ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

INDUSTRIAL WASTE AND URBAN COMMUNITIES IN ADDIS ABABA: THE CASE OF AKAKI KALITI AND KOLFE KERANIO SUB CITIES

By

Selamawit Kifle Ayele

July 2008
Addis Ababa

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
PUBLIC ADMINISTRATION AND DEVELOPMENT MANAGEMENT

INDUSTRIAL WASTE AND URBAN COMMUNITIES IN ADDIS ABABA: THE CASE OF AKAKI KALITI AND KOLFE KERANIO SUB CITIES

A Thesis submitted to School of Graduate Studies of AAU in Partial Fulfillment of the Requirement for the Masters of Art Degree in Public Administration and Development Management

By

Selamawit Kifle Ayele

July 2008
Addis Ababa

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
PUBLIC ADMINISTRATION AND DEVELOPMENT MANAGEMENT

INDUSTRIAL WASTE AND URBAN COMMUNITIES IN ADDIS ABABA: THE CASE OF AKAKI-KALITI AND KOLFE KERANIO SUB CITIES

BY
Selamawit Kifle Ayele

Approved By Board of Examiners

Advisor

_____ _____

External Examiner

_____ _____

Internal Examiner

_____ _____

TABLE OF CONTENTS

Acknowledgements ……...……....v
Acronyms……vi
List of Tables…….....vii
List of Figures …….....viii
Abstract …….....ix

Chapter 1 Introduction…….....1
1.1 Research Background…….....1
1.2 Statement of the Problem…….....3
1.3 Research Question & Objectives…….....4
1.3.1 Research Questions …….....4
1.3.2 Research Objectives…… ……....4
1.3.2.1 General Objectives……. …….....4
1.3.2.2 Specific Objectives……. …….....….....4
1.4 Significance of the Study…….....5
1. 5 Scope of the Study …….....5
1.5.1 Selection of sub cities in the study…….….....5
1.5.2 Selection of industries in the study…….....….6
1.6 Methodology……6
1.6.1 Research Design……...…….…...6
1.6.2 Sampling Techniques & Sampling Size……..7
1.6.2.1 Selection of the households……7
1.7 Limitations of the research…….....9
1.8 Methods of Data Collection……..9
1.8.1 Primary Data Collection……9
1.8.2 Secondary Data Collection……10
1.9 Methods of Data Analysis ……10
1.10 Organization of the Study……10

Chapter 2. Literature Review……11
2.1 Manufacturing Industry……11
2.1.1 Definition of manufacturing industry ……11
2.1.2 Processes of manufacturing industries……12
2.2 Industrial waste……12
2.2.1 Definition and Types of industrial waste ……12
2.2.2 Sources of industrial waste……..…14
2.3 Industrial waste management……..…15
2.3.1 Definition of industrial waste management……15
2.3.2 Methods of industrial waste management ……..15
2.3.2.1 Industrial waste diposal methods ……...15
2.3.2.2 Industrial waste recycling methods …….....17
2.3.2.3 Industrial waste avoidance and reduction methods……17
2.3.3 Practice of industrial waste management……18
2.3.3.1 Developed countries……..…...18
2.3.3.2 Developing countries…….....19
2.3.4 Problems /challenges in industrial waste management …….....20
2.4 The impact of industrial waste of health …….….21
2.4.1 The effects of air pollution on health……...21
2.4.2 The effects of water pollution on health……..22
2.4.3 The effects of land pollution on health……23
2.5 Policy issues in industrial waste management…….…...24
2.5.1 Regulatory body……24
2.5.1.1 Licensing and registration body……...24
2.5.1.2 Environmental protection body……25
2.5.1.3 Public health body……27
Chapter 3. Presentation of Findings ……..29
3.1 The industries selected for the study and industrial waste management…….30
3.1.1 Profile of industries……...30

3.1.2 Industrial waste management by the six industries……...30
3.1.3 Challenges faced by the industries for not managing their industrial waste properly……..31
3.1.4 Households' reaction to waste management by the industries……..…32
3.1.5 Opinions of the management of the industries on their waste management and disposal...…….……...32
3.2 Trade registration and licensing of industries and waste management…...……34
3.3 Environmental Protection Authority and industrial waste management……36
3.4 Industrial waste and health by Ministry of Health and health centers…….39
3.5 Opinions of farmers at *Tinishu* and *Tiliku* Akaki River banks……...…43
3.6 Responses of the community on industrial waste……....44
3.6.1 Individual characteristics and background data of respondents……..…44
3.6.2 How long did respondents live in their residence?.....47
3.6.3 Data on industrial waste management practices by the industries……47
3.6.4 Time industries use to dispose their wastes……..……49
3.6.5 Industrial waste and health of the community……..50
3.6.6 Complaints of the communities on the industries……54
Chapter 4. Data Analysis and Interpretation……..…60
4.1 Factors which increase the harmful effects of industrial wastes on community……....……60
4.1. 1 Individual characteristics and background data of respondents……..…..60
4.1.2 The prevalence of industrial wastes for long period of time…….....61
4. 2 Industrial waste management practices of the selected industries……..……62
4.2.1 Data collected from the industries……....…62
4.2.2 Opinions of the residents living adjacent to the industries…….…..64
4. 3 Health and industrial wastes……...…65
4.3.1 The use of the water bodies/ waste water by the community…….....65
4.3.2 The condition of polluted land for plant growth and for health…….….66
4.3.3 Health problems of the respondents……....67

4.4 Complaints of the community on industrial waste disposed from the selected industries……....69
4.4.1Where did the communities put their complaints.....70
4.4.2 Actions taken by the respondents ……...…..70

Chapter 5. Conclusions and Recommendations…….…..71
5 .1 Conclusions……..…….……71
5.2. Recommendations……..…74
Bibliography…….. ……..……..77

Appendices
Appendix I- Questionnaire
Appendix II- Focus Group Discussion Questions
Appendix III-Basic Interview Questions
Appendix IV- Forms (Licensing and registration)
Appendix V- List of interviewees and focus group discussion participants

ACKNOWLEDGEMENTS

I am grateful for God and the people who have helped me in my past and present achievements. My parents, my sisters and brother are on top of others who deserve to be thanked. The success I have attained is really not mine alone; rather it is also of those who are always there for me in every aspect I needed help. In order to make this paper successful my Advisor Dr Tegegne Teka has provided his unfailing effort and advice. The staff of Kolfe Keranio and Akaki Kaliti sub cities at different responsibilities has given their unreserved support. Especially W/o Genet and Ato Kifle from Kolfe- Keranio sub city and Ato Yoseph, Ato Kidane and Ato Philipos from Akaki-Kaliti sub city deserve a special word of thanks. In addition, the staffs and management of the offices I made visits to need to be thanked. Last but not least, I want to thank the School of Graduate Studies for providing me with financial support for this research.

ACRONYMS

EPA	Environmental Protection Authority (Ethiopia)
WHO	World Health Organization
UNIDO	United Nations Industrial Development Organization
WWTP	Waste Water Treatment Plant

LIST OF TABLES

Table 3.1: Profile of industries……... 30
Table 3.2: Industrial waste management methods…….…....31
Table 3.3: Complaints of residents on the industries……...32
Table 3.4: Actions of the industries against complaints…….....32
Table 3.5: Individual characteristics and background data of respondents…….....45
Table 3.6: Time respondents lived in their residences…….…..47
Table 3.7: Industrial waste management practice from the view point of the respondents……...48
Table 3.8: Types of industrial wastes……...…48
Table 3.9a: Do industries use special time to dispose their wastes?.....49
Table 3.9b: Special time industries use to dispose wastes …….….50
Table 3.10: Respondents' use of waste water …….....50
Table 3.11: Quality of water bodies …….....50
Table 3.12: Suitability of the land for plants …….....51
Table 3.13: Health problem of respondents ……....51
Table 3.14: Frequency of going to medical centers…….....53
Table 3.15: Respondents' opinion on the health problems of the communities…….….54
Table 3.16: Complaints made by respondents on the industries ……..55
Table 3.17: Actions taken by respondents after their first complaints……. ……..56
Table 3.18: Respondents' opinion on siting of industries…… …...57
Table 3.19: Failure of industries to properly manage their wastes……. …….....58
Table3.20: Respondents' opinion on Environmental Protection Authority……...58
Table 3.21: Respondents' opinion on the responsibility of Ministry of Health……59
Table 4.1: Health problems due to pollutions……. ……67

LIST OF FIGURES

Figure 1: Industrial waste disposal in the six industries…….…... 31
Figure 2a: Time spent by male respondents per day…….....46
2b: Time spent by male respondents per day……..…46
Figure 3: Industrial waste that affect the community……49
Figure 4: Health problems of respondents…….……....52
Figure 5: General health condition of respondents……53

ABSTRACT

Most industrial establishments in Addis Ababa discharge their wastes into the nearby rivers or on open spaces. The urban communities, who live adjacent to industries, face health problems due to industrial wastes. The study took two sub cities in Addis Ababa region. These are Akaki kaliti and Kolfe Keranio sub cities. In these sub cities the industries which are known by EPA for polluting the environment were selected. From Akaki Kaliti Sub city: Akrem Metena Animal Feed Factory, Kaliti Food SC, Akaki Metal Products Factory and K.K Textile Factory and from Kolfe Keranio Addis Ababa Tannery and Gulelle Soap Factory were selected.The general objective of the research is to assess the extent of the industrial waste problem on urban communities. Literature states that the proximity to the source of waste generation increases the risk of being affected by industrial wastes.

The findings of the research revealed that all the industries use industrial waste disposal systems, more specifically open and ocean dumping. Recycling or waste treatment systems are used by 33 percent of the industries. No industry uses waste avoidance or reduction methods. The licensing and registering bodies including Ministry of Trade and Industry at different levels and Ethiopian Investment Agency do not have siting criteria applicable in the placement of industries. Environmental Protection offices are not actively involved in controlling and regulating the industries which are polluting the environment due to industrial wastes. Ministry of Health did very little with respect to industrial wastes. On the other hand, the communities are affected by the industrial waste problem. Most respondents have respiratory diseases, cough, diarrhea, and eye problems. The day-to-day lives of the community are affected by pollution as a result of industrial wastes. The community had put complaints to different bodies including the sub city's top management, the sub city's Environmental Protection offices, the *kebeles* & industries.

To solve the industrial waste problem, coordinated effort of all involved is required. Awareness creation task should be done by Environmental Protection Authority and Ministry of Health. Siting criteria needs to be designed and implemented. Measures should be taken on those industries disposing untreated wastes on open spaces and/or water bodies. Coordinated effort would only work if those involved are aware of the problems and the solutions suggested.

CHAPTER ONE

1. INTRODUCTION

1.1 RESEARCH BACKGROUND

Economic growth of a country is a function of various activities, one of which is the development of industries. Industrialization is a primordial strategy for economic growth. However, paradoxically, industries are contributing to the loss of the well-being of society and are one of the causes for society's health problems. In principle, development activities of a country are meant to make the lives of citizens better off. But if the benefits people get out of development activities such as the development of industries is overwhelmed by the problems they face, it is considered as undesirable to society.

The generation of waste as an integral part of the manufacturing process was described by Drake et al (1972:357), 'Every activity involved in the generation of material goods for the survival and needs cause the production of waste residuals'. Industrial wastes, when released from industries without proper management, pollute air, water and land. For survival, human beings need air, water and land. However, when air, water and land are polluted; society's safety and health are affected. The following discussion is on health effects of industrial waste.

The national library of medicine in the United States, Pub Med (2008) stated, 'Assessing the health effects posed by hazardous waste sites in the United States, the Agency for Toxic Substances and Disease Registry (ATSDR) has identified seven groups of health effects most common among populations living in the vicinity of waste sites. These are: birth defects, cancer, immune function disorders, kidney and liver dysfunction, lung and respiratory diseases and neurotoxin disorders'. Neurotoxin is nerve poison, (ISCID Encyclopedia of Science and Philosophy, no date).

Though developed countries generate larger amounts of industrial wastes, they have the awareness and technology to manage their industrial wastes. According to St. Mary's University College [SMUC] publication on Environment and Development (2007:49), 'In developed countries control legislation has tightened in recent years'.

Contrary to this approach, (SMUC, 2007:55) wrote, 'As developing countries struggle to rehabilitate and strive industries to gainful capacities, pollution problems have crept in. In particular, pollution from solid waste has grown to pose hazards to health and life support capacity of urban systems. The danger of pollution is made worse because many industries are relatively small, without capacity to manage even their own wastes'.

In Ethiopia, the problem of industrial wastes is not properly investigated because of lack of awareness and technology. Mohammed (2002:39) described, 'Ethiopian industries are often located in areas such as the peripheries of large cities and towns, where the surrounding population uses untreated water from rivers for domestic purposes and other uses'. Moreover, Mohammed stated that 'The harmful industrial waste liquids when mixed with rivers and streams endanger public health through the uses as well as through feeding with fish that live in the polluted streams'.

Nowadays, even if books, articles, reports and other resources addressing industrial waste problems are available, most of them are written in the context of industrialized countries. The realities of the industrial waste management in the industrialized countries are different from developing countries like Ethiopia, but the health damages in society could more or less be similar. Therefore, this research which is conducted on industrial waste and its impacts on urban communities could help in generating new information to the City Government, local urban administration, the industries and Ethiopian Environmental Authority. It will also show that the safe living of the urban communities has been affected by industrial waste.

1.2 STATEMENT OF THE PROBLEM

The Location Assessment Report of Processing, Manufacturing and Health Care Industries (2006: 1) states, 'In Addis Ababa there are more than 500 processing, manufacturing and health care industries that are more than 65 percent of the country's industries. Since the majority of the industries are in Addis Ababa, they have significant negative and positive impacts in terms of socio-economic, political and environmental aspects of the city dwellers'. One of the negative impacts in the development of industries is the problem of industrial wastes. The industrial waste problem is increasing with the increase in the number of industries.

The industrial wastes in the Region of Addis Ababa are affecting the well-being of society. According to (Ethiopian Environmental Protection Authority [EPA], 2007:1), 'Manufacturing industries in Addis Ababa release 90 percent of their waste products to the atmosphere and water bodies without proper treatment. The manufacturing industries simply discharge waste products to the surrounding area instead of institutionalizing proper management and recycling systems'.

The EPA (2006:2) report also stated that 'In the 1992 to 1994 Waste Water Facility Master Plan Project of the country, it was reported that out of 70 factories 56 or 80 percent were dumping their untreated wastes into nearby water courses and urban streams'. The impact of industrial pollution according to the report '… appears in air, water and land'.

The rationale for the study is to find out how industrial wastes are affecting the urban communities in Addis Ababa. The study areas selected from Addis Ababa are Kolfe Keranio and Akaki Kaliti sub cities for having industries with problems of industrial waste management. Consequently, the industrial wastes affected the safety and health of the community for years. The communities found close to Akaki Metal Products Factory, K.K. Textile Factory, Akrem Metena Animal Feed Factory and Kaliti Food SC from Akaki Kaliti Sub City and Addis Ababa Tannery and Gulelle Soap Factory from Kolfe Keranio Sub City are affected by industrial wastes. The research addresses the industrial waste problem as a growing threat to the urban communities. At its present stage, the problem industrial waste is causing on the community is deep rooted. The increase in the number of industries in the city and yet the improper industrial waste management by the industries could make the future gloomy.

Moreover, in Ethiopia where researches are not conducted adequately, the implications of the problem of the industrial waste on the society are not revealed to the magnitude of the problem. This research therefore signifies the necessity of devising proper industrial waste management system by the industries that considers the environment and public health. The right avenue for the development of a country is when it embraces the society.

1.3 RESEARCH QUESTIONS AND OBJECTIVES

1.3.1 Research Questions

The research answers the following questions.

1.3.1.1. What are the responses of the communities affected by the industrial waste?

1.3.1.2. What has been done by the Municipal and the Federal Government to alleviate the industrial waste problems? What are the challenges?

1.3.1.3 What actions have been implemented by the industries to solve the industrial waste problems? What are the challenges?

1.3.2 Research Objectives

The research has the following general and specific objectives.

1.3.2.1 General Objectives

The overall objective of the research is to assess the problems caused by industrial waste on the urban communities and suggest solutions that can relieve the community from the problem.

1.3.2.2. Specific Objectives

The research aimed at meeting the following specific objectives.

i. To assess the extent and severity of the problem experienced by the urban community inhabiting in the localities of the industries.

ii. To indicate the urban community's current use of the rivers, streams and open spaces affected by untreated industrial wastes.

iii. To find out the practice of the industries on industrial waste; how they dispose and treat waste; the extent to which they comply with Environmental Law and Health Policy of the country.

iv. To find out the actions taken by the Municipal and Federal Government to curb the problems of industrial waste on the community.

v. To forward viable recommendations based on the findings of the research.

1.4 SIGNIFICANCE OF THE STUDY

The Federal Constitution of Ethiopia Article44 (1) states that, 'All persons have the right to have a clean and healthy environment'. The study provides some answers to this right in the context of the two sub cities. The importance of such kind of studies is that they raise the level of awareness of the different stakeholders of the industrial establishments. Stakeholders include society, government, industries and so on. If the level of awareness on the impacts of industrial wastes increase, it is possible to live in a clean and healthy environment. The research provides new information on industrial wastes to those bodies which have stake in the environment or public health of the society. Furthermore, the study is hoped to benefit practitioners and academicians who want to conduct further studies regarding the effects of industrial wastes on urban communities in Addis Ababa Region in general and Akaki Kaliti and Kolfe Keranio sub cities in particular.

1.5 SCOPE OF THE STUDY

1.5.1 Selection of the Sub cities in the study

Akaki Kaliti and Kolfe Keranio sub cities are the case study areas for the research. The selection of these sub cities was based on the discussions made with the Addis Ababa Environmental Protection Authority-Environmental Protection and Pollution Control Head. Accordingly, the head explained that in the two sub cities, there are industries causing pollution problems as a result of unsafe industrial waste disposal systems. The intent of the research was also to find out how industrial waste is affecting the well being of urban communities. Hence, the two sub cities were taken as case study areas.

We will now look at the two case studies, i.e. the two sub cities for research.

Akaki kaliti Sub City

Akaki Kaliti sub city is located to the south of Addis Ababa. According to Addis Ababa City Administration (2008), 'The sub city covers an area of 124.7 sq.km. There are 8 *kebeles* in the sub city with the total population of 194,002.' Akaki Kaliti sub city is found in the "industrial zone" of Addis Ababa. According to interview made with the head of Akaki Kaliti Sub City-Trade and Industry Office in December 2007, there are more than 200 industries in Akaki Kaliti sub city registered by the sub city.

Kolfe Keranio Sub City

Kolfe Keranio Sub City is located to the west of Addis Ababa. According to Addis Ababa City Administration (2008), 'The sub city covers 63.25 sq.km. There are 10 *kebeles* in the sub city with population of 261,235'. As per the interview made with the head of Kolfe Keranio Sub City -Trade and Industry Office in December 2007, there are more than 50 industries registered by the sub city.

1.5.2 Selection of the industries in the study

According to the discussions made with Addis Ababa Environmental Protection Authority-Environmental Protection and Pollution Control head, EPA has identified some industries and pollutants from each product category in the year 2001. As a result, K.K. Textile Factory, Kaliti Food SC, Akaki Metal Products Factory and Akrem Metena Animal Feed Factory were major pollutants from Akaki Kaliti sub city. Likewise, from Kolfe Keranio sub city, Gulelle Soap Factory and Addis Ababa Tannery were identified for having industrial waste disposal problems. Moreover, the head explained the fact that many of these industrial establishments are located nearby rivers, particularly in the *Tinishu* (Little) Akaki River, it makes it easy to dispose of their wastes into the river without difficulty. The head confirmed that the problem of pollution by these industries has continued to date.

1.6 METHODOLOGY

1.6.1 Research Design

The research uses the case study approach to examine the six industries selected in the two sub cities in Addis Ababa and whether the industrial waste they dispose into the rivers and open spaces affect the urban communities that live adjacent to the industries.

1.6.2 Sampling Technique and Sampling Size

Determination of the right sample size of the communities was first made on those residents who filed charges against the sub cities in the years 1998 and 1999. But it was later understood that the list was not exhaustive since there were lots and lots of complaints not filed in the sub city. Further more, the complaints made by the community and filed in the sub city are composed of complaints made on a number of industries including those selected for the study and others too. Therefore, basing the sample size on an objective ground was necessary. Literatures explain the fact that, proximity to the generation of industrial waste increases the level of being affected by the industrial waste. This fact was evidenced by the researcher's observation of the industries and their peripheries. It was found out that the production activity of the industries takes place in the backyards of the compounds of the factories. It is where the wastes are generated and therefore, the wastes are discharged from there. Located adjacent to the compounds of the factories, there are urban dwellers that are prone to the effects of air, water and land pollution. The other reason for taking the immediate neighborhood population of the industry premises as sample population was to precisely relate the industrial waste management practices of the 6 industries with the noticeable effects of industrial wastes on the community.

The target populations for the study are the urban communities that live close to the industries and who are affected by industrial waste. In the same token, interviews made with the Akaki Kaliti and Kolfe Keranio Environmental Protection Office team leaders indicated that these residents are victims of industrial waste because of their proximity to the industries.

1.6.2.1 Selection of the households

For the study households in the vicinities of the 6 industries, who live adjacent to the industries, were purposely selected. Literatures indicate that sources of waste generation are the most dangerous places as far as industrial waste is concerned. In addition, the researcher's observation confirmed that industrial waste is most affecting the day-to-day lives of those people residing near the factories where the actual waste generation is taking place. 50 households located in the immediate neighborhood of the industrial premises from each of the industries were selected.

These people are directly affected by every type of industrial waste including air pollution, industrial waste water, and land pollution and they are vulnerable to various health problems. Therefore, the total target population equals 300 households. Out of 300 households 10 percent were randomly selected as sample size of the study i.e 30 households. The count of houses starting from the first house to the last (50^{th}) was given assumed numbers and using lottery method 5 houses were selected from the areas close to the 6 industries. The sample households from Akaki Kaliti and Kolfe Keranio sub cities are 20 and 10 respectively.

The sources for generating data for the study are the following:

i. The survey questionnaire was prepared to gather data from the residents selected from the two sub cities. The questionnaires were administered by the researcher.
ii. The general managers of the two sub cities and team leaders of the Environmental Protection Offices in the two sub cities were interviewed.
iii. Department head of the Addis Ababa Environmental Protection and Pollution Control was interviewed.
iv. Professionals from 2 health centers in each sub city were interviewed.
v. Industries' management at different positions was interviewed.
vi. Interview was held with Ethiopian Manufacturing Industries Association secretary general.
vii. Focus group discussion was held with the Federal Ministry of Health by invoking the Health Policy of Ethiopia of 1993 on industrial waste disposal and environmental pollution.
viii. Interviews were conducted with Ministry of Trade and industry- Trade registration and licensing heads at the federal, regional and sub city levels.
ix. Interview was held with Ethiopian Investment Agency- Trade registration and licensing head.
x. Interviews were held with two farmers from *Tinishu* (Little) and *Tiliku* (Big) Akaki River banks on the use of the rivers for irrigation.
xi. Secondary sources were gathered from the above contacts: professionals, departments, industries, association, urban administration and federal offices.

1.7 LIMITATIONS OF THE RESREACH

The major problem the researcher faced was the shortage of time. This was due to the connection that the research had with different governmental and non governmental bodies. To be exhaustive, the researcher had to reach many of them. For all these, time was not in favor of the researcher. Lack of reference materials was the other problem faced. The materials found were very technical that require in depth knowledge on the areas of chemical engineering though background knowledge of development management has added value on the readings made. The other problem was the untimely provision of funds by the University.

1.8 METHODS OF DATA COLLECTION

1.8.1 Primary Data Collection

i. Survey Method

Survey questionnaires were administered on 30 households. They were administered on a face-to-face basis by the researcher. Before undergoing full scale administration of the survey, pre-testing of the questionnaire was made on five people residing near the backyard of the Gulelle Soap Factory, other than those randomly selected ones. This has allowed for the corrections on the questionnaire made by adding alternatives to choices and rewording of words and phrases.

ii. Interview Method

Through unstructured interview, data were collected from officials in the Environmental Protection offices in the two sub cities who are responsible to regulate the activities of waste disposal in the industries. Interview was conducted with Addis Ababa Environmental Protection-Environmental Protection and Pollution Control Head. Moreover, unstructured interviews were conducted with responsible bodies in each industry in order to learn how the industries manage their industrial waste. Pertinent bodies from two health centers located near the industries were also interviewed. Interviews were held with farmers from *Tinishu* and *Tiliku* Akaki river banks. Interviews were conducted with Trade registration and licensing heads from Trade and Industry offices at different levels from Ministry of Trade and Industry and Ethiopian Investment Agency. Interview was made with Ethiopian Manufacturing Industries Association –secretary general.

iii. Focus Group discussion

Focus group discussion was conducted with pertinent bodies in the Ministry of Health who work under Hygiene and Environmental Health Department.

iv. Observation

Researcher's observation of the industry premises within and outside the compounds of the industries. The production process in the industries was also observed in order to learn the instances of waste generation and the final disposal of the wastes. In addition, farmers were seen using *Tinishu* and *Tiliku* Akaki rivers for irrigation.

1.8.2. SECONDARY DATA COLLECTION

Data were collected from reference books, international organization publications, policies and laws, reports of Addis Ababa Environmental Protection Authority and other published and unpublished materials and the internet.

1.9 METHOD OF DATA ANALYSIS

The method of data analysis was descriptive including frequency distribution, and measures of central tendency which serve to clearly indicate the magnitude of the problem. Qualitative analysis is predominantly used in the data analysis.

1.10 ORGANIZATION OF THE STUDY

The study has five parts. The first part deals with research background, research questions and objectives, and research methodology. The second part deals with the review of related literature. The third part describes data presentation of the findings. Part four is on data analysis and interpretation. Finally, part five deals with conclusions and recommendations.

CHAPTER TWO

2. LITERATURE REVIEW

The industrial waste problem is one of the threats human beings are facing. However, it is not a natural event; it is rather a result of the actions of human beings and is therefore controllable. The review of literature deals with industrial wastes: definition and types of industrial wastes, the methods of industrial waste management by developing and developed nations, effects of industrial wastes on society's wellbeing and the interventions by regulatory bodies in controlling the proper handling of industrial waste by industries. Let's now start our discussion with the definitions of manufacturing industries.

2.1 MANUFACTURING INDUSTRY

2.1.1 Definition of Manufacturing Industry

To begin from a broader perspective, industries are classified into three categories: primary, secondary and tertiary industries. *Primary industries* are involved in the collection, utilizing and harvesting of resources directly produced by physical processes (e.g. mining and smelting). *Secondary industries* deal with manufacturing as they take raw materials, convert them into various ways and produce tangible goods (e.g. automobile factories). *Tertiary industries* produce services for individuals and groups (e.g. advertising), (Pollution Issues, 2006).

Secondary industries are the topic of discussion of this research. Secondary industries, manufacturing industries have been defined by different authors. The definition given by Sustainable Development Indicator Group (1996) states that 'Manufacturing industry is the branch of manufacture and trade based on the fabrication, processing, or preparation of products from raw materials and commodities.' The word manufacturing is described as a vast range of human activity, from handicraft to high tech, but is most commonly applied to industrial production, in which raw materials are transformed into finished goods on a large scale (Manufacturing, n.d).

These definitions indicate that manufacturing industry is involved in *input- process- output activities* where the output can be commodity or goods. For the purpose of this research, the terms manufacturing industry and/or industry are interchangeably used.

2.1.2. Processes of manufacturing industries

The definitions of manufacturing industries presented above indicate that there are some processes involved in the manufacturing undertaking. There are a vast range of processes involved in manufacturing industries: casting, molding, forming, machining and joining are major activities in manufacturing operation (Manufacturing, n.d). The transformation of raw materials involves a lot of energy and chemicals and other matters. At the time of production or after the production is over, matter and/or energy is released and discharged to the atmosphere as waste or pollutant (Manufacturing, n.d). The generation of industrial wastes or pollutants begins at the production process and at the end of the production process *waste is discharged*. Here, it is time to define the term *industrial waste*. What is industrial waste?

2.2 INDUSTRIAL WASTE

2.2.1 Definition and types of industrial waste

Before defining industrial waste, let's look at the different types of wastes. Wastes can be divided into many types. The most common method of classification is by their physical, chemical and biological characteristics. One important classification is by what they contain. Solid wastes are waste materials that contain less than 70 percent water. This class includes such materials as household garbage, some industrial wastes, and some mining wastes. Liquid wastes are usually waste waters that contain less than 1 percent solid. Such wastes may contain high concentration of dissolved salts and metals. Sludge is a class of waste between 3 percent and 25 percent solid, while the rest of the material is water dissolved material (Bassis, n.d.). This description of waste shows the overall nature of wastes including industrial wastes, though industrial wastes have their own peculiarities.

Two definitions are taken from Industrial Waste (n.d), where the first describes, 'Industrial waste is material discarded from industrial operation or derived from manufacturing processes.'

The second definition states, 'Unwanted materials produced in or eliminated from an industrial operation and categorized under a variety of headings such as liquid wastes, sludge, solid wastes and hazardous wastes.' The other definition of industrial waste states that industrial waste is a solid and liquid waste material generated incidental to the various manufacturing processes employed at industrial plants and establishments and require disposal (Hess 1998: 285). These definitions are similar for incorporating common defining elements such as solid, sludge and liquid components of industrial wastes. Tchobanoglous et al (1993: 41) state that 'Solid industrial wastes are industrial process wastes such as scrap materials.' Industrial waste waters are liquid or water carried wastes from the industrial process (Hess 1998: 291).Hazardous waste is a solid, liquid or gaseous substance which because of its source or measurable characteristics is classified under state or federal laws as potentially dangerous and is subject to special handling, shipping and disposal requirements (Jennings & Sneed 1996: 5).

Pollution is a term written or mentioned in connection with industrial waste. What is pollution? Pollution in industry is disposal of waste products into air, water and land (Trapp, n.d). Pollution is also explained as the presence of contamination or lack of purity to such a degree that the environment (land, water or air) is not suitable for a particular use (Jennings & Sneed 1996: 5). In addition, according to Woodward (2001: 61), 'Waste in industries includes solid waste, air pollutants and waste waters.' The definitions indicate that there are three forms of pollution: air pollution, water pollution and land pollution.

1) Air pollution

Air pollution is the existence of impurity /lack of purity in air and that interferes directly or indirectly with human health, safety, welfare or comfort and / or inhibits the full use and enjoyment of property (Hess 1998: 281). 'Air pollution is the accumulation in the atmosphere of substance that insufficient concentrations, endanger human health or produce other measured effects on living matter and other materials' (Botany, n.d).The presence in the out door atmosphere of one or more contaminants such as dust, fumes, gas, mist, odor, smoke or vapor (Air Pollution, n.d). In addition to the different types of air pollutions, noise is one form of air pollutants (Botany, n.d).

2) Water pollution

"Water pollution is a large set of adverse effects upon water bodies such as lakes, rivers, oceans and ground water caused by human activities" (Wikipedia, the free encyclopedia, 2008).Water pollution is institutional and industrial wastes and other harmful materials in sufficient quantities to result in a measurable lowering of the water quality (Environment Canada, 2007).

3) Land pollution

'Land pollution is the addition of undesirable matter to the land that damage the terrestrial organisms, reduce the uses of the land by man for agriculture, residential, recreational or other purposes or increase the risk of health hazards to man'(Land Pollution, n.d.). Land pollution is the lowering in the quality of the earth's land surface through misuse of the soil by poor agricultural practices, mineral exploitation, industrial waste dumping and indiscriminate disposal of urban wastes (Botany, n.d).It is also explained that soil pollution is the biggest land pollution (Land Pollution, n.d).

The above discussions indicate that industrial wastes may appear in the form of solid, liquid or sludge and may have hazardous components. The disposal of industrial wastes may pollute air, water and land. It is understandable that the amount and type of industrial wastes of one industry may vary from the other due to the difference in the process, raw materials used, etc. What are the major sources of industrial waste?

2.2.2. Sources of industrial waste

All industries generate waste in their production process but the amount and type of waste generated in one industry may vary from the other.

> Many of the largest polluters come from the chemical, pesticide; oil refining, petrochemical, metal smelting, iron and steel and food processing industries. All are major users of energy that produce large amounts of waste products and pollution. Other industries have less potential impact but are still considered highly problematic when it comes to pollution. These industries include the textile, leather tanning, paint, plastic, pharmaceutical and paper and pulp industries (Air Pollution, n.d.)**.**

Of the many industries, those which are considered hazardous include metal manufacturing, paint formulants, electronic industry, leather products manufacturing etc (Hess 1998: 228-239).If the above categories of industries are the major sources of industrial wastes and pollution, how are they taken care of? The following paragraphs talk about different aspects of industrial waste management.

2.3 INDUSTRIAL WASTE MANAGEMENT

2.3.1 Definition of industrial waste management

Although, there is no definition given for industrial waste management, the definition for waste management presented in general, serves as a base for defining industrial waste management. 'Waste management is the collection, transport, processing recycling or disposal of waste materials. The term usually relates to materials produced by human activity, and is generally under taken to reduce their effect on health, aesthetics or amenity" (Waste Management, 2008). In light of this definition, we can give the definition for industrial waste management. Industrial waste management is the method of handling industrial wastes. It can be disposal, recycling or treatment of waste. The different methods of industrial waste management are now discussed.

2.3.2 Methods of industrial waste management

There are various ways in the management of industrial wastes. Let's see each of the methods. Waste Management (2008) categorized the methods of waste management into three: Industrial waste disposal methods, industrial waste recycling methods, industrial waste avoidance and reduction methods.

2.3.2.1 Industrial waste disposal methods

This method is aimed at discarding of industrial wastes once they are produced. Proper disposition of a discarded or discharged material need to work in accordance with local environmental guidelines or laws. There are different ways of industrial waste disposal (Waste Disposal Methods, 2008).

1. Land fill (Sanitary land fill)

'Land fill is solid waste disposal site where waste is spread in layers, compacted and covered with soil or other cover materials each day to minimize pest, aesthetics, disease, air pollution and water pollution' (Jennings & Sneed 1996:11). 'Land fill can be useful because , filled land can be reused for other community purposes but their disadvantage is that the completed land fill areas can settle and require maintenance and proper planning and design and operation are required' (Waste Disposal Methods, 2008).

2. Incineration

Incineration is a technique of burning solid wastes (Bassis, n.d). The solid wastes are burned in incinerators. Incinerator is a facility in which the combustion of solid waste takes place (Jennings & Sneed 1996: 2). Incineration is advantageous because it requires minimum land, it can be operated in any weather, it produces stable odor- free residue and the refuse volume is reduced by half. It is however disadvantageous because it is expensive to build and operate and it requires high energy (Waste Disposal Methods, 2008).

3. Open dumping

This is open, unregulated dumping of industrial wastes on open spaces. Open dumping is inexpensive, but it poses health hazards and pollutes land, air and water (Waste Disposal Methods, 2008).

4. Ocean dumping

It is the dumping of industrial wastes into water bodies. Although it is convenient and inexpensive on the part of the industries, it pollutes water (Waste Disposal Methods, 2008).

5. Exporting wastes

There is a practice of exporting hazardous waste from industries by industrialized countries to less developed countries. It is now considered as illegal activity (Waste Export, n.d).

6) Waste exchange

'Conversion of a firm's process waste or discarded output into an input for another firm's process (es)', (Business Dictionary, 2008).The other definition explains, "Waste exchange is a computer and catalogue network that redirects waste materials back into the manufacturing or reuse process by matching companies generating specific waste with companies that use those waste as manufacturing inputs (Jennings & Sneed 1996: 14).

Industrial waste disposal methods focus on the way industrial wastes are disposed from the industrial premises. It takes an inside-out action on industrial wastes.

2.3.2.2. Industrial waste recycling methods

Waste recycling is a method or process for recovering wastes as inputs or resources (Business Dictionary, 2008). 'Recycling is a process by which materials otherwise destined for disposal are collected, reprocessed or manufactured and reused' (Jennings and Sneed 1996:10). The above two definitions indicate that industrial waste is not useless. Through recycling activity, the wastes can be converted for productive use. However, the negative aspect of recycling is that it takes time, energy, labor and money to make new products from recycled ones (Bassis, n.d). Through the recycling process the toxic or hazardous nature of waste is reduced, when it is not possible to recycle it to another process or another plant. Other factors being equal on site recycling is preferable because shipping hazardous waste off- site, even for recycling, carries the liability that the waste might be mishandled (La Grega, et al 2001:381).

'Waste Water Treatment Plants are also methods used for recycling of industrial waters. Waste Water Treatment Plant (WWTP) is a facility that treats waste water (and sometimes run off) from domestic and / or industrial source by a combination of physical, chemical and biological processes' (Jennings & Sneed 1996:14).Recycling is significant in providing safe environment but not all industrial wastes are recyclable. Some waste are not recyclable, technological push is needed and separation of useful material from waste is difficult (Waste Disposal Methods, 2008). It can be difficult to establish industrial waste recycling plants.

2.3.2.3. Industrial waste avoidance and reduction methods

There are many terms used to describe the activities that eliminate or reduce the generation of hazardous wastes or industrial waste; waste minimization , waste reduction, waste diversion, pollution prevention, recycling and reuse, source reduction etc.(La Grega et al 2001:372)

1. Industrial waste avoidance methods

'The best method of reducing waste disposal's negative effect on society is simply to prevent its generation' (Bassis, 2008). Preventing the generation of industrial waste relates with a method known as zero waste management. 'Zero waste is a philosophy that aims to guide people in the redesign of their resource-use system with the aim of reducing waste to zero' (Zero Waste, n.d).

Approximately 8 per cent of hazardous waste in the United States is stabilized, i.e. it is kept from moving through ground water and air. Sometimes waste can be stabilized on-site, simple remedies such as covering the waste may be sufficient. Other stabilization methods involve building a barrier around the waste. This barrier can be plastic, steel, concrete, clay or even glass (MSN Encarta, 2007).

2. Industrial waste Reduction Methods

Industrial waste reduction and industrial waste minimization are interchangeably used. Industrial waste reduction/ minimization is the reduction of industrial waste at its source to minimize the quantity required to be treated and disposed of , achieved usually through better product design and/or process management (Business Dictionary, 2008). The goal of waste reduction is to decrease the waste as much as possible. Recycling the material is also considered as waste reduction method because when unwanted wastes are converted into usable goods the amount of waste is reduced (AMA Management Briefing 1999: 31).

2.3.3. Practice of industrial waste management

The practice of industrial waste management in developed countries is different from the practice in developing countries. This is due to reasons discussed hereunder.

2.3.3.1. Developed countries

The economic development of developed countries helps them to apply technologies that are useful in the proper industrial waste management endeavor. But, many factories still release pollutants into air and water supplies (Green Foot Steps, 2006).

'…… despite the best effort of scientists, engineers and technological optimists, progress in solving the waste and pollution problems has been decidedly erratic even in the worlds most "advanced" economies'(Pollution Issues, 2006). From these statements we can understand the fact that the industrial waste problem is still a problem for developed countries.

> Tens of thousands of square kilometers of land have been contaminated by past poor practices in handling hazardous wastes, including inadequate land fill. There are 40,000 such sites in the United States, 55,000 in just six European countries and 78,000 in New Zealand. Cleaning them up is enormously expensive, the United States Environmental Protection Agency estimate that dealing with just the 1,400 top priority sites will cost $ 31billion (Toepfer, n.d).

The situation Toepfer explained relates to past waste disposal actions which have profound effect for today. 'Waste is increasing, rising by 10 percent in Europe over the first five years of the 1990s. And so is the public concern 17 in 20 European Union citizens are concerned about industrial waste, they worry about leaking waste tips, pollution from incineration plants, and contaminated land' (Toepfer, n .d). As the level of awareness of society on industrial waste rises, developed nations are preventing the generation of industrial wastes (Bassis, n.d).

2.3.3.2 Developing countries

We have learned from the above discussions that developed countries are still facing problems due to haphazard industrial waste management practices, though there are proper industrial waste management practices widely applicable. Many developing countries are not so well protected and uncontrolled industrial pollution is still going on (Green Foot Steps, 2006).

The most widely practiced waste disposal method in most developing countries is open, unregulated dumps (World Health organization Regional Office for Western Pacific, 2005). From the discussions on industrial waste management methods, many of the modern and useful techniques of waste management require technology, finance and skilled personnel, which are the problems mainly in developing countries. Nachf (1991:1-2) stated the following.

In countries where needs are pressing, money is short and industry in its early stages, the temptation to regard environmentally responsible technology as an expensive luxury is understandable. Yet experience teaches that competitive advantages based on ignoring environmental impacts are illusory and the resultant damage is costly to correct, if not irreversible. Merely to point the finger of blame at industries that pollute, deplete resource without thought to the future, or cause harmful wastes is neither just nor helpful. Indeed, if anything, the motives for overcoming such practice are most urgent in developing countries.

2.3.4 Problems /challenges in industrial waste management

There are many problems in the management of industrial wastes. One of the problems is the unchanged industrial behavior of the industries. According to Pollution Issues (2006), Sometimes polluting companies have not succumbed to social, political and governmental pressure served companies have denied responsibility for pollution even when found with strong evidence to the contrary. Other companies after admitting responsibility, they propose strong action, but deliver nothing.

It is vital that the industrial awareness and willingness comes first before proper waste management system is designed. The problem developing countries face in their industrial waste management has been described. The main problem in under developed countries is the lack of well-developed laws and their enforcement that government control on the disposal of industrial waste. Thus, it is quite common to hear of manufacturing establishments of developing countries that they are dumping untreated toxic and harmful industrial waste through the canal into the river. Many others are burying harmful waste through the lack of education and cost considerations (Recycling Point, 1992). 'Cost consideration has been taken as the major impediment to the proper industrial waste management. Industrial waste reductions some times result in process modifications. Process modifications include changes in raw materials, equipment, operating procedures, material storage and products etc.' (La Grega et al 2001: 400).This is a challenge for the industries not to follow proper industrial waste management systems.

2.4 THE IMPACT OF INDUSTRIAL WASTE ON HEALTH

The effect of industrial waste on health has been the focus of attention for researchers in the west. Researchers are able to reveal the health hazards these wastes are causing. Before discussing the detailed health problems, here is a quote by American Congress woman Louis Slaughter, which depicts that industrial waste is a growing threat to human beings. 'That we have children coming in to this world already polluted, at the same time we don't know what the effects of pollution will be on their mental and physical development is both bad policy and immorally wrong' (Brainy Quotes, 2008) .

In our earlier discussions, we said that industries release wastes. These industrial wastes may appear in solid, liquid or sludge form or may have hazardous components. The effect of industrial waste rests on polluting water, air and land. Human beings are affected by polluted air, water and land, since their lives are dependent upon them. Now, let's look at the health impacts of air, water and land pollution one by one.

2.4.1 The effects of air pollution on health

Before talking about the health problems of air pollution, let's look at facts on air pollution presented by Disease Control Priorities Project in Developing Countries. The extent of the health effects of air pollution depends on actual exposure. Young children and elderly people may travel less during the day than working adults, and their exposure may therefore be closely correlated with air pollution level, in their homes. Children are particularly vulnerable to environmental toxicants because of their possibly greater relative exposure and the effects on their growth and physiological development. Meteorological factors, such as wind speed and direction, are usually the strongest determinants of variations in air pollution along with topography and temperature inversion; therefore, weather reports can be a guide to likely air pollution level on a specific day. Moreover, the importance of epidemiological analysis to quantify the health impact in an exposed population is explained (Disease Control Priorities Project in Developing Countries 2006: 1). Epidemiology is the study of factors affecting the health and illness of population and serves as the foundation and logic of intervention made in the interest of public health and preventive health (Epidemiology, n.d).

With the above facts in mind, several studies conducted on the health impacts of air pollution, reveal similar findings in terms of mostly affected parts of the human body. 'Although air pollution can have health effects throughout the body, the target organ for many major urban air pollutants is the respiratory system (Environmental Pollution in Urban Environment and Human Biology, 2003).

The World Health Organization (WHO) in (Wikipedia, the free encyclopedia, 2008) states '2.4 million people die each year from causes directly attributable to air pollution. Direct causes of air pollution related deaths include aggravated asthma, bronchitis, lung and heart diseases, and respiratory allergies. 'In addition, WHO (in Disease Control Priorities Project in Developing Countries 2006:3) explained post neonatal mortality and mortality caused by acute respiratory infections, as well as effects on children's lung functions, cardiovascular and respiratory hospital admissions in the elderly, are markers for functional damage to the heart muscle. However, (Buchanan and Horwitz n.d) wrote, 'People are mostly oblivious to the effects of air pollution. They know it's out there and it is a problem but excepting skin cancer, there have been very few deaths with a direct link to air pollution.' When the discussions on air pollution and the reports by WHO and others on the health problems of air pollution are taken into consideration, it is difficult to accept Buchanan and Horwitz's report that air pollution has limited impact on health.

2.4.2 The effects of water pollution on health

Industrial waste pollutes water if it is released into water bodies. Water is basic necessity for living things. If water lacks proper care, the survival and health of living things is affected. Disease Control Priorities Project in Developing Countries (2006: 3), reported the following facts.

> Drinking contaminated water is the most direct route of exposure to pollutions in water. The actual exposure via drinking water depends on the amount of water consumed, usually 2 to 3 litters per day for an adult, with higher amounts for people living in hot areas or people engaged in heavy physical work. Use of contaminated water in food preparation can result in contaminated food, because high cooking temperature does not affect the toxicity of most chemical contaminants. Toxic chemicals in water can affect unborn or young children by crossing the placenta or being ingested through breast milk.

The other report by (Pollution Control, 2008) explained, “Water pollution is a major problem in global context. It has been suggested that it is the leading worldwide cause for deaths and diseases and that it accounts for the deaths of more than 14,000 people daily.’

Some of the health effects of water pollution include nervous system diseases, kidney and bone diseases, the circulatory system diseases, irritation or inflammation of the eyes and nose, skin and gastro intestinal system diseases (Disease Control Priorities Project in Developing Countries 2006: 4). Water pollution causes diarrhea, typhoid and typhus, (Hygiene and Environmental Science 2007: 8).

In developed countries where there are water purification technologies at large, the problem of water contamination as a result of industrial waste waters is relatively under control. In many developing countries, however, rivers and streams etc are used for drinking water sources, food preparation purposes etc. with no purification. It is therefore, endangering the lives of human beings and other living organisms.

2.4.3 The effects of land pollution on health

Industrial wastes improperly disposed on open grounds or uncontrolled land fills are the causes for land pollution. Human beings have close contact with land. They live on it and they grow their food on it. If land is not taken care of, it will cease to be productive and its safety for people to live on will be affected. Land pollution can have many effects upon animals and wildlife. Also many land pollutants can wash into water sources such as rivers and reservoirs.

Skin problems, respiratory problems, birth defects and cancers can all be caused by some of the most serious pollutions. Toxic pollutants can get into our bodies directly through skin contact or by breathing in particles or dust. Some pollutants can get in to our systems indirectly from eating vegetables grown in contaminated soil (Green Foot Steps, 2006).

WHO in Disease Control Priorities Project in Developing Countries (2006: 2) reported that air pollution contributes as much as 0.6 to 1.4 percent of the burden of disease in developing regions, and other pollution such as water, air and soil may contribute 0.9 percent. It further pointed out that these numbers may seem small but the contribution from most risk factors other than the top 10 is within the 0.5 to 1.0 percent range.

2.5 POLICY ISSUES IN INDUSTRIAL WASTE MANAGEMENT

2.5.1 Regulatory body

There are international and local standards addressing issues of industrial waste management. These regulatory bodies can play vital role in the fight against industrial waste and pollution problems.

2.5.1.1. Licensing and registration body

Before industries are established they have to fulfill minimum criteria set by licensing and registration body. The sites where industries are to be established need to be investigated from different perspectives. As an example of hazardous waste facility siting factor is population where proximity to dwelling units, proximity to schools and population density are to be considered (Hess 1998: 445). Licensing and registration bodies should assure siting criteria that helps the industries before they are established. 'Most screening methods require siting criteria. Siting criteria stem from siting factors associated with specific consideration important in judging the suitability of a site' (Hess 1998: 445). In addition, it is a method that the primary objective of a site selection is to assure that new facilities are located at intrinsically superior sites that by virtue of their natural features and land use setting provide a high degree of protection of public health and the environment. In this concept, the land use setting and natural features function as an additional line of defense if the facility's operations do not perform as planned. Proximity to source of waste generation is another important criterion (Hess 1998: 441).

The Indian guideline for siting of industries has the following major points as presented below. (Environmental Guidelines for Siting of Industry, 1985).

1. To prevent air, water and soil pollution arising out of industrial projects, the industrial licensing procedure require that the entrepreneurs before setting up the industries should obtain clearance from central/ state air and water pollution control boards. The central/state pollution control board stipulates that air and water emanating from the industry should adhere to certain quality standards.
2. Industrial progress brings along with it a host of problems. Many of these problems could be avoided if industries are located on the basis of environmental considerations. Injudicious siting of industries can seriously affect the environmental feature such as air, water, land, flora, fauna, human settlements and health of people and should take necessary steps while setting up the industries so as to minimize the possible adverse effects on the environmental resources and quality of life.
3. In siting industries, care should be taken to minimize the adverse impact of the industries on the immediate neighborhood as well as distant places. Some of the natural life sustaining systems and some specific land uses are sensitive to industrial impacts because of the nature and extent of fragility. With a view to protecting such an industrial site shall maintain the following distance from the areas ecologically and /or otherwise sensitive areas at least 25 km, depending on the geo-climatic conditions.

There is a very detailed guideline along with the above general guideline. From the points of view of various stakeholders of an industry, it is important to deal with preventive rather than curative action required after the industries are established.

2.5.1.2 Environmental protection body

Environmental protection body is directly involved in the policy making, enforcement of the proper disposal of waste and regulatory activities pertinent to industrial waste affecting the environment.

Even though, the environmental protection involves and focuses on the environment, regulatory activities by environmental protection organs means that, environment is protected and therefore society is safeguarded. Today, most developing countries have environmental protection organs let alone developed ones.

To protect the environment from adverse effects of pollution, many nations world wide have enacted legislation to regulate various types of pollution as well as to mitigate the adverse effects of pollution. The United States Environmental Protection Agency, established standards for all pollution to protect human health on January 1970. In 1999, the United States Environmental Protection Agency replaced the Pollution Standard Index with the Air Quality Index. The United States Congress passed the Clear Air Act in 1963 to legitimate the reduction of pollution in general**.** That legislation has subsequently been amended and extended in 1966, 1970, 1977, and 1990. Passage of the Clean Water Act amendments of 1977 required strict permitting for any contaminant discharge to navigable waters. In the United Kingdom, Pollution Prevention and Control (PPC) is a regime for controlling pollution from industrial activity on an international level. The Kyoto Protocol is notable (Pollution Control, 2008).

The United Nations Industrial Development Organization [UNIDO] is the United Nations agency with prime responsibility for furthering industrialization in developing countries. The Industry and Environmental guide prepared by UNIDO presented that the management of the environment should comprise four mutually complementary actions (Nachf 1991: 2-8).

1**. Legislation**-permissible rates of pollution, the nature and quantity of pollutants produced by industrial activity and the possibility of influencing pollution flow in their own and other countries,

2. **Establishing standards-**standards and regulations are the means by which the public authorities and industries respond to problems linked to environmental protection. They are specific to each country and are elaborated by analyzing the risks to which the population and the environment are exposed, compared to the consequences of the prevention of these risks on the situation.

3. **Measurement and monitoring-** methods of measuring and monitoring pollution, the permissible level of pollutants, both inside and outside plants and technologies to be applied to reduce pollution.

4. **Establishing or supplementing numerical data for monitoring the environment-** government offices need to collect data concerning the environmental effects of existing and projected industrial activities.

2.5.1.3 Public health body

Public health is a field of medicine and hygiene dealing with the prevention of disease and the promotion of health by governmental agency. Public health authorities are concerned with the pollution levels in air and water, and must assure the safety of water used for drinking, for swimming and as a source of sea food. In addition, they collect vital statistics on death rates, birth rates, communicable and chronic diseases and other indicators of the state of public health (Questa Media America, 2007).

In light of this general purpose of public health bodies, they can play a vital role in curbing the industrial waste problem. The health problems arising from pollution related causes are preventable. Thirteen million deaths per year are due to preventable environmental causes.
Preventing environmental risk could save as many as four million lives a year, in children alone, mostly in developing countries (Public Health and Environment, 2000).

> World Heath Organization (WHO) is the directing and coordinating authority for health within the Untied Nations system. It is responsible for providing leadership on global health matters, shaping the health resource agenda setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends. Industrial waste management, particularly its hazardous component, has become a major issue in rapidly industrializing countries. As many Asian countries underwent rapid industrialization from the mid- 1980 to mid- 1990 s, legislative control of hazardous waste was established during that period. WHO has been involved in supporting the development of legislative framework and human resources in combating hazardous waste in these countries (WHO, n.d).

When it comes to the context of a given country, the public health organs have the responsibility of setting laws, rules and regulation on the overall industrial waste management activity and monitor the practices by industries in their industrial waste management systems.

We have discussed major points regarding the industrial waste problems on society. The researcher is of the opinion that developed countries have relatively ample research based data on the topic. Books, journals and articles are largely written in the context of developed countries. Most materials written address the issue of waste in general and not industrial wastes in particular. In addition, the materials written on industrial waste dominantly deal with technical aspects dealing with, engineering and chemistry aspects of industrial wastes. The impacts of industrial wastes on the communities' safety and health are not treated as they should be. To conclude, the points discussed in the literature review are believed to give sufficient frame for the subsequent parts of the research specifically data analysis and interpretation.

CHAPTER THREE

3. PRESENTATION OF FINDINGS

This chapter deals with the presentation of data collected from urban communities, industries and different pertinent governmental bodies and private organizations. Data is gathered from primary and secondary sources. The primary data were collected through interviews, focus group discussion, survey questionnaire and the researcher's own observation. The secondary sources of data include brouchers, reports, printed as well as published materials and government laws and policies.

The presentation of the findings includes data collected from the industries: the profile of the industries, the industrial waste management methods the industries apply, the complaints by the communities on the industries, the challenges of the industries in properly managing their wastes and what the management of the industries plan with respect to industrial wastes. The interview made with Ethiopian Manufacturing Industries Association is also presented The data collected from the Ministry of Trade and Industry at different levels and Ethiopian Investment Agency includes the criteria for investment in industries and the regulatory activities by the Ministry. The data collected from Environmental Protection Authority includes the intervention of the Authority at different levels on the industrial waste management practices of the industries, the challenges of the offices in regulating the industries and the plans in regulating the industries. Data on health and industrial waste include the health problems of the community as a result of industrial wastes collected from health centers and from Ministry of Health. Opinion of Farmers at *Tinishu* and *Tiliku* Akaki river banks regarding their vegetable farms is presented. Finally data from the community including the personal characteristics and background data of the respondents, the time respondents lived in their current residences, the types of industrial wastes that affect the community and respondents' opinion on the industrial waste management practices by the industries is presented.

3.1 THE INDUSTRIES SELECTED FOR THE STUDY AND INDUSTRIAL WASTE MANAGEMENT

Data collected on the industries are presented here under.

3.1.1 Profile of the industries

The industries selected for the study have the following profiles as summarized in Table 3.1.

Table 3.1 Profile of industries

Name of industry	**Sub city**	***Kebele***	**Ownership**	**Year of Establishment (GC)**
K.K.Textile Factory	Akaki kaliti	08	Private	1992
Akrem Metena Animal Feed Factory	Akaki kaliti	10	Private	1976
Akaki Metal Products Factory	Akaki kaliti	04	Government	1964
Kaliti Food SC	Akaki kaliti	10	Government	1938
Addis Ababa Tannery	Kolfe Keranio	15/16	Private	1925
Gulelle Soap Factory	Kolfe Keranio	15/16	Private	1965

Source: Own Field Survey, A.A., 2008.

All of these industries were established by foreigners. K.K.Textile Factory used to be the blanket line of operation in Akaki Textile Factory before it was privatized. Akrem Metena Animal Feed Factory is also known by the name Kaliti Animal Feed Factory. Kaliti Food SC was known as Cerealia. Gulelle Soap Factory was known as Oil and Soap Industries SC.

3.1.2 Industrial waste management by the six industries

In order to get data from the management of the industries, interviews were made. The interviews made with the 6 industries' management were focused mainly on issues related with what the industries' current industrial waste management practices are, what their challenges are in their industrial waste management and what their plans are. The industrial waste management methods in the six industries are presented in Table 3.2.

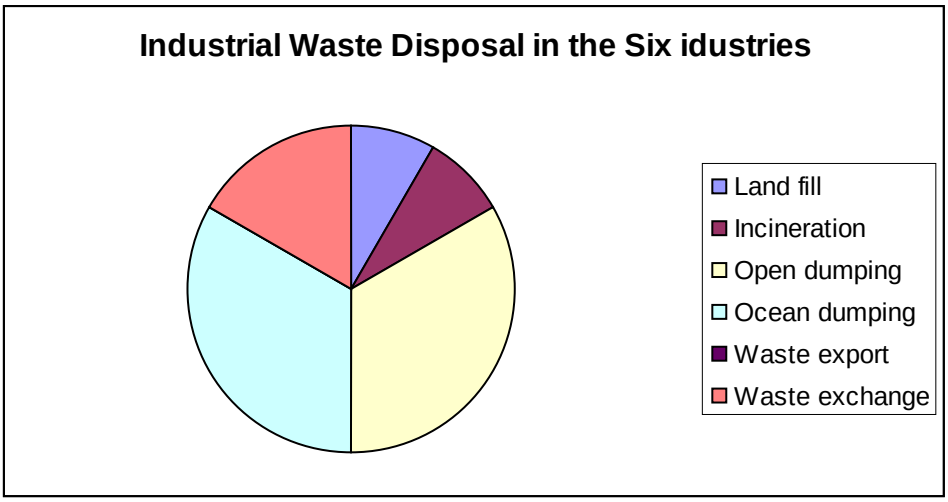
Table 3.2 Industrial Waste Management Methods

Industry	Industrial Waste Disposal						Industrial Waste Recycling	
	Land Fill	Incineration	Open Dumping	Ocean Dumping	Waste Export	Waste Exchange	Solid Waste Treatment Plant	WWTP
K.K. Textile Factory	-	-	-	Yes	-	-	-	Yes
Akrem Metena Animal Feed Factory	-	-	Yes	-	-	-	-	-
Akaki Metal Products Factory	-	-	Yes	Yes	-	Yes	-	-
Kaliti Food SC	-	Yes	Yes	-	-	-	-	-
A.A Tannery	-	-	Yes	Yes	-	Yes	-	-
Gulelle Soap Factory	Yes	-	-	Yes	-	-	-	Yes

Source: Own Field Survey, A.A., 2008.

The following pie chart shows waste disposal systems in the selected six industries.

Figure 1



Source: Own Field Survey, A.A., 2008.

3.1.3 Challenges faced by the industries for not managing their industrial waste properly

The industries all mentioned their challenges in managing industrial wastes. All the industries pointed out: lack of financial resources and lack of trained personnel as the major obstacle. Whereas, in addition to the above mentioned challenges, Addis Ababa Tannery mentioned scarcity of space as an obstacle to make proper industrial waste management practice operational.

3.1.4 Households' reaction to waste management by the industries

The other point raised to the management of the industries was whether they face complaints by the residents residing close to the industry premises against the industries' waste management practices. The responses by the industries are presented under Table 3.3.

Table 3.3 Complaints of residents on the industries.

Industry	Complaint by urban communities	
	Yes	No
K.K Textile Factory	✓	-
Akrem Metena Animal Feed Factory	✓	-
Akaki Metal Products Factory	✓	-
Kaliti Food SC	-	✓
Addis Ababa Tannery	-	✓
Gulelle Soap Factory	✓	-

Source: Own Field Survey, A.A., 2008.

Following the complaints of the residents, what did the industries do to improve the situation? The following responses were made as summarized in the following table.

Table 3.4 Actions of the industries against complaints

Industry	Actions taken	
	Improved the industrial waste management system	Did nothing
K.K. Textile Factory	-	✓
Akaki Metal Products Factory	-	✓
Akrem Metena Animal Feed Factory	✓	-
Gulelle Soap Factory	✓	-

Source: Own Field Survey, A.A., 2008.

3.1.5 Opinions of the management of the industries on their waste management and disposal

The plan of the industries to improve their current method of industrial waste management was the question raised at the end. In this regard, K.K Textile Factory's production manager and quality control head explained that they will do better in changing old machinery with new and modern ones, which will help decrease the amount of industrial waste discharged. They said that they will get adequate waste water treatment plants and be able to determine whether the treated waste water is free from hazardous chemicals.

The management said, to be able to determine the level of hazard of the waste water that flows out of the industry, professionals and the necessary equipment are needed which they said may be difficult to acquire.

The Akrem Metena Animal Feed Factory- Administration Head explained that in the past there were animals in factory premise, which were sheltered and fattened in the industry. The administration head said due to complaints by the community, the fattening activity was totally removed from the factory. Now, the production of animal feed is only done. The head said, for the future, recycling of solid waste will be operational.

Akaki Metal Products Factory-Production Department Head mentioned that the harmful effect of the liquid waste is not yet determined. There have been complaints on the waste water disposal and on the air pollution due to smoke. On the other hand, the head explained that there are people who are expressing their fear of disruption of supply of waste water that is discharged from the factory. The head mentioned that it is their livelihood .They grow vegetables by using the waste water and generate income from the sale of vegetables. The Production department head said, these groups are begging for an uninterrupted supply of waste water.

The Kaliti Food SC-Production Division Head said that the use of incineration has made the solid waste under control. The Head said, the waste water that comes out after the production process is not harmful to health. The head further said that they don't think that installing Waste Water Treatment Plant is necessary, at least in the near future.

The Addis Ababa Tannery-General Manager said that, it is a requirement for them to install Waste Water Treatment Plant. It is a requirement by their customers abroad i.e. not only is the leather quality they sell needed but also whether the factory uses safe production activity that does not affect the environment. The General Manager further mentioned that they have financial constraint. Therefore, they needed financial support where UNIDO has promised the support in terms of finance and technical advice. The General Manager also said that they have a problem of space to install the system.

However, the general manager said, they are planning to use one of their workshops for the purpose of installing industrial waste water treatment plant though this will have adverse effect on their performance.

Gulelle Soap Factory's General Manager and Administration Head said that, the factory used to release its waste waters directly to the environment. Now industrial Waste Water Treatment Plant is installed. The system of waste reduction is also designed and will be implemented in the near future. The WWTP is however limited in its recycling capacity and needs upgrading. The management said that, the major industrial waste problem of the factory is the bad smell which they said is harmless.

3.2 TRADE REGISTRATION AND LICENSING OF IDUSTRIES AND WASTE MANAGEMENT

The next data collection was made on governmental bodies which are involved in registering and giving licenses to investors. The first governmental body where the discussion was conducted with was the Federal Ministry of Trade and Industry- Trade License and Registration Department Head. For the question raised on the general criteria for the establishment of industries, the Head said that there is a broucher prepared by the Ministry for new investors who want to establish industries. The investor is given the broucher and is required to read and understand what is expected of him or her. Whenever there is doubt on the terms and conditions for investment, their department will clarify. When an investor comes to invest he/she is required to fill a form. This ends the process and he/she can run the industry. This short procedure to get investment permit is aimed at creating conducive investment climate unlike the previous practice which used to take months to get license.

According to the Head, most of the trade registration and licensing activity is made by Ethiopian Investment Agency and at the sub city level by- Trade and Industry Bureau. At the federal level, very few registrations are made for investors with very huge investment capital. The Head said that there is no criterion for investment except for being able to invest-financially. The current trend has put aside the previous experiences of inquiring detailed data including what waste the industry would generate. The head said that the previous practice delays investment and is not desirable.

The Ethiopian Investment Agency -Trade Registration and Licensing Head was asked the same questions regarding what their criteria in establishing industries are. According to the Head, the Agency has the authority and responsibility of giving licenses for those investors who come to the office as far as they are able to invest. The head stated that many investors are getting licenses from Ethiopian Investment Agency in order to get investment incentives. The department makes the investor fill forms and from that time on the investor is able to start operations. The Head also said that there are obligations which the investor is required to fulfill. The obligations which the investor is subject to, include environmental and health issues. (Appendix IV). The acknowledgement of the applicant as an investor is made by writing letters to offices such as EPA, Ministry of Health, Ministry of Labor and Social Affairs etc. From this time on, the relevant governmental offices are expected to regulate and follow up the industries based on their respective concerns to the environment or public health.

The Addis Ababa City Government, Trade and Industry-Trade registration and Licensing Head was approached and was asked about the procedures in the provision of license to applicants who want to establish an industry. The same procedure stated by both the Federal Ministry of Trade and Industry and Ethiopian Investment Agency-Trade Registration and Licensing heads was also explained at the regional level. No sitting criterion is applicable that would decide whether an industry would be placed in a particular site or not.

The Trade and Industry Bureau at the sub city level is also involved in registering and licensing industries at the sub city level. The two sub cities' Trade and Industry- Trade Registration and Licensing Office Heads were approached. The Akaki Kaliti and Kolfe Keranio sub cities also stated that, for those investors who come directly to the sub city, they make the investors fill forms which mainly require data regarding the amount of capital, details about the owners, what the intended product is and so on. Afterwards, the sub cities' offices write letters to Environmental Protection Offices and Health committees at the sub city levels.

3.3 ENVIRONMENTAL PROTECTION AUTHORITY AND INDUSTRIAL WASTE MANAGEMENT

Interviews were conducted at different levels of the Environmental Protection Offices. The first of which is the Addis Ababa Environmental Protection Office. It has a department called Environmental Protection and Pollution Control. The Head of the Department was interviewed. The first question raised was the intervention of the office in regulating the industries. The Head answered that Environmental Protection Authority (EPA) is the authority to make every effort to regulate the industries with regard to their wastes and their effects on the environment. But the regulation of the industries has been very weak due to lack of qualified personnel. Therefore, said the Head, the office did very little. What have you done was the second question raised by the researcher. The Head replied that they have been doing very limited activities; especially they took measures on those industries which required immediate actions. These include industries that use explosives and yet situated in the middle of communities .The Head explained that it is very difficult with the current staff to conduct visits to all industries. The Head said that they only made very few visits to industries. These visits were made by preparing programs of visit on a yearly basis and on very few industries. The head added that most of the industries are not regulated even once in their operation and yet new industries are established very rapidly. In addition, the head remarked that knowing a certain industry is polluting the environment doesn't mean it is possible for EPA at different levels, to take actions on the industries. The reason the Head gave was that if we end up shutting an industry for polluting the environment the lives of the workers and their dependents would be affected. This has limited the Authority's actions to mere warning and advice.

The other point raised by the researcher which was explained by the Head was the reporting relationship between the sub cities' Environmental Protection Offices and Environmental Protection and Pollution Control Department at regional level. The Head said that they make contacts with the team leaders of the sub cities' Environmental Protection Offices for some major tasks. Otherwise, the sub city is self-autonomous. The Head mentioned the challenges to curb the industrial waste problem have been lack of qualified personnel, inability to take strong measures on those who failed to comply with Environmental law of the country.

The Head added that some of the industries do not know the dangers of the industrial waste they release, but the majority knows the effects of industrial waste.

They lack willingness and are negligent to the environment. The Head said, this is evidenced by the fact that some industries have established waste treatment plants but it is established for the sake of creating good image. The treatment plants hardly function. When there are regulatory visits by Environmental Protection inspectors or by others, they use the treatment plants and pretend as if the plants are always operating. The head explained that, financial shortage by the industries has been another impediment for not using appropriate equipment and technology to industrial waste management. The Head said, for the future, the hiring of adequate number of inspectors/experts in the Environmental Sciences is mandatory.

The Environmental Protection Office Team Leaders at the two sub cities were also interviewed. The two Environmental Protection Team Leaders gave similar responses regarding the level of intervention they have on industries polluting the environment. They said that they can do nothing and are powerless as far as taking actions on the industries is concerned. In some instances, they paid visits to industries and even if they know for sure the industries are polluting the environment, they did nothing except giving advices. They explained that they are incapable in taking actions on the industries. They explained that they are aware of most of the industries are following improper industrial waste management practices; they dispose their wastes on open spaces and/or water bodies. For the question, what did you do upon the complaints of the community on the industrial waste problem they face; their answer was that they did nothing. The challenges they face are lack of relevant personnel, the number of staff is limited to conduct inspection work in all the industries in the respective sub cities. The team leaders also explained that there have to be standards that should help the sub cities' Environmental Protection inspectors know whether the wastes generated from a specific industry are hazardous or not so that they could convince the industries on the basis of actual evidences and enforce the laws. The team leaders from both sub cities said that they did nothing as far as industrial wastes are concerned.

The General Managers of the two sub cities were interviewed as to why the two sub cities' Environmental Protection offices didn't do anything to regulate the industries. The Kolfe Keranio sub city General Manager said that the power and authority of EPA is limited to the central government. It is almost on solid wastes that are domestic by nature, that the sub city is authoritative at.

The other problem raised by the general manager was that the level of authority and responsibility at the sub city level is not clearly demarcated. However, the general manager mentioned that land filling of industrial solid wastes used to be practiced by the sub city. The sub city used to collect industrial solid wastes using the sub city's vehicles. The sub city used to collect the solid wastes of big industries. This activity is totally stopped now because, the labor force engaged in the collection and land filling activities were not willing to continue the activity for fear of the hazardous effects of industrial wastes. The other reason for the apathy of the office, according to the General Manager, is lack of appropriate and adequate personnel, lack of research and lack of financial capacity.

The Akaki Kaliti sub city's General Manager also explained that almost nothing is done on industrial wastes so far because of lack of qualified personnel and also lack of finance. He further mentioned that the budgetary allocation for environmental protection is one of the smallest. The activities of the office are mainly focused on greening activities only. The General Manager explained as another limiting factor, the centralized power structure of the Federal Environmental Protection Authority.

The Ethiopian Manufacturing Industries Association is a private association for industries. One of the objectives of the Association is to protect the environment from pollution. To learn what the Association did and is planning to do on industrial wastes, focus group discussion was planned by the researcher. But it was understood from the secretary general of the Association that, it was not possible to organize focus group discussion. The reason the secretary general gave was that they did nothing on the issue of industrial waste and nothing to discuss. Then the researcher had to change the focus group discussion into personal interview with the secretary general.

The secretary general said that the Association knows the problem of industrial wastes but did nothing so far. The reasons he mentioned was that it is the responsibility of the regulatory bodies like Environmental Protection Authority, Ministry of Health and Ministry of Trade and Industry to play a major role in taking measures and controlling the industries. The effort of the Association is futile unless the governmental bodies regulate the industries.

The secretary general added that it was impractical for the Association to raise the problems the industries are causing on the environment and community due to their industrial waste disposals. The reason the secretary general mentioned was that, in the situation where the government kept silent on the industrial waste problem by the industries, the Association couldn't possibly has a say. The secretary general explained that, it is only through well-organized activity that the problem of industrial waste is removed.

3.4 INDUSTRIAL WASTE AND HEALTH BY MINISTRY OF HEALTH AND HEALTH CENTERS

In order to find out the health impacts of industrial waste on the community, two health centers from each sub city were selected. The health centers are situated near the industries in the study and many people go to the health centers because they are either free or charge very little.

From Akaki Kaliti sub city: the Akaki Kaliti Health Center and the Akaki Textile Trade Union Clinic were investigated. The Akaki Kaliti Health Center has a unit that works on environmental health and hygiene. The Environmental Health and Hygiene Department Head stated that there are diseases that are directly related with the pollution of the area. One of the diseases which are affecting many of the inhabitants is upper respiratory infection. He added that, it is in fact one of the top 10 leading causes of morbidity in Addis Ababa. Other health problems include acute bronchitis, inflammatory diseases of the eyes and infection of the skin. The head added that to determine the industrial waste as the cause for these illnesses in terms of statistics, research based data is required. Unfortunately, lack of proper quality and quantity of staff is the problem of the health center, according to the head. He further added that from experience, the health risks of pollution could very likely be the cause of the health problems mentioned above.

In the same token, the recurrence of the health problems in the area indicates that the patients living in the polluted area are exposed to pollution. Diarrhea is almost seasonally affecting the community.

The Akaki Textile Trade Union Clinic is serving the society at large, as per the interview made with Administration Head. According to the head, the clinic was established by the trade union of Akaki Textile Factory, but it has nothing to do with Akaki Textile Factory.

Even workers of the factory used to be charged when they wanted medical service. The clinic is for low income bracket members of the society. The Head said that there is no statistics as to the number of patients on a certain health problem in terms of age and sex. But if the trend of an illness at some instance indicates that there is a very high frequency of patients, it is considered as an epidemic and the clinic forms a team and details of age and sex of patients are prepared and investigated. Sometimes diarrhea epidemic occurs which would be as a result of pollution. The Head further added that even though, it is difficult to say for sure a certain disease is caused as a result of pollution, taking the actual practices of the industries' waste management systems, it is possible to say that many of the patients coming to the clinic having respiratory problems, eye diseases and the like are affected by pollution. The head explained lack of qualified personnel as the major problem to make research based data that would help a lot in keeping the public health.

From Kolfe Keranio sub city, Mary Joy Health Center and St. Paul General Specialized Hospital were preferred. The selection was made because, they are established to give services to the public at large, and specially helping those poorer sections of the society and therefore would have relevant data. Mary Joy Health Center is a non profit making organization which gives general health services. A public health officer was interviewed from Mary Joy Health Center. He said that the health problems of the community are varied. And there is no organized data that shows the frequency of patients at some specified time. But on a daily basis more than 100 patients come to the center. Respiratory problems, diarrhea, heart and typhoid come in no particular trends.

St Paul General Specialized Hospital was also approached for the study. It has a department called Environmental Health and Hygiene. The department head was interviewed. The head said that even though it is the responsibility of the department to make studies on the effects of industrial waste on the public health of the society, there are only three staffs in the department. It is therefore difficult to do large scale assignments. The department mainly focused on the hygiene and food and beverage control activities. The head added that patients with different types of health problems use the hospital. Not only are patients from Addis Ababa but also from all over the country.

Focus group discussion was organized with the Ministry of Health-Hygiene and Environmental Health Department professionals. Due to work load getting more number of participants for the discussion was difficult. Therefore, the focus group discussion was made with three participants: Water and waste management control team head, Industrial and other institutional health control team head and the head of the Department of Hygiene and Environmental Health.

The discussion resumed by discussing the industrial waste problem as a growing threat to the city. All of the participants agreed that the increase in the number of industries in the city have intensified the pollution problem. The participants said that the problem of industrial waste is causing problem on urban dwellers in general and those dwellers living close to the industries in particular. The participants said that the regulation of the industries from the health point of view of the society is the concern of the Ministry. However, the participants expressed the issue of industrial waste as “political issue”. They further added that it is not due to lack of concern by the professionals in the Ministry that the problem of industrial waste has increased. Rather the Ministry can do nothing with regard to the industrial waste management practices of the industries. The participants expressed that, on several occasions they have tried to tell the government authorities the effects of industrial wastes on public health. They tried to convince the officials that actions should be taken on those industries that do not follow sound industrial waste management practices. But the government’s concern is the expansion of industries in any way possible. Taking action on those industries which are not following proper industrial waste management practices is considered against development endeavors of the country.

According to the focus group discussion participants, the government officials say that let's first go deep into the expansion of industries and we will worry about the problem of industrial waste later. The participants said that because of the reasons mentioned above the Ministry is not doing any thing of importance with regard to industrial waste. They exclaimed that Industrial waste is out of their focus of attention.

The participants explained, even though the Ministry is disabled, they made visits to some of the industries and tried to give advices that industrial waste problems are affecting every urban dweller. Specifically, the urban agriculture basically uses the waters of the rivers which are polluted and the vegetables have harmful substances which cannot be removed even when cooked. On the contrary, it is almost impossible to avoid eating vegetables by almost everyone.

The participants in the discussion also mentioned that, in the visits to the industries, the industries pretend as if they are using industrial waste treatment plants but in actuality there are very few industries which use industrial waste treatment plants on a permanent basis. They explained that surprise visits should be made in order to find out the reality in terms of the practices of the industries' waste management systems. The participants added that in order to do regulatory activity, adequate number of personnel is required.

The other point of discussion was with regard to the use of research in the industrial waste control. All the participants underlined the power of research based data in convincing the government on the effects of industrial waste on public health. But due to lack of capacity in terms of qualified personnel, very few researches are made. The participants further explained that the problem with researches is that they do not reach the higher government officials.

Finally, the participants said that for the industrial waste problem to get solution, the government should start to think in terms of the public safety and should say "no" to industrial development at the expense of the society.

3.5 OPINIONS OF FARMERS AT *TINISHU* AND *TILIKU* AKAKI RIVER BANKS

In order to find out how the farmers at the vegetable farms are using the water of the *Tinishu* and *Tiliku* Akaki Rivers, field visit was made on the river banks. Two farmers from each of the river banks were interviewed.

The farmers at the *Tiliku* Akaki River bank said that the pollution level of the water is increasing over time. They said that seven years back, there were very big fishes in *Tiliku* Akaki River. Today there are hardly any worms let alone fishes. They believe that this is due to the pollution of the river by toxic chemicals. But, they said their livelihood is dependent on the river; they grow vegetables and generate income from selling the vegetables. The other question raised was what they know about the nature of the vegetables they grow. They said that they know that the vegetables contain chemicals in them. For the question regarding the health problem they face in their family and in their neighborhood, they answered that they suffer from respiratory diseases especially asthma. They said that they also suffer from skin diseases and eye problems. The observation also revealed that the water is black in color and it has bad smell as well. The farmers at *Tiliku* Akaki river bank were pumping the water from the river at the time the interview was made.

The farmers at *Tinishu* Akaki river bank were also interviewed. The two farmers explained that their source of income is from selling vegetables. These farmers also know that the river is polluted but it is the source of water for their farms. The health condition of the farmers and their family and neighborhood was asked. They said that especially children are not in good health condition. Adults also suffer from skin problems and respiratory problems. Especially during the dry season the river is much polluted and has bad smells too. They said that *Tinishu* Akaki river is the river that receives all the city's industrial and domestic wastes all the way from *Geferssa* through *Asko* and all the way through the city, and to *Tinishu* Akaki River and finally to *Aba Samuel* reservoir. These farmers said that they know the vegetables grown are harmful to health but it is the source of their income and said that they can do nothing about it. The observation of the researcher is similar to the explanations given by the farmers.

The water is very dark in color and has very bad smell. The researcher further observed that the farmers were washing the vegetables collected from the farms by using the water from *Tinishu* Akaki River.

3.6 RESPONSES OF THE COMMUNITY ON IDUSTRIAL WASTE

The replies of the respondents for the questions raised in the survey questionnaire, which was organized under six major categories is presented below.

3.6.1 Individual characteristics and background data of respondents

The individual characteristics and general background data of the respondents were the first category of questions on the questionnaire. The data is summarized under Table 3.5.

Table 3.5 Individual characteristics and background data of respondents

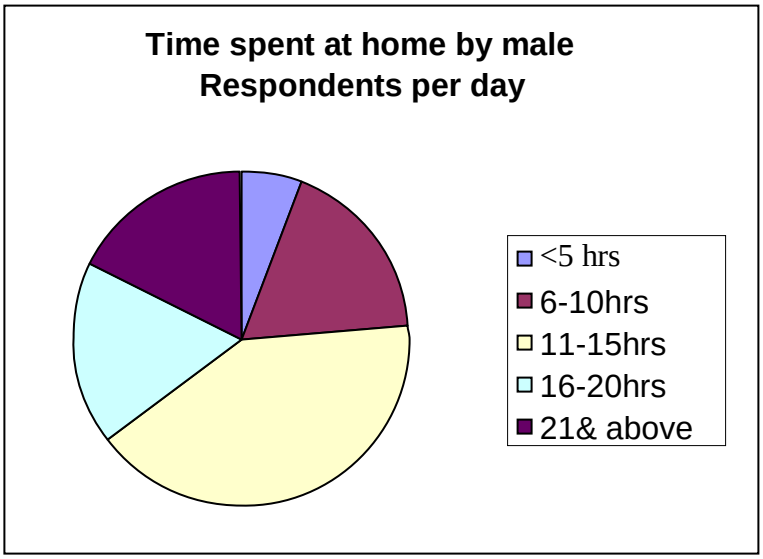
Item		Akaki Kaliti Sub City				Kolfe Keranio Sub City				Total			
		M		F		M		F		M		F	
		f	%	f	%	f	%	f	%	f	%	f	%
Sex		10	50	10	50	7	70	3	30	17	56.67	13	43.33
Age	18-22	-	-	1	10	-	-	1	33.33	-	-	2	15.38
	23-27	-	-	1	10	-	-	1	33.33	-	-	2	15.38
	28-32	1	10	1	10	2	28.57	-	-	3	17.68	1	7.70
	33-42	-	-	2	20	1	14.29	-	-	1	5.88	2	15.38
	43-47	3	30	-	-	3	42.85	-	-	6	35.29	-	-
	48-52	2	20	1	10	1	14.29	1	33.34	3	17.65	2	15.38
	53-57	3	30	1	10	-	-	-	-	3	17.65	1	7.70
	58-62	-		1	10	-	-	-	-	-	-	1	7.70
	63& above	1	10	2	20	-	-	-	-	1	5.88	2	15.38
Employment Condition	Employed	8	61.54	5	38.46	6	85.71	2	66.67	14	82.35	7	53.85
	Unemployed	2	28.54	5	71.43	1	14.29	1	33.33	3	17.65	6	46.15
Number of years respondents lived in their current house	<5 years	1	10	-	-	-	-	-	-	1	5.89	-	-
	6-10	2	20	2	20	-	-	1	33.33	2	11.76	3	23.08
	11-15	2	20	1	10	1	14.29	-	-	3	17.65	1	7.69
	16-20	2	20	-	-	2	28.57	-	-	4	23.53	-	-
	21-25	-	-	2	20	2	28.57	1	33.33	2	11.76	3	23.08
	26-30	2	20	1	10	-	-	1	33.34	2	11.76	2	15.38
	31-35	1	10	-	-	1	14.28	-	-	2	11.76	-	-
	36 & Above	-	-	4	40	1	14.29	-	-	1	5.88	4	30.77
Number of hours respondents spend at home per day	< 5 hrs	1	10	1	10	-	-	-		1	5.88	1	7.70
	6-10	1	10	3	30	2	28.57	1	33.33	3	17.65	4	30.77
	11-15	4	40	2	20	3	42.86	-	-	7	41.17	2	15.38
	16-20	3	30	1	10	-	-	1	33.33	3	17.65	2	15.38
	21 & above	1	10	3	30	2	28.57	1	33.34	3	17.65	4	30.77

Source: Own Field Survey, A.A., 2008.

Note that *M* represents *Male*, *F* represents *Female*, and *f* represents frequency throughout the research paper.

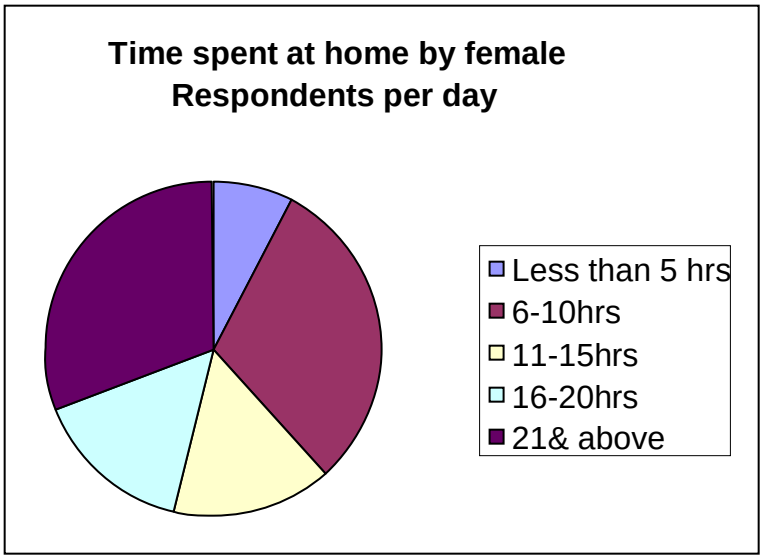
The number of hours spent at home per day by male and female respondents is further depicted using the following pie charts.

Figure 2a



Source: Own Field Survey, A.A., 2008.

Figure 2b



Source: Own Field Survey, A.A., 2008.

3.6.2 How long did respondents live in their residences?

This question was aimed at finding the replies of the respondents about the industries found in their localities in relation to the time respondents lived in their houses. Accordingly, the respondents were asked whether the industries in the vicinity i.e. the industries selected for the study were established before or after the respondents started to live in their current houses. The responses are summarized under Table 3.6.

Table 3.6 Time respondents lived in their residences

Industry	Respondents who lived in their current residences			
	Before the industry was established		After the industry was established	
	f	%	f	%
A.A Tannery	-	-	5	100
Gulelle Soap Factory	-	-	5	100
Akrem Metena Animal Feed Factory	4	80	1	20
K.K.Textile Factory	5	100	-	-
Akaki Metal Products Factory	-	-	5	100
Kaliti Food SC	-	-	5	100

Source: Own Field Survey, A.A., 2008.

3.6.3 Data on industrial waste management practices by the industries

The other set of questions asked respondents on the industrial waste management methods the industries use. The responses are summarized under the following tables: Table 3.7, 3.8 and Figure 3.

Table 3.7 Industrial waste management practice from the view point of the respondents

Responses on the appropriateness of the industrial waste management practice on the communities well being	Six selected industries												Total	
	Addis Ababa Tannery		**Gulelle Soap Factory**		**K.K Textile Industry**		**Akrem Metena Animal Feed Factory**		**Akaki Metal Products Factory**		**Kaliti Food SC**			
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Appropriate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Not Appropriate	5	100	5	100	5	100	5	100	5	100	5	100	30	100

Source: Own Field Survey, A.A., 2008.

In relation to the above question, respondents were asked the types of industrial wastes and/or pollution they suffer from, during and after the production process of the industries. The following table and the subsequent pie chart show the responses of the residents.

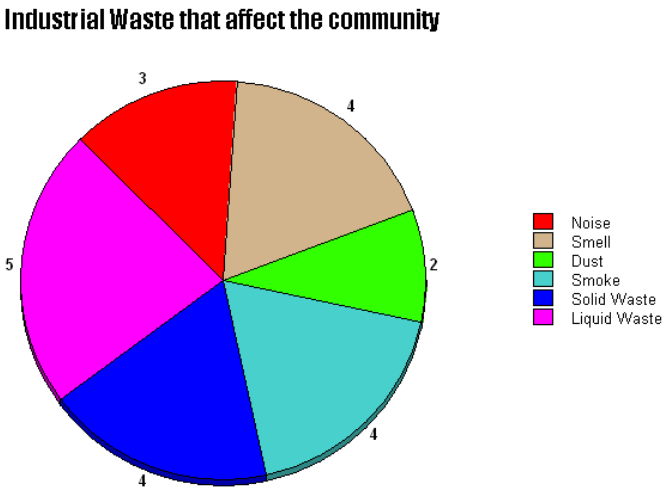
Table 3.8 Types of industrial wastes

Industry	Pollution during production process				Pollution after production process	
	Noise	Smell	Dust	Smoke	Solid waste	Liquid waste
A.A Tannery	-	Yes	-	Yes	Yes	Yes
Gulelle Soap Factory	-	Yes	-	Yes	Yes	Yes
K.K Textile Factory	Yes	-	-	-	-	Yes
Akrem Metena Animal Feed Factory	-	Yes	Yes	Yes	Yes	-
Kaliti Food SC	Yes	Yes	Yes	-	-	Yes
Akaki Metal Products Factory	Yes	-	-	Yes	Yes	Yes

Source: Own Field Survey, A.A., 2008.

The proportion of the industrial wastes during and after the production process is presented under the following pie chart.

Figure 3



Source: Own Field Survey, A.A., 2008.

3.6.4 Time industries use to dispose their wastes

Is there any special time the industries use to dispose their waste? The respondents gave their answer as per Table 3.9a.

Table 3.9a Do industries use special time to dispose their waste?

Special time for industrial waste disposal?	Akaki Metal Products Factory	K.K.Textile Factory	Akrem Metena Animal Feed Factory	Kaliti Food SC	A.A Tannery	Gulelle Soap Factory
	Yes	-	-	Yes	-	Yes

Source : Own Field Survey, A.A., 2008.

Respondents, who answered that there is special time of waste disposal by the industries, indicated the special times industries dispose their wastes in the following table.

Table 3.9b Special time industries use to dispose wastes

Special time for industrial waste disposal?	Akaki Metal Products Factory	K.K. Textile Factory	Akrem Metena Animal Feed Factory	Kaliti Food SC	A.A Tannery	Gulelle Soap Factory
Morning	Yes	-	-	-	-	Yes
Afternoon	-	-	-	-	-	-
Night	Yes	-	-	Yes	-	Yes

Source: Own Field Survey, A.A., 2008.

3. 6.5 Industrial waste and health of the community

The category of questions asking the effects of industrial waste on the health of the community is presented in the following tables.

A.The first data was on the use of the waste water by the respondents

Table 3.10 Respondents' use of waste water

The respondents' use of waste water	Akaki Metal Products Factory		Akrem Metena Animal Feed Factory		K.K. Textile Factory		Kaliti Food SC		A.A Tannery		Gulelle Soap Factory		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Drinking	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Food Preparation	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washing	-	-	-	-	-	-	-	-	2	40	2	40	4	13.33
Irrigation	3	60	-	-	5	100	-	-	3	60	-	-	11	36.67
Not in use	2	40	5	100	-	-	5	100	-	-	3	60	15	50

Source: Own Field Survey, A.A., 2008.

B.The next question asked the quality of the water bodies nearby. The responses are presented below.

Table 3.11 Quality of water bodies

Quality of water	**Number of respondents**	**%**
Good	-	-
Bad/Polluted	26	86.67
Don't know	4	13.37

Source : Own Field Survey, A.A., 2008.

C. To know the suitability of the land for plants, a question was raised and the responses are given in the table below.

Table 3.12 suitability of the land for plants

Is the land suitable for plant?	Respodents residing close to the industries												Total	
	Akaki Metal Products Factory		Akrem Metena Animal Feed Factory		K.K Textile Factory		Kaliti Food Industry		A.A Tannery		Gulelle Soap Factory			
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	5	100	5	100	-	-	-	-	5	100	3	60	18	60
No	-	-	-	-	-	-	2	40	-	-	-	-	2	6.67
Don't know	-	-	-	-	5	100	3	60	-	-	2	40	10	33.33

Source: Own Field Survey, A,A, 2008.

D.The following table depicts the health problems of the respondents.

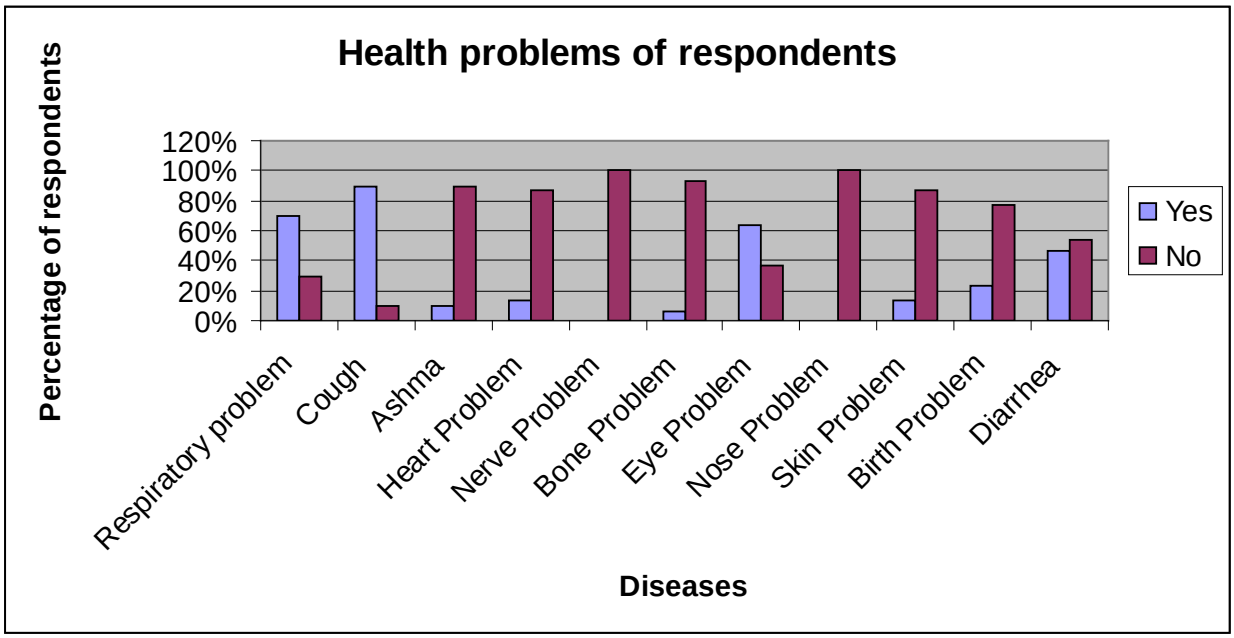
Table 3.13 Health problems of respondents

Do you/ members of your family have the following health problems?		Respondents residing close to the industries												Total	
		Akaki Metal Products Factory		Akrem Metena Animal Feed Factory		K.K.Textile Factory		Kaliti Food SC		A.A Tannery		Gulelle Soap Factory			
		f	%	f	%	f	%	f	%	f	%	f	%	f	%
Respirator y problem	Yes	3	60	4	80	2	40	4	80	5	100	3	60	21	70
	No	2	40	1	20	3	60	1	20	-	-	2	40	9	30
Cough	Yes	4	80	5	100	3	60	5	100	5	100	5	100	27	90
	No	1	20	-	-	2	40	-	-	-	-	-	-	3	10
Asthma	Yes	2	40	1	20	-	-	-	-	-	-	-	-	3	10
	No	3	60	4	80	5	100	5	100	5	100	5	100	27	90
Heart problem	Yes	1	20	-	-	1	20	-	-	-	-	2	40	4	13.33
	No	4	80	5	100	4	80	5	100	5	100	3	60	26	86.67
Nerve problem	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No	5	100	5	100	5	100	5	100	5	100	5	100	30	100
Bone problem	Yes	-	-	-	-	-	-	-	-	2	40	-	-	2	6.67
	No	5	100	5	100	5	100	5	100	3	60	5	100	28	93.33
Eye problem	Yes	2	40	2	40	3	60	5	100	4	80	3	60	19	63.33
	No	3	60	3	60	2	40	-	-	1	20	2	40	11	36.67
Nose problem	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No	5	100	5	100	5	100	5	100	5	100	5	100	30	100
Skin problem	Yes	1	20	-	-	2	40	-	-	1	20	-	-	4	13.33
	No	4	80	5	100	3	60	5	100	4	80	5	100	26	86.67
Birth problem	Yes	1	20	-	-	3	60	1	20	2	40	-	-	7	23.33
	No	4	80	5	100	2	40	4	80	3	60	5	100	23	76.67
Diarrhea	Yes	3	60	1	20	1	20	2	40	3	60	4	80	14	46.67
	No	2	40	4	80	4	80	3	60	2	40	1	20	16	53.33

Source: Own Field Survey, A.A., 2008.

From Table 3.13 the following bar graph is presented to show the health problems of the respondents.

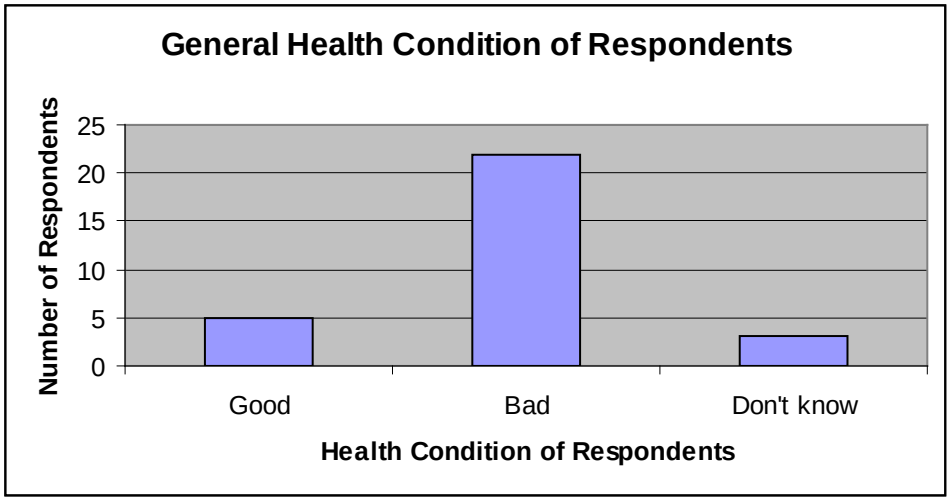
Figure 4



Source: Own Field Survey, A.A., 2008.

E. The general health condition of the respondents was asked. The responses of the communities are presented in the following bar graph.

Figure 5



Source: Own Field Survey, A.A., 2008.

F. The other question in the category of questions in relation to the respondents' health was, how frequent respondents' go to health centers. Table 3.14 summarized the responses.

Table3.14 Frequency of going to medical centers

Frequency of respondents' seeking medical treatment	Respondents residing close to the industries												Total	
	Akaki Metal Products Factory		Akrem Metena Animal Feed Factory		K.K.Textile Factory		Kaliti Food SC		A.A Tannery		Gulelle Soap Factory			
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Weekly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fortnight	-	-	1	20	-	-	-	-	-	-	-	-	1	3.33
Monthly	-	-	1	20	1	20	1	20	1	20	1	20	5	16.67
2 – 5 months	1	20	3	60	-	-	1	20	-	-	1	20	6	20
6 months – 1 year	1	20	-	-	3	60	2	40	3	60	2	40	11	36.67
More than 1 year	3	60	-	-	1	20	1	20	1	20	1	20	7	23.33

Source: Own Field Survey, A.A., 2008.

G. The last question in this category of questions asked what the possible cause for health problems of the community in their respective areas is. Accordingly, the following table presented the responses.

Table 3.15 Respondents' opinion on the health problems of the community

The respondents' view with regard to the cause of the health problem in the respective locality	Respondents residing close to the industries												Total	
	Akaki Metal Products Factory		Akrem Metena Animal Feed Factory		K.K Textile Factory		Kaliti Food SC		A.A Tannery		Gulelle Soap Factory			
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Lack of personal hygiene	1	20	-	-	1	20	-	-	-	-	-	-	2	6.67
Pollution	4	80	4	80	4	80	5	100	5	100	5	100	27	90
Cause other than pollution and lack of personal hygiene	-	-	1	20	-	-	-	-	-	-	-	-	1	3.33

Source: Own Field Survey, A.A., 2008.

3.6.6 Complaints of the communities on the industries

The other category of questions focused on the communities' actions to solve the industrial waste problem. The subsequent tables show aspects related with complaints on the respective industries by the community.

Table 3.16 Complaints made by respondents on the industries

Item		The six selected industries												Total	
		Akaki Metal Products Factory		K.K Textile Industry		Akrem Metena Animal Feed Factory		Kaliti Food SC		A.A Tannery		Gulelle Soap Factory			
		f	%	f	%	f	%	f	%	f	%	f	%	f	%
Do you have complaint on the industrial waste management practice?	Yes	5	100	5	100	5	100	5	100	5	100	5	100	30	100
	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Where did you make your complaints?	Industry	-	-	-	-	1	20	2	40	1	20	1	20	5	16.67
	Sub City's Management	-	-	-	-	1	20	-	-	-	-	-	-	1	3.33
	Sub city's Environmental Protection Office	1	20	-	-	-	-	-	-	-	-	2	40	3	10
	Sub city's Trade & Industry Office	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kebele	1	20	-	-	-	-	-	-	-	-	1	20	2	6.67
	Made no complaints	3	60	5	100	3	60	3	60	4	80	1	20	19	63.33
Reason for not complaining	The problem is not serious	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fear of not getting solution	2	66.67	4	80	3	100	3	100	3	75	1	100	16	84.21
	Thinking that the relevant bodies would solve the problem	1	33.33	1	20	-	-	-	-	1	25	-	-	3	15.79
Did the respondents who made complaints get solution?	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No	2	100	-	-	-	-	2	100	1	100	4	100	9	81.82
	Partly	-	-	-	-	2	100	-	-	-	-	-	-	2	18.18

Source: Own Field Survey, A.A., 2008.

A. After the residents made their complaints what were the result of the complaints. Table 3.17 shows the responses of the community.

Table 3.17 Actions taken by respondents after their first complaints

Source: Own Field Survey, A.A., 2008.

Respondents action		The six selected industries												**Total**	
		Akaki Metal Products Factory		**K.K Textile Industry**		**Akrem Metena Animal Feed Factory**		**Kaliti Food SC**		**A. A Tannery**		**Gulelle Soap Factory**			
		f.	%	f	%	f	%	f	%	f	%	f	%	f	%
Made complaint to other body	Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sub City's Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sub City's Environment Protection Office	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sub City's Trade and Industry Office	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kebele	-	-	-	-	-	-	-	-	-	-	1	25	1	9.10
Kept silent	Due to fear of not getting solution	2	100	-	-	-	-	2	100	1	100	-	-	5	45.45
	Because the problem is not serious	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thinking that the problem would get solution by responsible bodies	-	-	-	-	2	100	-	-	-	-	3	75	5	45.45
Made compliant to the first body	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No	2	100	-	-	2	100	2	100	1	100	4	100	11	100

B. The last category of questions was aimed at getting the attitudes of the respondents on general aspects related to the proper location of the industries, the causes for the problem of industrial wastes and possible solutions to the problems. These questions were presented in a Likert Scale.

Table 3.18 Respondents' opinion on siting of industries

Where should industries be located?	**Scale**	**Number of respondents**	**Percentage**
Far from residences	Strongly Agree	20	66.67
	Agree	8	26.67
	Undecided	1	3.33
	Disagree	1	3.33
	Strongly Disagree	-	-
Less populated areas	Strongly Agree	13	43.33
	Agree	16	53.33
	Undecided	-	-
	Disagree	1	3.34
	Strongly Disagree	-	-
Near water bodies	Strongly Agree	2	6.67
	Agree	-	-
	Undecided	1	3.33
	Disagree	12	40
	Strongly Disagree	15	50
Near open fields	Strongly Agree	-	-
	Agree	-	-
	Undecided	2	6.67
	Disagree	21	70
	Strongly Disagree	7	23.33

Source: Own Field Survey, A.A, 2008.

C. Respondents were asked to give their opinions why the industries failed to use proper industrial waste management system. It is presented under the following table.

Table 3.19 Failure of industries to properly manage their wastes

Respondents opinion on the reason for failure of employing industrial waste management	**Scale**	**Number of respondents**	**Percentage**
Lack of finance	Strongly Agree	1	3.33
	Agree	-	-
	Undecided	1	3.33
	Disagree	25	83.34
	Strongly Disagree	3	10
Lack of qualified personnel	Strongly Agree	1	3.33
	Agree	-	-
	Undecided	1	3.33
	Disagree	22	73.34
	Strongly Disagree	6	20
Lack of awareness	Strongly Agree	3	10
	Agree	1	3.33
	Undecided	-	-
	Disagree	18	60
	Strongly Disagree	8	26.67
Carelessness	Strongly Agree	13	43.33
	Agree	16	53.34
	Undecided	1	3.33
	Disagree	-	-
	Strongly Disagree	-	-
Loose control by regulatory bodies	Strongly Agree	11	36.67
	Agree	18	60
	Undecided	1	3.33
	Disagree	-	-
	Strongly Disagree	-	-

Source: Own Field Survey, A.A., 2008.

D. The statement stating that environmental protection offices at different levels did their best to curb industrial waste problem, revealed the following disagreement.

Table 3.20 Respondents' opinion on Environmental Protection Authority

Environmental Protection has done enough on industrial waste problem.	**Scale**	**Number of respondents**	**Percentage**
	Strongly Agree	-	-
	Agree	-	-
	Undecided	-	-
	Disagree	14	46.67
	Strongly Disagree	16	53.33

Source: Own Field Survey, A.A., 2008.

E. The final opinion question asked the respondents' opinion on what should be done by the Ministry of Health to curb the industrial waste management problem.

Table 3.21 Respondents' opinion on the responsibility of Ministry of Health

What needs to be done by Ministry of Health to Control the industrial waste problem	**Scale**	**Number of respondents**	**Percentage**
Control	Strongly Agree	14	46.67
	Agree	16	53.33
	Undecided	-	-
	Disagree	-	-
	Strongly Disagree	-	-
Advocacy and awareness creation	Strongly Agree	7	23.33
	Agree	23	76.67
	Undecided	-	-
	Disagree	-	-
	Strongly Disagree	-	-
Taking action on those who do not to comply with laws and polices of the environment, public health and health.	Strongly Agree	16	53.33
	Agree	14	46.67
	Undecided	-	-
	Disagree	-	-
	Strongly Disagree	-	-

Source: Own Field Survey, A.A., 2008.

CHAPTER FOUR

4. DATA ANALYSIS AND INTERPRETATION

In chapter three, data collected from both primary and secondary sources were presented. In this chapter, major points of the research will be analyzed and interpreted based on the data collected. The data will be analyzed using descriptive analysis techniques. More specifically, since the intention of the paper is to reveal the magnitude of the problem of industrial wastes on the urban communities, frequency distributions are used. Further more, measures of central tendency are also used. The analysis is primarily qualitative because, as RTI International (2008) stated 'Qualitative analysis is a powerful tool enabling researchers to explore people's motivations, behavior, desires, and needs'. Quantitative analysis is also used in the data analysis of the research.

4.1. FACTORS WHICH INCREASE THE HARMFUL EFFECTS OF INDUSTRIAL WASTES ON COMMUNITY

4.1.1. Individual characteristics and background data of respondents

The data presented under Table3.5 on individual characteristics and background data of respondents indicate that the sex composition of the respondents is 17 male and 13 female i.e., 57 percent male and 43 percent female. The data on age shows that respondents who are less than 48 years of age are composed of 58.85 percent male and 53.84 percent female. In addition, out of the 17 male respondents, 41.18 percent and out of 13 female respondents, 46.15 percent are more than 48 years of age. From the 17 male respondents, 17.65 percent are unemployed whereas, 82.35 percent are employed. Out of the 13 female respondents, 46.15 percent are unemployed and 53.85 percent are employed. According to literatures, the extent of being affected by industrial wastes is dependent upon the extent of exposure to the wastes. The extent of exposure to the effects of industrial waste increases when the time one spends in an area where there is industrial waste is long. It also means that the more one lives in an area where there is industrial waste, makes the effect of industrial waste severe. Old age is one of the reasons for a person to stay and spend long hours at home. In areas where there are industrial wastes, spending long hours at home due to unemployment, old age or any other reason, makes the health of the individual worsened.

When it comes to the number of years respondents lived in their current residences, 58.82 percent male and 30.77 percent female lived 20 or less number of years in their present houses. The male and female respondents who lived more than 20 years in their current residences are 41.17 percent and 69.23 percent respectively. The number of hours respondents spend in their residence per day shows that 64.71 percent male and 53.85 percent female spend less than 16 hours per day at home. The respondents who spend more than 16 hours per day are 35.29 percent male and 46.15 percent female.

The proportion of respondents above 48 years of age is dominated by female. The proportion of unemployed female is greater than the unemployed male. The proportion of female respondents who lived in their current residences for more than 20 years is greater than that of male respondents. Therefore, other things being equal, it is evidently seen that the female respondents are more exposed to the effects of industrial wastes only because of their individual characteristics and backgrounds. It should be noted however that even though the female respondents are more exposed than male respondents, to the harmful effects of industrial wastes, the target population is homogeneous and all individuals share the same vulnerabilities.

4.1.2 The prevalence of industrial wastes for long period of time

Profile of the industries presented under Table 3.1 shows that the industries are aged. The mean age of the industries is 48 years. The minimum age of the industries is 16 years whereas; the maximum age is 83 years. As per the data given under Table 3.6 regarding the respondents' years of stay in their present residences in relation to years of establishment of industries, Addis Ababa Tannery, Gulelle Soap Factory, Akaki Metal Products Factory and Kaliti Food SC were established before all the respondents started to live in the area. Whereas, out of the 5 respondents who live adjacent to Akrem Metena Animal Feed Factory, 20 percent lived in their current residence after the industry was established and 80 percent lived in their current residence before the industry was established. Likewise, all of the respondents who live adjacent to K.K Textile Factory started to live in their current houses before the industry was established.

According to Table 3.6 on time respondents lived in their current residence 100 percent of the residents who live adjacent to Addis Ababa Tannery, Gulelle Soap Factory, Akaki Metal Products Factory and Kaliti Food SC have always been exposed to the industrial waste problem. Out of the total respondents these group comprise 66.67 percent. The theoretical background described earlier shows the harm of industrial wastes is intensified when the level of exposure to the wastes increases. Since the industries are aged they have been there before the residents started to live in the area.

4.2INDUSTRIAL WASTE MANAGEMENT PRACTICES OF SELECTED INDUSTIRES

4.2.1 Data collected from the industries

The industrial waste management practices by the industries, as per the data collected from the industries, show that most industries follow industrial waste disposal methods. Few of the industries use recycling methods whereas, none of them use waste reduction or avoidance techniques. (Refer Tables 3.2 on Industrial Waste Management Methods)

Gulelle Soap Factory and KK Textile Factory have established waste water treatment plants. Specifically, 33.33 percent of the industries are applying waste water treatments. When it comes to industrial waste disposal methods, the only industries applying land fill and incineration in their industrial waste disposals are Gulelle Soap Factory and Kaliti Food SC respectively. The application of incineration and landfill by the two industries is 16.67 percent out of the total. On the other hand, 4 industries are applying open dumping of industrial wastes i.e., 66.67 percent of the industries are disposing their industrial solid wastes on open spaces. The two industries which do not use open dumping are K.K Textile Factory and Gulelle Soap Factory. The practice of discharging waste water to water bodies by way of canals or directly to the rivers, commonly known as ocean dumping, is applied by 66.67 percent of the industries. Waste export is not practiced by all the 6 industries. Waste exchange is practiced by 33.33 percent of the industries. The two industries using waste exchange are Akaki Metal Products Factory and Addis Ababa Tannery.

Taking the data on methods of industrial wastes adopted by the industries described above, the following points are made.

1. The use of land fill to dispose industrial waste is safe on the side of the society. But many of the industries are not applying the system.
2. Incineration is also safe on the side of the society, even though most of the industries do not use the system since incinerators are expensive.
3. Open dumping is most dangerous to the community, since it is unregulated dumping of the wastes. 66.67 percent of the industries are dumping their wastes on open spaces either in the compounds of the industries or outside.
4. Ocean dumping is also widely practiced by the industries. 66.67 percent of the industries are releasing their waste waters to the rivers via canals. The researcher's observation revealed that A.A. Tannery releases its waste water directly to the river that starts from *Geferssa* and called *Leku* around the factory. The other 3 industries release the waste waters through canals which finally mix with the rivers.
5. Waste export is not practiced by all of the industries. It is practiced by developed nations because; developed nations do not want the wastes to remain in their countries. They want to export it to developing countries. Developing countries lack the awareness of protecting the environment and they are receiving the wastes of the developed nations. The practice is now considered illegal.
6. Waste exchange is practiced by only two industries- Akaki Metal Products Factory and Addis Ababa Tannery. It is a good practice by way of selling the wastes for those users of the wastes as raw materials or other processes. It is good for the industries selling the wastes, for those purchasing the wastes and for the community as well.
7. Solid waste treatment plants are not practiced by all. It is very important that industries install solid waste treatment plants. By installing solid waste treatment plants, industries could have saved their costs by making use of the solid wastes which otherwise were considered as useless. The primary beneficiary is the society from solid waste treatment plants.
8. Waste water treatment plants are not widely practiced; only two industries are applying waste water treatment plants: K.K. Textile Factory and Gulelle Soap Factory. Establishing waste water treatment plants is important for both the industries and the community. The industries can benefit from the treated waste waters, by recirculation of the water back to the production process.

9. Due to lack of technology, trained personnel and financial capacity, the systems of reducing and avoiding wastes are not yet practiced by the industries.

The industrial waste management practices of the 6 industries show that most of the industries are not properly managing their wastes. There is strong doubt by Environmental Protection Authority and Ministry of Health that the industries which are claiming that they have installed solid or waste water treatment plants are not using the system regularly. The systems are considered by these bodies as having symbolic purposes. Surprise visits to these industries may help reveal the actual situation on the ground.

4.2.2 Opinions of the residents living adjacent to the industries

The above analysis and interpretation of data was made based on the interviews conducted with the industries' management. The same questions were asked to the residents through the survey questionnaire. The responses of the respondents (100 percent) indicated that the industries are not appropriately managing their wastes.

According to Table 3.8 on types of industrial wastes, 50 percent of the industries are creating noise pollution to the society. 66.67 percent of the industries are causing bad smells to the nearby community. 33.33 percent of the industries are polluting the environment by dust. 66.67 percent of the industries are polluting the environment by smoke. 66.67 percent of the industries are polluting the environment by solid waste. 83.33 percent of the industries are polluting the environment by liquid waste: industrial waste water.

We can understand from the above descriptions that there is air pollution through noise, smoke, dust and bad smell. The researcher's observation confirmed the respondents' replies. Notable to the problem of noise pollution, according to the researcher's observation, is the K.K. Textile Factory. The observation of the researcher also revealed the problem of smoke pollution. The smoke in the area of the Addis Ababa Tannery is very disturbing. The smoke has also bad odor.

From the observation made by the researcher it is easy to imagine that the communities' surrounding the Addis Ababa Tannery are not only suffering from the offensive odor of the wastes and the smoke during the production process, but also the discomfort it creates to live in the area. The offensive odor of the Gulelle Soap Factory is also witnessed by the researcher's observation.

As per Table 3.8, on types of industrial wastes during and after the production process, 66.67 percent of the industries are using open dumping and 83.33 percent use Ocean dumping to dispose their wastes. The responses of the community indicated the same percentages (66.67 percent) of the industries are affecting the society by their industrial solid wastes. However, the industries' response regarding their practice of ocean dumping totaled 66.67 percent as compared to the responses of the respondents, i.e. 83.33 percent. The plausible response could be those of the respondents since they are the victims of the problem. In areas where there are liquid and solid waste disposals together, the problem is deepened. These are Gullele Soap Factory, Addis Ababa Tannery and Akaki Metal Products Factory.

4.3 HEALTH AND INDUSTRIAL WASTES

The main intention of this research is to reveal the magnitude of the problem of industrial wastes on the urban dwellers. The use of the water bodies by the community influences the extent of receptiveness to the harmful impacts of industrial wastes. The problem of industrial waste is seen from the health problem it causes to the community via air, water and land pollution.

4.3.1. The use of the water bodies/waste water by the community

The respondents' were asked to give their responses on their use of the water bodies' nearby/waste water. The survey result revealed that 50 percent of the respondents do not use the water for any purpose. 13.33 percent of the respondents use the water bodies for washing purpose and the rest 36.67 percent use the water for irrigation purpose.

With regard to the view of the respondents on the quality of the water bodies nearby, 86.67 percent responded that the water is bad in quality/polluted. The rest 13.37 percent of the respondents replied that they don't know the quality of the water. None of the respondents use the water bodies for drinking and food preparation purpose.

Literatures disclose that the most direct way to the effects of contaminated water is when the water is used for drinking and food preparation purpose. The reason for not using the water bodies for drinking and food preparation purpose may be attributable to the increase in the level of urbanization and understanding of the community members in the two sub cities.

Issayas (1993: 8) in his article, wrote that 'Although *Tinishu* Akaki and *Tiliku* Akaki rivers are highly polluted and totally unfit for consumption, some 50, 000 people in the rural part of Addis Ababa and Akaki village up to *Aba Samuel* reservoir were dependent on it for drinking and food preparation purpose'.Those respondents, who use the rivers for irrigation, grow vegetables. They sell and also consume the vegetables. The health risks of consuming these vegetable irrigated with highly polluted rivers is high. Literatures have revealed that cooking the vegetables grown by polluted water doesn't' contribute to reduce the health risk.

4.3.2. The condition of polluted land for plant growth and for health

Land pollution causes soil contamination. When soil is contaminated it highly reduces productivity. To see the suitability of the land polluted by industrial waste, respondents were asked. 60 percent of the respondents noticed the problem of polluted soil in growing plants. 6.67 percent of the respondents answered that there is no problem for plants to grow on polluted land. However, 33.33 percent answered that they do not know whether polluted land is suitable to grow plants or not.

The researcher's observation shows that the solid wastes filled areas; do not have plants. In some cases, the soils are blackened and look burned lands. The grassland grown near the factories were seen watered using the polluted waste waters. But the open dump areas were not used for plants.The solid waste accumulated in the compound of Gulelle Soap Factory, made the area marshy and wet and there is hardly any plant grown in the area. Literatures also prove that polluted land is not suitable for plants to grow. In addition, literatures state that polluted land increases the risk of health hazards to man.

4.3.3. Health Problems of the respondents

The data on the general health conditions of the respondents show that 73.33 percent of the respondents stated their health conditions: bad, while, 16.67 percent of the respondents replied that their health is good. 10 percent of the respondents' replied that they do not know about their health condition. (Refer Figure 3 on the general health conditions of the respondents).

There are a number of health problems that occur as a result of pollution. The health problems are categorized along with the pollution type that brings about the health problem.

Table 4.1 Health problems due to pollutions

Health problem because of pollutions		Frequency of Respondents	Percentage
Air pollution	Breathing problem	21	70
	Cough	27	90
	Asthma	3	10
	Heart problem	4	13.33
Water Pollution	Nerve problem	-	-
	Diarrhea	14	46.67
	Bone problem	2	6.67
	Eye problem	28	63.33
	Nose problem	-	-
Land pollution	Birth problem	7	23.33
Land, air and water pollution	Skin problem	4	13.33

Source: Own Field Survey, A.A., 2008.

From the above table 70 percent of the respondents have breathing problems. 90 percent of the respondents have cough problems and 10 percent of the respondents are asthmatic. Breathing problem cough and asthma are respiratory problems. According to literature, air pollution affects respiratory organs severely. The interview made with the public officer at Akaki kaliti Health Center revealed that respiratory problems are one of the top 10 health problems in the city of Addis Ababa. 13.33 percent of the respondents have heart problems. Heart problems are caused by air pollution. None of the respondents have nerve problem. Bone and eye problems are caused by water pollution and 6.67 percent and 63.33 percent of the respondents are affected by these health problems respectively. Birth problems are caused by land pollution. Birth problems affected 23.33 percent of the respondents. Skin problem affected 86.67 percent of the respondents. Skin diseases come as a result of air, water or land pollution.

The health problems due to industrial waste are prevailing on the community. In fact, the research did not conduct specific levels of pollution of the environment nor did public health study on the community. However, by taking into account the practices of the industries which are dominantly disposal of industrial wastes without making any treatment on the one hand, and taking the jeopardy of open and ocean dumping presented in the literature part, we can logically link the health problems of the community are largely due to causes attributable to pollution. Moreover, literature explains the major sources of pollutants as: food processing industries, metal smelting industries, textile industries and tanneries. These industries are largely the ones dealt with in the study i.e. the six industries selected for the study fall under these categories.

The economic problem of the people in our country together with ignorance and negligence made the tendency of the society not to go to health centers more frequently. People hardly go to health centers to get medical treatment. This makes it difficult to know the health status of the society. It is customary to go to health centers when the health problem of an individual gets worse. Due to these facts, the effects of industrial wastes on the community can not be determined accurately.

According to Table 3.14, no respondent goes to health centers weekly, 16.67 percent of the respondents go to health center every month, 20 percent of the respondents go to health centers within 2-5 months time, 36.67 percent of the respondent go to health centers every 6 months to 1 year time and the rest 3.33 percent of the respondents do not go to health centers within one year time. In our earlier discussion, we said that 73.33 percent of the respondents' health conditions are not good. On the other hand, when we see the frequency of respondents going to health centers, it is less frequent. The time gap could have been considered more frequent, if it was within intervals of such as once in a month and so on. Lack of awareness of the health impact of industrial wastes has placed the community into a negligent position.

The health centers visited in the two sub cities and the focus group discussion made with professionals from Ministry of Health also show that lack of awareness of the dangers of industrial waste is prevalent in the society.

4.4 COMPLAINTS OF THE COMMUNITY ON INDUSTRIAL WASTE DISPOSED FROM THE SELECTED INDUSTRIES

Even though, the community has little knowledge on the health impacts of industrial wastes, some of them complained on the unsafe and unconformable state the industrial wastes created on their day-to-day lives. However, very few of the complaints got partial solutions. 63.33 percent of the respondents did not make complaints to any body. Where as, only 36.67 percent made complaints. The respondents who did not make the complaints to any body doubted the positive replies by the relevant bodies. From Table 3.20 on respondents' opinion on EPA, we can understand that 46.67 and 53.33 percent of the respondents disagreed and strongly disagreed respectively on the statement that states that EPA has done enough on industrial wastes. Likewise, on Table 3.19 on failure of the industries to properly manage their wastes due to loose control by regulatory bodies was strongly agreed by 36.67 percent and was agreed by 60 percent of the respondents. The respondents are not confident on the positions of the responsible bodies. They seem to have lost hope in getting solution and seem to be harmed by the whole game between the government, the industries, and the relevant bodies.

4.4.1. Where did the communities put their complaints?

The respondents, who made complaints, took the cases to different bodies. Accordingly, 16.67 percent of the respondents complained to the industries, 3.33 percent reported to the sub city's top management and 10 percent took the case to sub city's environmental protection offices.

The result of their complaint revealed that only Akrem Metena Animal Feed Factory has improved partly, the rest of the industries did nothing to solve the problem. From the interview with Akrem Metena Animal Feed Factory management, it was known that the fattening of animals used to take in the compound of the industry, now they have taken out this process to somewhere else. But still, pollution due to smoke, smell and dust are the problems identified by the respondents.

4.4.2. Actions taken by the respondents

After the respondents made their complaints, except for Akrem Metena Animal Feed Factory, which partly solved the problem, the other industries were passive. Unable to get solution, 9.10 percent of those respondent who made complaints, made another compliant to other responsible body than the previous. The rest 90.90 percent of the total respondents who made complaints, kept quiet due to fear of not getting solution and thinking that the problem would be solved by responsible bodies. No respondent made another complaint on the body that he/she made his/her previous complaints. The discussions above show that the communities do not know where exactly to go, who the responsible party on industrial waste related issues. It seems that there is another body which is responsible for the industrial waste problem other than EPA and Ministry of Health but there isn't. The problem seems untouchable, no body really cares. The suffering of the society has continued.

From the analysis and interpretations of data, we can conclude that industrial waste is affecting the wellbeing of the society. The health of the community is at risk at present and with the increase in the establishment of the industries it would get worse. The problems of industrial wastes will increase unless immediate actions are taken to curb the situation by the government and the appropriate non governmental and civil society organizations.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The findings and analysis of this research on the effects of industrial wastes on urban communities revealed that the six industries: K.K Textile Factory, Kaliti Food SC, Addis Ababa Tannery, Gulelle Soap Factory, Akrem Metena Animal Feed Factory and Akaki Metal Products Factory lack proper industrial waste management practices. The environment and the community are not taken into consideration by the industries. The industries are using waste disposal methods predominantly in open and ocean dumping. They simply dump their solid and liquid waste on the open spaces and/or water bodies. Waste management has not been a priority by the industries as they are able to dispose the wastes without incurring any expense, they become negligent on waste management. Only 33% of the industries have waste treatment plants. However, the proper functionality of the waste treatment plants of these industries is doubted by Ministry of Health and Environmental Protection Authority.

While people living close to the industries are leading a difficult life due to industrial wastes, the industries operate even without being bothered by Ministry of Health, EPA, Ministry of Trade and Industry and Ethiopian Investment Agency. All the industries underlined the lack of finance and qualified personnel as the reason for not applying proper industrial waste management methods. Negligence to both the environment and society by the industries is evidenced by the fact that except citing the problem of finance and personnel, most of the industries couldn't mention any of the tangible efforts they made.

The improper industrial waste management practice by the industries is largely attributable to the loose control and regulation by EPA, Ministry of Health and Ministry of Trade and Industry and Ethiopian Investment Agency. Failure of these regulatory bodies to control the industries has increased the haphazard practices of waste management by the industries. The licensing bodies including Ethiopian Investment Agency and Ministry of Trade and Industry at different levels focus on giving as many investment permits as possible through “ever smooth service delivery”. This licensing process underrates the society and the environment.

Moreover, there is no siting criterion applicable by the licensing bodies. Industries are placed anywhere without considering neither the nature of the wastes nor proximity to dwelling units.

Even though, there is no code of conduct operational in EPA which guides, Environmental Protection Authority at different levels is the authority to protect the environment from pollution and is entitled to take measure on those bodies which do not comply with the country's environmental policy. But the reality is contradictory to this entitlement. The environmental policy couldn't help to save the rivers and the land. The policy is just a “paper tiger” as far as the industrial wastes issue is concerned. Rapid industrialization strategy at any cost by the government has crippled the Authority to take a reluctant stance on the industrial waste issue. The researcher is of the opinion that unlike, the other activities performed by the Authority, the most pressing one could have been the problem of pollution from industrial wastes. However, EPA is focusing on less important issues like land leveling and filling while ignoring the most important issue of industrial waste problem.

Ministry of Health has also been inactive in safeguarding public health from health effects of pollution due to industrial wastes. Even though, the Ministry tried to convince the government official on the health impacts of industrial wastes and the fact that measures should be taken on those who failed to comply to the policies, the efforts produced nothing. This again is reasoned out by the government’s concern in increasing the number of industries and keeping the issue of industrial wastes pending.

From the findings of the research it was found out that all the respondents do not use the water bodies for drinking and food preparation purposes. The use of the polluted waters for vegetable farms has placed not only the communities who live close to the industries but also the city dwellers as well in a disastrous position. The health impacts of industrial wastes on the community was determined by taking the health problem of the respondents and relating the proven health problems as a result of pollution, from literatures.

Evidently however, most of the industries are disposing their wastes on open spaces and/or water bodies without treating them and the pollution problem at the production process given that the proximity to the sources of waste generation increase the level of damage from industrial wastes poses hazard on the health of the communities.

The communities are suffering from pollution problem as a result of industrial wastes and yet nobody listens to the complaints of the communities. People are forgotten and the right by every one to have a safe and clean environment is ignored. Does it mean that this right works excluding the communities living close to the industries with unsafe and unhealthy environment? Of course, the communities lack the awareness in exercising the right boldly stated under article 44 (1) of the constitution as 'Every body has the right to have a clean and healthy environment'. To sum up, the communities are suffering from industrial waste problems but the government, the industries, EPA, Ministry of Health, Ministry of Trade and Industries and Ethiopian Investment Agency have not yet solved the problem.

5.2 RECOMMENDATIONS

Industries have been releasing their wastes without any intervention by Ministry of Health, EPA, Licensing bodies. But this negligence has placed the communities residing close to the industries in a dangerous position. Corrective action is required from the industries. The industries should start to think for the society and the environment. Since the industries are part and parcel of the society, they should think in terms of their future livelihood and operation. Therefore, the industries should seek ways of improving their industrial waste management systems. They have nothing crucial than the issue of industrial wastes. The haphazard industrial waste practices by the industries will affect their survival sooner or later. To fill their financial and expertise gaps, they should work on creating links with organizations working on the environment both within and outside the country. The industries should secure funds to install the system of waste treatment and recycling in any way possible. There is no other alternative than installing waste treatment plants and therefore, strategic priority needs to be given by the industries.

Siting criteria needs to be designed and implemented. It is better to consider the location of the industries, the planned system and technologies of waste management etc, before the industries are established. It is better to focus on preventive action than curative ones. Those industries which are established already may not be moved to sites far from proximity to dwelling units or populated areas. For these industries it would be less costly to improve the system of waste management than make a new move and still install to improve the system there. Licensing bodies should give weight to the type of product produced, the waste type etc along with the sitting criteria. Regulatory task should be done again by licensing bodies before business permits are made. This can be done by contacting the respective bodies from health and environment offices. This means for industries that showed weak industrial waste management, the licensing body should not renew their licenses.

The government bodies which has stake on the environment or public health, the licensing bodies and others as well need to work in integrity rather than in isolation. There should be checks and balances as among these bodies.

When the licensing bodies give permits, it is in the belief that EPA and Ministry of Health will play their roles in regulating the industries. But the case has been different. Therefore, one option is to form some kind of units/desks which communicates with Ministry of Health and EPA for the industries given licenses or for those industries which renew their licenses. This unit/desk works to check the progresses made, the problem encountered and so on. The other option is to establish reporting relationship between EPA, Ministry of Health and Ministry of Trade and Industry and Ethiopian Investment Agency disclosing which industries were regulated and the details as well.

The laws and policies on environment and public health needs to be effectively implemented or revised if they have problems. The right to live in a safe & healthy environment should not be compromised for what ever problem raised. Moreover, the country's development can only be attained if it encompasses all the packages necessary for development. The most important of which is the society. Experience taught us that with the loose control by pertinent bodies, it seems as if the problem is "irresolvable". But this attitude should be removed; industries shouldn't be allowed to dispose their wastes as they wish.

At the top of the problem of industrial wastes is lack of awareness by industries, government and EPA, Ministry of Health, Ministry of Trade and Industry and Ethiopian Investment Agency. A lot should be done by Ministry of Health and EPA or other governmental and non-governmental bodies that have interest in public health & environment. Ministry of Health and EPA should educate the society on the harmful effects of industrial wastes. The public should be informed about the toxic chemicals found on the vegetables grown in places where the polluted waters are used for irrigation. These places include the vegetable farms of *Tinishu* and *Tiliku* Akaki river banks. The public need to know these specific places and should be informed not to buy the vegetables grown in those specific places where the use of polluted waters is apparent. Public media should be used to this end. Once the public is aware of the damages of industrial waste, it may discourage consumers to buy products produced by polluting industries. This may also lead to a creation of a social movement that will stand against polluting industries which will despise industrial development that do not take into consideration the society and the environment.

Attaining industrial development without affecting the society and the environment is possible. Developed countries had no predecessors to share experiences on the industrial waste problems on society and environment. That is the reason why they are still paying for what happened in the past. We should learn from developed countries and focus on the problem now more than ever before. Of course, it may not be easy to make this change of attitude in industry, environment and public safety and health relationship. The situation needs to be pressed so hard in order to get solution in the shortest time possible.

Researches need to be undertaken which show the health impacts of industrial wastes on the community. Researches can play vital roles in revealing the actual situation and the extent of the problem of industrial wastes. The lack of qualified personnel in environmental health and sciences should be solved. Getting more number of graduates in the environmental health and sciences is mandatory to attain the desired change. Last but not least, it should be stressed that the solution by coordinated efforts of EPA, Ministry of Health, Ministry of Trade and Industry, Ethiopian Investment Agency, the industries, the government, society and non- governmental organizations.

BIBLIOGRAPHY

Addis Ababa City Administration.2008. Available at: http://www.addisababacity.gov.et. Accessed on 21 June 2008.

Location Assessment Report of Processing, Manufacturing and Health Care Industries.2006.Addis Ababa.

Air Pollution .n.d. Available at: http://www.answers.com/topic/air_pollution. Accessed on 20 January 2008.

AMA Management Briefing.1998.*Towards Pollution Free Manufacturing*. USA. Institute for Local Self Reliance.

Bassis, Luke.n.d .*Waste Disposal*. Available at: http://www.umich.edu/society/waste dispsoal.htm.Accessed on 28 January 2008.

Botany.N,d.Availableat:http://www.botany.uwc.ac.za/sci_ed/grade10/ecology/conservation/poll. htm.Accessed on 13 January 2008.

Brainy Quotes.2008.Available at: http// www.brainy quote. com/quotes authors/louis-slaughter.html. Accessed on 25 February 2008.

Buchanan, Narisa and Horwitz, Carl N.d. *Pollution and Society*. Available at http://www.umich.edu/gs265/society/pollution.htm. Accessed on 12 March 2008.

Business Dictionary. 2008. Available at: http://www.Businessdictionary.com.Accessed on 22 March 2008.

Disease Control Priorities Project in Developing Countries.2006.*Air and Water Pollution: Burden and Strategies for control*. Available at: http://www.ncbi.nlm.nim.gov. Accessed on 24 January 2008.

Drake, Alvin W., Keeney, Ralph L. & Morse, Philip M..1972. *Analysis of Public Systems*. USA.

Environmnet Canada.2007.Available at http://www.ec.gc.ca.Accessed on 12 February 2008

Environmtal Guideline for Siting of Industry. 1985. New Delhi. India. Accessed on 31 March 2008.

Environmental Pollution in Urban Environment and Human Biology.2003.
Air Pollution and Health. Available at http://www.sciencemag.org/cgi/content.
Accessed on 02 January 2008.

Epidemiology. n.d. Available at: http:en.wikipedia.org/wiki/epidemiology. Accessed on 08 March 2008.

Ethiopian Environmental Protection Authority. 2006. [Report] Addis Ababa.

Ethiopian Environmental Protection Authority. 2007. [Report] Addis Ababa.

Federal Democartic Republic of Ethiopia(FDRE).1995.*Environmnental Rights*.(Negarit Gazeta).Addis Ababa: Ethiopia

Green Foot Steps.2006.*Industrial Pollution.* Available at://www.Green Foot Steps.com.Accessed on 25 March 2008.

Hess, Kathleen.1998. *Environmental Site Assessment: Phase I: A Basic Guide*.2nd ed. USA.Lewis Publishers.

Hygiene and Environmental Health.2007.Ministry of Health. Addis Ababa.

Industrial Waste. n.d.Available at:http://en.mimi.hu/environment/industrial-waste.html. Accessed on 30 December 2007.

Issayas Tadesse.1993.*Tanning Industries in Ethiopian Water Pollution Impact and Possible Interventions* (Article).Finland.

ISCID-Encyclopedia of Science and Philosophy N.d. *Neurotoxin.*Available at: http://www.iscid.org/encyclopedia/Neurotoxin.Accessed on 02 March 2008.

Jennings, Gregory D. and Sneed, Ronald E.1996. *Water Quality and Waste Management*. North Carolina Cooperative Extension Service.

LaGrega,Michael D. Buckingham,Philip L.Evans,Jeffery C.and Environmental Resources Managemnt.2001.*Hazardous Waste Management*. Singapore: Mc Graw Hill International Edition Biological Sciences Series.

Land Pollution .n.d.Available at.http://library think quest.org.Accessed on 01 February 2008.

Manufacturing.n.d. 2008. Availableat:http:en.Wikipedia.org/wiki/manufacturing.html. Accessed on February 2008.

Manufacturing Industry.n.d.Availableat:http://en.Wikipedia.org/wiki/manufacturing_ process. Accessed on 11 February 2008.

Mohammed, M.A. 2002.*Industrial Pollution and its impacts on little Akaki River*. [Unpublished paper] Addis Ababa

MSN Encarta.2007.*Hazardous Waste.* Available at:http//ca.encarta.msn.com/stabilization.html.Accessed on13February 2008.

Nachf, Verlag Grib.1991.*Industry and Environment*.Germany.United Nations Industrial Development Organization.

Pollution Control.2008.Available at http://en. wikipedia.org/wiki/pollution_control. Accessed on 23 March 2008.

Pollution Issues.2006.*Indusrty*.Available at:http://www.pollutionissues.com/Ho_Li Industry.html.Accessed on 10 January 2008.

Public Health and Environmnet.2000.available at: http://www.who.int/ple/en/index/html.accessed on 02 April 2008.

Pub Med - indexed for MEDLINE. Last modified 12 Feb2008. Available at http://www.nvbi.nlm.nim.gov/sites. Accessed on 20 February 2008.

Questa Media America.2007. *Public Health*. Available at:http://http://www.questa.com.public health. Accessed on 28 March 2008.

Recycling Point.1992. *The Business of NeutralizingIndutrial Waste*. Available at: http://www.recycling point.com.sg/articles/Feb1992 neutralizing industrial _wastes.htm. Accessed on 12 February 2008.

RTI International.2008.*Qualitative Analysis*. Available at http://www.rti.org/page308. Accessed on 30 May 2008.

St. Mary's University College. (2007). *Environment and Development*. Modules 1 &2.Addis Ababa

Sustainable Development Indicator Group.1996.*Manufacturing Industry*. Available at:http://www.hq.nasa.gov/iwgsdi/manfacturing.html.Accessed on 28 December2007.

Tchobanoglous, George.Theisen, Hilary and Vigil, Samuel A. 1993.*Integrated Solid Waste Management: Engineering Principles and Management Issues*.Mc Graw Hill International Edition Civil Engineering Series.

Toepfer, Klaus. n.d. *At a Glance: Waste*. Available at:http://www.unep.org/ourplanet/imgversn104/waste.html.Accessed on 21March 2008.

Transitional Government of Ethiopia (TGE) 1993. *Health Policy of the Transitional Government of Ethiopia*. Addis Ababa.

Trapp, John.n.d.*Pollution*.Available at http://www.gradebook.org/pollution.html Accessed on 30 March 2008.

*Waste Disposal Methods.*2008.Seminar Handout: Available athttp://www.gdrc.org/uem/waste/disposal.html.Accessed on 12 March 2008.

Waste Management. Last Modified March 2008.Available at:http://en.wikipedia.org/wikipedia.org/wiki/waste_management.Accessed on20 March 2008.

Waste Export .n.d.Available at: http://en.wikipedia.org/wiki/waste_export.Accessed on 05 March 2008.

Wikipedia, the free Encyclopedia. Last Modified February 2008. Available at:http://en.Wikipedia.org/wiki/water_pollution.Accessed on 12 February 2008.

Woodward, Frank.2001.*Industrial Waste Treatment Handbook*. USA.

WHO. n.d.*World Health Organization (WHO)*. Available at: http//www.who.int/about/en/ Accessed on 12 April 2008.

World Health Organization Regional Office for the Western Pacific.2005.*Waste Management*. Available at http://www.wpro.who.int/health topics/waste management/general info.htm.Accessed on 12 Feb 2008.

Zero Waste.n.d.Available at:http://en.wikipediaorg/wiki/zero_waste. Accessed on21 April 2008.

APPENDIX I

Addis Ababa University

School of Graduate Studies

Business and Economics Faculty

Public Administration and Development

Management Department

A Questionnaire to be filled by residents in Akaki kaliti and Kolfe Keranio Sub Cities.

The purpose of this questionnaire is to collect data for thesis entitled Industrial Waste and Urban Communities in Addis Ababa: The Case of Akaki Kaliti and Kolfe Keranio Sub Cities. In addition to the researcher's endeavor, the success of the study depends upon your genuine responses. Thus the researcher kindly requests your sincere responses to each of the items provided in the questionnaire and acknowledges your cooperation to a great extent.

In responding to the questions, please note the following:

1. You are not required to write your name.
2. All the questions raised here are equally important to attain the objectives of the study. Failure to complete any of them will adversely affect the overall study.
3. Provide your response by putting "√" or "×" mark in the spaces provided for questions with options and by writing your opinion briefly to the open-ended questions.
4. Be sure that all your response will be kept confidential and will be used only in the analysis of data to reach on the findings.

Part One

1. Individual characteristic and background data of respondents.

1.1. Respondent's sub city: _____ *Kebele* _____

1.2. Sex: Male ☐ Female ☐

1.3. Age:

18 – 22 years ☐	43 – 47 Years ☐
23 – 27 years ☐	48-52 years ☐
28 – 32 years ☐	53-57 years ☐
33-37 years ☐	58-62 years ☐
38 – 42 years ☐	More than 63 years ☐

1.4. Employment Condition: Employed ☐

Unemployed ☐

1.5. How long did you live in your present residence?

Less than 5 years ☐	21-25 years ☐
6 – 10 years ☐	26-30 years ☐
11-15 years ☐	31-35 years ☐
16 – 20 years ☐	More than 36 years ☐

1.6. How many hours do you spend at home per day on the average?

Less than 5 hours ☐

6 – 10 hours ☐

11-15 hours ☐

16-20 hours ☐

More than 21 hours ☐

Part Two

2. Data on industries

2.1. How many industries are there in your locality?

A. One ☐ B . Two ☐ C. Three ☐

D. More than three ☐

2.2. Mention the name /s/ and the product /s/ of the industry/industries in you locality.

Name of industry	**Product/s of the industry**

2.3. When was the industry established?

A. Before you started to live in your present house	**Name of industry**
B. After you started to live in your present house	

Part Three

3. Data on industrial waste during and after the production process.

3.1 Does/Do the industry or industries in your locality affect your day-to-day life?

A. It creates Problem	Name of industry
B. It doesn't have problem	

C. Don't know ☐

3.2 If the industry/industries is/are causing problem/s, what is/are the cause/s/ of the problem/s?

A. Problems of Noise, smell and dust during the production process	Name of industry
B. Problem as a result of poor industrial waste management	
C. If there is/are other problem/s/, please write in the space below,...	

3.3 If the industry/industries is/are creating problem/s/ during the production process, which of the following are the problem/s/?

A. Noise	Name of industry
B. Smell	
C. Dust	
D. Smoke	

3.4 If the problem/s/ is/are due to poor industrial waste management, which one is/are the cause/s for the problem/s/?

A. Due to dumping of solid wastes every where	Name of industry
B. Due to the discharge of industrial liquid wastes and the subsequent bad smell	
C. Due to the mixing of industrial liquid wastes with water bodies i.e. rivers and streams or problems due to the use of the waste water	

3.5 Is there any specific time for waste disposal by the industries?

A. Yes ☐ B. No ☐ C. Don't know ☐

3.6. If your answer to question 3.5 is yes, which are the specific times?

A. Morning ☐ B. Day ☐ C. Night ☐

Part Four

4. Industrial waste management and health

4.1 How much litter of water do you drink per day?

A. Less than one litter ☐

B. 1 – 1 and ½ litters ☐

C. More than 2 litters ☐

4.2 Is there any water body near your house or the industry?

A. Yes ☐ B. No ☐ C. Don't know ☐

4.3 If your answer for question No 4.2 is "Yes" for what purpose do you use the water?

A. Drinking ☐
B. Food preparation ☐
C. Washing ☐
D. Irrigation ☐
E. Don't use the water ☐

4.4 If your answer for question 4.3 above is that you use the water for one or more use/s/, do you know the quality of the water?

A. I know the water is not polluted ☐
B. I know the water is polluted ☐
C. I don't know ☐

4.5 Is there any vegetable farm in you locality?

A. Yes ☐ B. No ☐ C. Don't know ☐

4.6 If your answer for question 4.5 above is "Yes", what is the water source for the plants?

A. Rivers/streams
B. Pipe ☐ ☐
C. Don't know ☐

4.7 Do you have breathing problem due to air pollution?

A. Yes ☐ B. No ☐

4.8 If there are open dumps of industrial wastes in your locality, what do you observe on the land?

A. The soil is not suitable for plants ☐
B. Plants grow on the soil ☐
C. If you have any other observation, please write on the space below, …

4.9 What are the health problems you are suffering from?

A. Cough ☐
B. Asthma ☐
C. Bronchitis ☐
D. Heart problem ☐
E. Nerve problem ☐
F. Bone problem ☐
G. Eye problem ☐
H. Nose problem ☐
I. Skin problem ☐
J. Birth problem ☐
K. Diarrhea ☐
L. If there are other health problems, please specify, on the space below,…

4.10 How is your general health condition?

A. Good ☐ B. Bad ☐ C. Don't know ☐

4.11 How frequently do you go to the health centers?

A. Weekly ☐
B. Fortnight ☐
C. Monthly ☐
D. 2-5 months ☐
E. 6 months – 1 year ☐
F. More than a year ☐

4.12 What do you think is/are the cause/s for the residents' health problem/s/ in your locality?

A. Lack of personal hygiene ☐
B. Pollution due to industrial waste ☐
C. Problems other than pollution, please write ton the space below,…

Part Five

5. What have been done by the residents with regard to industrial waste problem?

5.1 Do you have any compliant on the industrial waste management practice of the industry/industries near by?

A. Yes ☐ B. No ☐

5.2 If you have compliant, did you make your compliant?

A. Yes ☐ B. No ☐

5.3 If your answer for question 5.2 is "Yes", where did you put your complaint?

A. Industry's management ☐

B. Sub city's top management ☐

C. Sub city's Environmental Protection office ☐

D. Sub city's Trade and Industry Bureau ☐

E. *Kebele* ☐

F. If you put your complaint to other body, please specify on the space below - - -

5.4 Did you get solution for your complaints?

A. Yes ☐ B. No ☐ C. Partly ☐

5.5 If your answer for question 5.4 above is "No" or "Partly", what did you do next?

A. Complained to another body ☐

B. Kept silent ☐

C. Made 2nd complaint to the previous body ☐

5.6 If your answer for question 5.5 is "made compliant to another body", for which body?

A. Industry's management

B. Sub city's top management ☐

C. sub city's Environment Protection office ☐

D. Sub city's Trade & Industry Bureau ☐

E. Kebele ☐

F. If you put your compliant on bodies other than the above, please write below.

5.7 If your answer for question 5.5 is “kept silent”, what is your reason?

A. Because the problem is not serious ☐

B. Because of fear of not getting solution ☐

C. Thinking that the problem would be solved by relevant bodies ☐

D. If you have other reason, please write on the space below...

5.8 If your answer for question number 5.1 is “Yes” and for question number 5.2 “No”, that is you have compliant but not made any compliant to any body, what is your reason?

A. Because the problem is not serious ☐

B. Because of fear of not getting solution ☐

C. Thinking that the problem would be solved by relevant bodies ☐

D. If you have other reason, please write on the space below...

5.9. What is the current status of industrial waste problem in your locality?

A. It is totally solved ☐

B. It is partly solved ☐

C. It is not yet solved ☐

Part six

6. Respondents' opinion on what to do on the problem of industrial waste.

Read each item separately and indicate your degree of agreement/disagreement by putting a tick mark "√" or "×" under one of the indicated rating scales: S-Strongly Agree, A – Agree, N- Neutral, DA - Disagree and SD - Strongly Disagree.

SN	Item	Response				
6.1	In your opinion, where should industries be located?	SA	A	N	DA	SD
	6.1.1. Far from residences					
	6.1.2 In less populated areas					
	6.1.3 Near rivers and streams					
	6.1.4 Near open fields					
6.2	What do you think are the problem of the industries not to apply proper industrial waste management system?	SA	A	N	DA	SD
	6.2.1 Lack of capital					
	6.2.2 Lack of qualified personnel					
	6.2.3 Lack of awareness					
	6.2.4 Carelessness					
	6.2.5. Loose control by regulatory bodies					
6.3	Environmental Protection Authority has done much on industrial waste.	SA	A	N	DA	SD
6.4	What should be done by Ministry of Health to curb the industrial waste problem?	SA	A	N	DA	SD
	6.4.1 Follow up & control					
	6.4.2 To create awareness on the harmfulness of industrial waste to different parties					
	6.4.3 To take measures on those industries who do not comply to the laws					

APPENDIX II

Focus Group Discussion Questions on the health impacts of industrial wastes on urban communities of Addis Ababa, with Federal Ministry of Health Pertinent Bodies

1. What do you think about the topic that has brought us here today, i.e., health impacts of industrial waste and pollution on urban communities in Addis Ababa?
2. The Federal Ministry of Health has the responsibility of protecting the public health of the country. One of the threats to public health has been the problem of industrial waste and pollution. The extent of the problem is directly related with the expansion of industries. Specifically, urban dwellers in Addis Ababa are affected by the industrial waste problem. If the Ministry is responsible to control the industries, why is the problem there? What are the challenges of the Ministry?
3. One way in the discharge of responsibility by the Ministry is through uninterrupted regulatory activity. How are the regulatory activities performed? How frequent is the regulatory activity undertaken? What measures are taken on those who do have problems in their industrial waste management?
4. What do you think are the advantages of researches involved in revealing the level of health damages of communities as a result of industrial waste and pollution? Is there research based data in the Ministry that shows the extent of the problem across time?
5. Are there any efforts made by the Ministry to work with the industries and/or the Ethiopian Manufacturing Industries Association and others to curb the industrial waste management problem. Don't you think raising the level of awareness of the industries and the Association plays a vital role in minimizing the health problems of industrial waste and pollution? Moreover, if their level of awareness is raised, the willingness and initiation by the industries to apply proper industrial waste management systems is improved. What do you say?
6. Currently, industrial development of Addis Ababa is rapid. Likewise, industrial wastes and pollution are also increasing. The haphazard practices of the industries in their industrial waste disposal are continued. Therefore, the health problem is also increasing from time to time. The Ministry has to bring tangible changes. What are the future plans of action of the Ministry?
7. What do you think is the remedy to solve the problem?

APPENDIX III

Basic points for unstructured interviews

I. Environmental Protection team leaders of Kolfe Keranio and Akaki-Kaliti Sub Cities

1. Practice of industries, in each sub city, in their industrial waste management, according to Environmental Protection Office information.
2. Practices of industries, selected for the study, with respect to industrial waste management, according to Environmental Protection Office information.
3. The problems of selected industries for the study, in polluting the environment (air, water and land).
4. Regulatory activities by each sub cities' Environmental Protection Offices on industries in each sub city in general and selected industries in particular.
5. Measures taken by each sub cities' Environmental Protection Offices, on industries in each sub city in general and selected industries in particular.
6. Handling the complaints of the communities in each sub city.
7. Challenges to the Environmental Protection Office with respect to implementing the Environmental Protection Policy of the country, particularly on industrial waste.
8. Future plans of actions to control the industrial waste management problems.

II. Ministry of Trade and Industry, Addis Ababa City Government-Trade and Industry Bureau, Akaki-Kaliti and Kolfe-Keranio Sub Cities-Trade and Industry -Licensing and Registration Office Heads and Ethiopian Investment Agency- Trade Registration and Licensing Head

1. General criteria for establishment of industries.
2. Siting factors/criteria for licensing industrial establishments.
3. Level of emphasis placed on community's wellbeing before industries are licensed and registered.
4. The industry's waste type, amount etc, considered for licensing and registration? Why/why not?

III. Kolfe-Keranio and Akaki-Kaliti sub cities'-General Managers

1. Role of the sub city in regulating the industrial waste management practices of the industries.
2. The problem of the industrial wastes on communities recognized by the sub cities.
3. Things done so far, why is the problem unresolved?
4. Future plans of action to solve the problem.

IV. Two health centers from each sub city (Kolfe-Keranio and Akaki-Kaliti)-Health professionals- public/community health professionals, doctors, nurses or health officers

1. Frequency of the residents coming to the health center seeking medical help
2. Types of health problems of the residents related with industrial wastes or pollution.
3. Curability of the health defects, due to industrial waste problems.
4. Mortality rate or frequency of mortality due to the health problems of industrial wastes.
5. Specific age, sex, exposing situations etc, of the communities to be prone to effects of industrial waste problems.
6. Communities are most affected by which: air, water or land pollution?
7. Extent of the problem from the view points of the health professionals.
8. Suggested solutions to the industrial waste problem by health professionals

V. The six industries selected for the research from Kolfe-Keranio and Akaki- Kaliti- Two management members from each industry

1. Methods of industrial waste management, the industries use, for different types of industrial wastes: solid, liquid, sludge and hazardous wastes.
2. Any waste treatment, recycling plants?
3. Practices such as waste avoidance, waste reduction methods etc. why/why not?
4. The industries' view on whether they are applying fair industrial waste management systems or not. Reasons.
5. Major problems of the industries in following proper industrial waste management systems.
6. How they deal with complaints of the communities.

7. Working together with others to solve the problem.
8. Who are responsible for the industrial waste problem, in the industries' view?
9. Future plans of action of the industries.
10. The support industries need to solve the problem and from whom?

VI. Addis Ababa Environmental Protection Authority- Environmental Protection and Pollution Control Department

1. What are the interventions of the Authority in regulating the industrial waste problem?
2. What have been done so far to solve the problem of industrial wastes on the community via the environment?
3. How is the sub cities' performance controlled, in view of what they did at some point in time?
4. What challenges the office face in regulating and doing tangible tasks to curb the industrial waste problem?
5. What is planned for the future?

VII. Two farmers growing vegetables using *Tiliku* Akaki and *Tinishu* Akaki Rivers for irrigation.

1. How long they lived in the area?
2. What their view is on the waters' observable quality?
3. What changes they observed over the years on the waters?
4. Their use of the vegetables: sale, consumption?
5. What their health condition is?

VIII. Interview with Ethiopian Manufacturing Industries Association Management Body

1. What do you think about the topic that has brought us here today, i.e., industrial waste problem in Addis Ababa?
2. What does the Association know about industrial waste management failures by manufacturing industries in Addis Ababa in general and member industries in Addis Ababa, in particular?

3. Are industrial waste management practices by member industries the concern of the Association? If yes, what are the mandates of the Association on members industries?
4. What are the problems of industrial waste on society? Are there any researches conducted by the Association, especially on the societal impacts of industrial wastes?
5. What did the Association take as a measure to curb the industrial waste problem?
6. Don't you think that member industries of the Association are in a better position to control industrial waste problems? This may be due to the fact that working together and sharing experiences can build the capacity of the member industries which would otherwise be difficult for industries. Please explain.
7. The real situation shows that there are urban communities, residing near industrial establishment, who are most affected by industrial wastes and the subsequent pollution problems. The problem is still there, hence, it means there is failure of the industries to control their industrial wastes. What are the obstacles to the Associations' and the industries' not to make sound industrial waste management systems operational?
8. What are the future action plans of the Association? Isn't it important to involve the government, NGOs, international organizations and others and get the necessary support to minimize the industrial waste problem?
9. How do you rank the responsible bodies in the industrial waste management problems? Start from the most accountable to the least.(The industries, Ministry of Health, Ethiopian Manufacturing Industries Association, Environmental Protection Bodies, Ministry of Trade and Industry and others), and why?

APPENDIX V

List of interviewees

- General Manager of Kolfe Keranio sub city
- General Manger of Akaki Kaliti Sub city
- Addis Ababa Environmental Protection Authority -Environmental Protection and Pollution Control Head (W/o Fantu)
- Secretary general of Ethiopian Manufacturing Industries Association (Ato Asrat Abebe)
- Team leader of Environmental Protection Office-Akaki Kaliti sub city (Ato Yoseph Assefa)
- Team leader of Environmental Protection Office- Kolfe Keranio sub city
- Head of A.A City Administration- Trade and Industry Bureau (Ato Mulugeta Assefa)
- Head of Federal Ministry of Trade and Industry (Ato W/Tsadik)
- Head of Trade Registration and Licensing of Ethiopian Investment Agency (Ato Tamene)
- 4 farmers, 2 from *Tinishu* Akaki and 2 from *Tiliku* Akaki River banks
- Gulelle Soap Factory General Manager and the Administration Head Ato Ababu
- General Manager of Addis Ababa Tannery (Ato Indris Ibrahim)
- K.K Textile Factory Production Manager and Quality Control head
- Akrem M etema Animal Feed Factory- Administration Head
- Akaki Metal Products Factory – Production Manager (Ato Gashaw Mengesha)
- Kaliti Foods SC- Production Division Head (Ato Haile Yimam)
- Akaki Kaliti Health Center – Environmental Health and Hygiene Department Head (Ato Messay)
- Akaki Textile Factory Trade Union Clinic – Public Health Officer (Ato Daniel)
- Akaki Kaliti Sub city-Trade and Industry office– Registration and licensing head (w/o Etabezahu Taye).
- Mary Joy Health Center- Public Health Officer(Ato Addisu)
- St. Paul's General Specialized Hospital -Hygiene and Environmental Health Office head (Ato Yilma)
- Kolfe Keranio Sub City- Trade and Industry – Registration and Licensing Bureau Head.

List of participants in focus group discussion from Ministry of Health

- Ato Fikru Tessema – Water Quality and Waste Management team head in Ministry of Health
- W/o Beshadu Hailu – Industrial and Institutional Hygiene Control Team Senior Expert in Ministry of Health
- Ato Sileshi Taye – Department head of Hygiene and Environmental Health in Ministry of Health.

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university, and that all sources of material used for this thesis have been dully acknowledged.

Declared by:

Name: _____

Signature: _____

Date: _____

This thesis has been submitted for examination with my approval as a university Advisor.

Confirmed by:

Name: _____

Signature: _____

Date: _____