ambitions were well known. However, I will take a closer look at the divergent opinions elicited by the KCL saga. Now I will turn our attention to the contentious chemical process at the Thika factory.

THE MANUFACTURE OF SULFURIC ACID

Sulfuric acid is a colourless, odourless and highly corrosive liquid. It is a chemical with a lot of industrial importance and its per capita consumption is an indicator of the level of industrial activity taking place in a country. It has got varied uses which include, petrochemical industry, oil refining detergent and soap industry, battering manufacture and food industry to mention but a few.

There are two processes through which sulfuric acid is manufactured in commercial quantities. These are the low obsolete chamber process, which we shall not look into, and the commonly used contact process. Here the acid is got from elemental sulphur, which is either mined or recovered from the oil or natural gas deposits. At the KCL facilities in Thika, it is the contact method, which is used. (Kenya Times, August 20, 1991)

The gaseous products essential in the contact process are also the contentious fumes of environmental and human health concern if not handled properly. Firstly, sulphur is burnt in the presence of air (oxidation process) to produce a gaseous oxide of sulphur, sulphur dioxide (SO_2). This gaseous oxide is further oxidized (at high temperatures and in the presence of air) to form the trioxide compound, sulfuric trioxide (SO_3) i.e. an extra atom of oxygen is added to the sulphur dioxide.

This final oxidation process has its efficiency enhanced if it takes place in the presence of a catalyst (that compound that enhances the rate of a chemical reaction on the efficiency of a process while it remains largely unaltered). For the oxidation of sulphur dioxide gas in water or in a solution of concentrated solution of the acid commonly called "fuming sulfuric acid", because the acid literally fumes.

As I have said earlier, it is these gaseous products, sulphur dioxide and sulphur trioxide in the manufacture of the acid, which are the contentious ones if not handled properly.

Depending on the efficiency of the plant, not all the sulphur dioxide is converted to the trioxide also, not all the trioxide will be converted to the acid. At the same time, it is nearly impossible to confine the gaseous products to the process chamber. Some trace quantities do escape.

Another factor, which makes this, battle of the management of gaseous products a difficult one is, the corrosive nature of sulfuric acid. The acid eats away on pipes and tanks and weakens their seals considerably. These weakened containers and pipes are the likely escape routes for the gases.

At the same time, traces of the sulphur dioxide do react with water vapour in the atmosphere or in the piping to a relatively weak acid, sulphurous acid, this may in turn help to corrode the pipes and other metallic parts and enhance the escape of the gases, sulphurous acid being an inherently weak acid, does dissociate to release sulphur dioxide and water when exposed to atmospheric conditions.

Mined sulphur is always contaminated with traces of arsenic compounds. When the sulphur is combusted in air, arsenous oxide gas is released into the atmosphere. This is classified as an asphyxiating gas - those that replace oxygen transfer in the lungs, transport in blood and utilization in tissues. It's however not a proven fact that the sulphur used at KCL factory is not contaminated with arsenic whose product of combustion, arsenous oxide, is lethal even at very low quantities both the management at the factory and the OHSS personnel had agreed that it had never occurred to them to test the Sulphur for arsenic compound contamination. (Weekly Review October 11 1991).

According to the Institute of Occupational Health in Helsinki, Finland, workers in the following industries are exposed to toxic fumes and gases. These are chemical manufacture, glass works, ceramic manufacture, smelting, oil refining, welding plastic works, digressing, mining, electroplating, bleaching, embalming, fumigation, tanning, oil prospecting, farming and sewage treatment (Kenya Times, August 20, 1991).

The gaseous products from KCL factory (Sulphur dioxide and Sulphur trioxide) are highly soluble in water. They are categorized as irritating gases. They are referred to

internationally as "undesirable pollutants in air". Their capacity to irritate is enhanced by their solubility in water. Sulphur dioxide reacts with the water's of the rich mucous membranes of the respiratory system and the eyes, causing extensive irritation and burning (Kenya Times, August 20 1991).

At the time when Makongeni residents' complaints heightened, many had burning sensations in their eyes, noses and the rest of the respiratory tract. There was little evidence that the irritating ability of these gases could also be felt on the skin. Private doctors who examined patients said gas poisoning close to those caused the symptoms displayed.

THE PUBLIC REACTION TO THE KCL SAGA

Kenyans reactions to the KCL Factory controversy were varied. The politicians and the administration officials reaction was typical, stack-in-the-trade and shop-worn in those days of monopolistic autocracy. Then, dissent of whatever form was not entertained. Phrases like "He is in the payroll of our political enemies", "these are disgruntled elements were quite common. In fact, on numerous occasions, those who championed the KCL issue were said to harbour a "hidden agenda" by both the politicians and the administration officials.

On the other hand, it was apparent that those who formed the Kiambu District Environment Committee (DEC) or its Technical Evaluation Committee were never in tune with each other for a greater part. This lack of cohesion in the committees paralyzed their activities, leading to intervention from "higher authorities" to gauge them in action or make a binding decision.

As the controversy grew to unprecedented proportions, it became apparent that this lack of working protocol was crippling the DEC. At one point when the officers from the OHSS department were supposed to collaborate with those from the Ministry of Health to carry out the screening exercise, they refused saying that they were going to do their own survey. The situation was only saved when certain members of the DEC pulled ranks on the Labor officials. (Kenya Times, August 20, 1991, and August 23, 1991).

The bitter acrimony within the DEC and its technical wing was aggravated by what certain officers called a superiority complex by the OHSS officers who on a number of occasions had called their colleagues in the Ministry of health and public health departments "laymen" and had nothing to offer to the screening exercise. There was also deep rooted suspicion that Labor Ministry department was colluding with the factory management and those Criminal Investigation Department offices were hot on their trail. (Kenya Times, August 23, 1991)

The principal opponents of the KCL factory in Thika were the local Catholic Church through the Kenya Episcopal Conference (KEC) and its St. Mulumba and St. Maria Magdalene Parishes. The fact that they took up other social issues during their protest march e.g. illegal allocation of commercial plots in Thika, arbitrary price hikes, inflation, pitted them squarely against the establishment. I also accused the then Juja MP and Research Science and Technology Minister George Muhoho of ignoring the plight of his constituents.

This left me open to attack from almost all quarters. The then Thika Mayor, Douglas Mundia said that the whole Catholic Church and I harboured a "hidden agenda" in our pursuit of the factory's closure. At one time, he even accused the Church of being out to "incite the people" of Thika against the established order. He threatened to take stringent action against the Church, which came to nought by the end of his term of office as the Mayor.

Mr. Ngugi accused me of propagating lies and misleading my flock by pursuing issues, which had nothing to do with my spiritual calling. In response, I pledged never to abandon my Parishioners, especially at a time of need. I swore to battle to the bitter end. Ngugi added that it was obvious that I had taken up the KCL crusade so as to bolster my chances winning political seat in the area. He noted that all knew my political ambitions and that I was aiming at the 1992 general elections.

It would be interesting to note the Nairobi based United Nation Environment Program (UNEP), and many of the environmental Non-governmental organization operating in Kenya did not raise a finger. The only notable exception was Prof. Wangari Maathai, the founder and Co-ordinator of the Greenbelt Movement.

She accused the government of abdicating its primary constitutional duty: protection of all the lives in Kenyans. She said the company's secretiveness proved it had something to hide to Kenyans. She also sought to know why its management refused to reply to her earlier enquiries in writing but instead opted to talk to her on phone (The Standard October 10, 1991).

Others who joined in on the fray included the Central Province branch of the Central Organization of Trade Unions (COTU) through its vice chairman, Mr. J.K. Muthama, who threatened to lead a mass protest of over 70,000 of his members against the factory. He said his branch could not sit still while some of their members (in KCL and those living in Makongeni Estate) were in trouble.

Mr. Muthama and employee of the Kenya Post and Telecommunications Co-operation were arrested in the predictable move by the government to muzzle any form of opposition. Two of his associates, Chairman Mukuhe Kiragu and assistant secretary Erustus Kioni were interrogated and made to write statements on the proposed demonstration. The latter two, upon their release, issued a statement disassociating themselves from the proposed demonstration (Daily Nation, October, 10 1991).

The media which had been carrying the KCL stories from the onset, was also no spared the attacks. Prompting the then Thika DO (1), Mr. Omweno, noted that to accuse the dailies of reviving a 'dead' issue. He accused the press of highlighting 'trivialities'. Mayor Mundia was more blunt. He humiliated a Kenya Times correspondent based in Thika, Mr. Dan Kitheka, during the 1991 Moi Day celebrations and accused him of writing "bogus" stories even without checking his facts". In a display of emotions not befitting his office, he dismissed Mr. Kitheka as a "liar". (Kenya Times, October 11, 1991; Daily Nation, October 11 1991).

Mr. Ngugi on his part dismissed press reports as lies, saying his firm was in the process of taking legal action against the Kenya Times and their staff Science writer/Reporter, Michael Otieno. He said if his firm were absolved by the December, then they would go ahead and sue the two for fabricating stories against KCL, (Kenya Times, October, 14, 1991).

The most inspirational support for the residents of Makongeni Estate came from the Catholic Justice and Peace Commission of the Kenya Episcopal Conference. A statement signed by the commission chairman Bishop John Njue said: "The commission registers its solidarity with the community of St. Mathias Mulumba Parish and those living around Makongeni Estate, Thika, in their stand against toxic fumes produced by Kel Chemicals" (Daily Nation, October 12, 1991, Kenya Times October, 12 1991).

In their pastoral letter of September 27 1991 the Catholic, Bishops called on the government and all concerned to protect the environment against pollution. They insisted that being the home of UNEP, Kenya must prove to be a worthy home for the International body. In his communiqué, Bishop Njue challenged UNEP to come clean in the saga, while also raising fears of a "streak of corruption in the factory management to ensure that the people of the Estate continue to suffer at the expense of foreign exchange". (Bishop John Njue, October 11, 1991)

Apart from these comments from official sources and personalities, the mailbox column in the local press carried endless letters of people expressing their concern at the plight of the people affected in the whole controversy. Some called for the outright closure of the company since they claimed that not all the 65,000 strong population in Makongeni Estate would be lying by saying that they felt that their health was being affected by emissions from the company.

THE REPORT

The government continued to be under intense pressure to act decisively on the KCL saga from the Church, Makongeni residents, the press and other well wishers. And as the month of August came to an end, the Kiambu DC Samuel Oreta announced that a team of medical doctors from Nairobi would carry out a screening exercise on Makongeni Estate residents and others working at the KCL factory and the other neighboring plants.

What's of interest is that most of government moves against the Thika factory have not been borne of a necessity to manage, monitor and be the ultimate but actually due to pressure from all manner of quarters. It's difficult to explain how certain senior

government officers could say that there was nothing wrong with the company's operations while people in the neighborhood were complaining. The actions of these officers are further confusing when they take an about turn when pressure gets too much for them to bear.

This final announcement to have people screened on August 24 at Kenyatta primary school, in Makongeni, came after a protracted war of words, threats and fears of widespread lawlessness within Thika Municipality. Earlier that week, I had threatened to convene a mass meeting of all the priests in the Nairobi Archdiocese (also covering Thika). One can only imagine the amount of emotional outburst this kind of meeting could evoke. On the weekend preceding Mr. Omweno's announcement, St. Mulumba and St. Maria Magdalene parishes had threatened to hold another demonstration against KCL factory.

To further dilute the screening exercise and throw it further into announcement by the OHSS department staff detailed to carry out a joint examination exercise with personnel from the Ministry of Health and Public health departments, that the officers from Health Ministry were laymen when it came to occupational health and thus had no business joining in the exercise.

This showed how the government departments were disorganized and the total lack of political will in settling the KCL problem once and for all. One would have expected at least the affected Ministries could have come together, diagnose the problem then chart out an appropriate plan of action or a protocol, which would help them, dissect the problem and hopefully come up with a solution. Instead, what did these otherwise senior government officers do? They just landed in Thika and proceeded to screen those who presented themselves.

This lack of protocol made it difficult for the screening exercise to weed out those undesirable people who did not have genuine complaints to make. There were cases where people's complaints had absolutely nothing to do with gaseous emissions for the KCL factory. There was a lady who was splashed on the Kenya Times front page (Kenya Times. August, 25th 1991) who I have come to learn from very authoritative

medical sources that she actually suffered for a parasitic infection complication with a serious medical problem and had actually nothing to do with emissions from KCL.

A censure by a weekly review article (October 11th 1991) titled "A questionable verdict" was quite in order. I also believe that this lack of protocol in the enquiry by the government would have grossly affected the results of the screening process and probably compromised the case the Makongeni residents had.

After a lot of acrimony, protest and war of words in the press, the government, through the central province provincial administration, admitted publicly that the results of the screening work at the factory and the surrounding area had indeed been handed over to them and was still being perused. In a press interview (Kenya Times, December, 21 1991), Mr. Musoga said the report had been handed over to the government and could reveal the actual date when the report will be made public. The Justice and Peace Commission asked the PC to release the report as a matter of "Utmost urgency".

Bishop Njue, a letter to the PC dated December 20 charged that the government must have only instituted the screening exercise "to quieten the people of Thika but no steps were meant to be taken against the Thika factory. When he charged that there was a conspiracy not to release the contents of the report, I threatened to lead another demonstration if the results were not released.

Musoga yielding to the intense pressure and directed the Kiambu DC to release the report on January 20 1992. The report, titled "Interim report of the Environmental and medical investigations carried out in and around KEL Chemicals Limited Thika" was dated November 1991. Its preface indicted that the Kiambu Environmental committee adopted it on November 11, 1991.

This was of course misleading because the report was formerly adopted on January 24 1992 following a marathon meeting of the DEC convened 10 weeks following the date appearing on the report. To show their disgust and lack of confidence in the document, the Catholic Church boycotted the meeting, chaired by Mr. Musoga, which unanimously adopted the report. (Kenya Times, January 25, 1992 Daily Nation, January 25, 1992, Standard Newspapers, January 25, 1992).

The representation of the church by Deacon Peter Kiarie and lay leader Charles Gakori irked the PC prompting him to claim that the Church was not sincere in its involvement in the controversy. He threatened to deal firmly with any form of dissent from Thika resulting from the KCL issue.

The 25-page document absolved the KCL factory of most of the accusations leveled against it. It gave the company a clean bill of health by saying that the emissions from it were well below the WHO recommendations of two parts per million. The report recommended that there should be constant monitoring of sulphurous gas emissions throughout the country to help monitor any levels, which may be injurious to the public. They also called on KCL to have a positive attitude while handling matters on air pollution.

The report dismissed complaints by Makongeni residents who presented themselves for screening. It said these persons were "just hostile about anything to do with the factory" and that their investigation revealed that the residents were not genuine. However, the committee ties itself up by saying its work was not conclusive and that its report should be treated as interim documents for, they followed a method not recommended by the WHO.

And it still remains interim; I do not see the government coming up with a final report on the KCL factory issue in the near future.