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G421: RESEARCH PROJECT REPORT

TITLE: AN ASSESSMENT OF PEOPLES' PERCEPTION AND
AWARENESS OF AIR POLLUTION IN KAFUE TOWN,
ZAMBIA.

By

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DEDICATION

To my late father, my mother, brother Mpasha and maternal sister Sarruge and my wife Charity.

I will always love you.

DECLARATION

I, John Rwali, do hereby declare that this project has been composed by me and that all the work recorded is my own. The map and diagrams were drawn by me and all quoted information has been appropriately acknowledged. This project has not been previously submitted for any academic award.

Signed: _____

Date: _____ OCTOBER, 1995

ACKNOWLEDGEMENTS

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CHAPTER ONE

INTRODUCTION

1.1   INTRODUCTION

This study attempts to assess people's perception and awareness of air pollution which most studies in Zambia seem to have neglected in pollution studies. This study is based on Kafue town, Zambia (fig 01).

It is increasing becoming evident that Economic development in both industrialised and developing countries, especially of late, is not environmentally sustainable. Bholla (1992) points out that Economic development is at least in part, attributable to the "cost" imposed on the environment through the depletion of non-renewable natural resources and damage to the physical environment.

In Zambia, Economic growth, based on modern technologies borrowed from the developed countries, has no doubt also played an important role in the environmental degradation. The global concern for the environment comes at a time when third world countries are just beginning to hope that they could follow the technologies for their Economic growth taken by developed countries, these developing countries have an urgent need to increase their rate of Economic growth more than at any time in the past, owing to increasing populations (Bhella, 1992).

Zambia is almost unique amongst the developing nations of Africa in having a history which involves a high level of

industrialisation from the early part of the twentyth century (Roberts, 1976). It has also been stated by Bailey (1971) that in Zambia air pollution problems have already appeared in certain areas and are bound to increase with increasing industrialisation.

Zambia in a hurry to develop pays little attention to problems of pollution. The major focus of this study is placed on finding out how people perceive the pollution problem in Kafue and their awareness in the deterioration of the state of their environment.

1.2   ORGANIZATION OF THE STUDY

This study is organised in six Chapters. In the first chapter, following the statement of the research problem introduction, scope objectives and rationale for the study are discussed.

Chapter two reviews existing literature on air pollution while chapter four deals with methods of study-used.

Chapter five deals with analytical matters and gives the research findings. Lastly, chapter six concludes the study with some recommendations.

1.3   STATEMENT OF THE PROBLEM

'Air pollution by industrial waste gases is a universal problem affecting mankind. It can easily become a tolerated inconvenience, but can also be irreversible and can have an insidious effect on community health and the general Ecology of a region.

In Zambia, lack of financial resources has led to a failure in effective management of industrial waste gases with the consequence of environmental degradation and air pollution.

There are certainly variations in the quality of the air and these are not easily noticed by human senses. However, even when they are the adjustment process and acceptance in humans has usually been rapid. As a result, little is done until the effects reach alarming proportions.

The aim of this research is to find out the ill effects of

air pollution on the people of Kafue, peoples' feelings and concerns as well as what the Government is doing to address the problem.

1.4   SCOPE AND OBJECTIVES OF THE STUDY

The purpose of this study is therefore to find out how people perceive the problem of air pollution in Kafue, an industrial town in Zambia.

The scope of the study was limited to the assessment of people's perception and awareness of air pollution in their environment. This was achieved by fulfilling the following objectives:

1.   To identify the major air pollution sources

2.   To identify the major pollutants as perceived by the local people.

3.   To find out if air pollution has any ill effects on people's lives.

4.   To assess what people think about the state of their environment.

5.   To assess public awareness of air pollution.

6.   To assess human adaptive measures to air pollution.

1.5   RATIONALE AND SIGNIFICANCE OF THE STUDY

In Zambia, there is need for studies on air pollution to help in future planning and expansion of Kafue especially as

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regards the location of chemical industries and residential area.

Studies such as this one could help in arousing awareness among people on the nedd to use natural resources in a more sustainable manner.

It is worth pointing out that statements on air pollution simply on a few Meterorological reports without being supported by research is of little significance. In recent past, there have been conflicting statements on the state of the envionment in Kafue. For instance, an article which appeared in Sunday Mail on 3rd July, 1994 attributed an increase in health problems among Kafue residents to pollution from the town's major industries, notably N.C.Z factory.

On 25th July, 1994, there was another article in Times of Zambia in which N.C.Z Management reputed allegations that their factory was responsible for the pollution of the environment and the icreased health problems among residents in Kafue.

Therefore, this study will help in resolving these contradictions and to ascertain the status of the environment in Kafue.

Above all, perception and Awareness seem to have been neglected in most studies on air pollution in Zambia. It follows that nobody has ever carried out such a research before. This research will therefore be of significant contribution to the literature on perception studies. This will probably be a pioneering piece of work which might stimulate more studies in future on this topic.

1.6   DEFINITION OF TERMS

1.   **Air Pollution**, Air a is common resource property, it is one of the open access environmental resources which has been and continues to be affected negatively by industrial activities. According to Tomany (1975), air pollution is the emission into the atmosphere of a waste gas steam containing one or more containiments such as dust, gases, mist or fumes in concentrations sufficient to be injurious to human, or plant health or to affect property values adversely.

2.   **Air Pollutants**, are therefore those that cause injuries to human, or plant health. The common pollutants include carbon, sulphur and nitrogen oxides. These emission generally need to be kept within the environment's assimilative capacities. It is therefore the excessive emission of these industrial waste gases that give rise to air pollution and its' associated problems.

CHAPTER TWO

LITERATURE REVIEW

2.1   INTRODUCTION

This study looks at people's perception and awareness of air pollution in Kafue town. Literature on this topic in Zambia is very scanty most of the literature has ben reviewed from studies carried out in some developed countries. This Chapter however, reviews the literature on air pillution and attempts to give the effects of air pollution on the environment as well as some approaches used to determine air pollution.

2.2   Air Pollution - General

As a part of a worldwide effort in environmental protection, pollution has recently come in for greater international consideration. This concern can be demonstrated by the United Nations's Conference on Human Environment which was held in Stockholm in June, 1972. The Conference among other things, tried to bring awareness to the public of the mass, long-term effects of air pollution that constitute the most serious threat to man and his environment (Postel, 1984).

Air pollution is a result of a number of activities, it is affected by many factors and the effects on the environment are diaverse. Therefore, no single study can effectively investigate and exhaust all problems associated with air pollution.

2.2.1   FACTORS AFFECTING AIR POLLUTION

Air pollution is affected by a number of factors some of which will be outlined below.

Meteorological conditions are among the main factors which affect air pollution, they determine the change with space and time of atmospheric pollutants.

The sensitivity of some vegetation to air pollution depends upon the intensity of incident sunlight, the relative humidity and the temperature (Bailey, 1973).

Bailey (1973) outlines the influence of Meterorological and other factors affecting air pollution as follows:

(i)   **Wind**: When a pollutant is emitted at a uniform rate, the wind flow tends to reduce it's concentration immediately and directly.

(ii)   **Atmospheric Stability**: The stability of the air has a major influence on pollution dispersal. A stable atmosphere is one with a relatively small decrease of temperative with height and unstable atmosphere is one with a relatively large decrease of temperature with height. Temperature inversions are quite common in stable atmospheres and sometimes occur at certain levles in temperatures that are not quite so stable. Atmosheic pollution tend to concentrate at or underneath temperature inversions

which act as a block to further upward motions,
therefore, temperature inversions worsens the pollution
levels.

(iii) √**Buildings:** Wind speed is affected by buildings.
Meteorological reports on a average wind speed are
reduced mainly due to the roughness of the
underlying surface created by buildings. The
reduced wind speed result in the increased
accumulation of pollutants in the atmosphere.

(iv) √**Chimney Height**: Tall Chimney are more effective
at diluting and dispersing waste gases where as
short Chimneys are likely to increase the concentration
of pollution within surrounding areas.

(v) √**Topography**: If land is sloping away from the Chimney
stack chances of experiencing pollution problems are
quite remote considering that the effluent plume might
never strike it. However, if it does it's harmful
effects will have been neutralised thereby causing
no pollution problems at all. If, on the other
hand, land is rising near or towards the Chimney
the effluent plume is likely to strike the land
and this could result in pollution problems.

(vi) ✓**Nature of the Pollutant**: A cold and damp gas arising

from any Chimney stack is likely to cause more pollution

problems than the one which has been heated.

A cold damp gas being more dense than the

surrounding layer of the atmostphere, will simply

fall on the ground close to the Chimney. This is

likely to cause pollution problems. A warm effluent

on the other hand is likely to rise, get dispersed

and diluted. This would result in reduced pollution

levels.

2.3   **AIR POLLUTION IN ZAMBIA: GENERAL**

In Zambia, just like any other developing nation, the

increasing tempo of industrial activity and urbanisation is not

without costs, it has been coupled with an increase in air

pollution and this have had a negative effect on the Environment.

The problem of air pollution in Zambia became pronounced recently

in the 1970s and 1980s.

In Zambia, while air pollution has not yet become a country

wide problem, it has become serious locally, where industrial and

mining activities have taken place. The most prone areas to air

pollution are the Copperbelt (Mining), Kabwe (especially before

the closure of the Lead and Zinc Mines). Kafue (Fertiliser

Production) and Mamba (Coal Mining).✓

The fact that Zambia experinces a rain season for five

months of the year also present problems. During the dry season

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pollutants can build up in the atmosphere and if precipitated as dust or particles, can remain on the ground surface.

Reports of Meteorological effects on environmental pollution in Zambia should therefore be read with caution. Zambia is considered to be a country in which severe pollution may develop as a result of industrial expansion.

Table 2.1   MAJOR AIR POLLUTANTS IN ZAMBIA

POLLUTANTS	IDENTIFIED AREA OF CONCERN
1. Sulphur Dioxide (SO)	Kafue from Sulphuric Acid Manufacture, Copperbelt from Mining by ZCCM and Oil Refining.
2. Suspended particulate Matter (SPm) eg. dust, blacksmoke etc. respirable and non respirable.	Chilanga from Cement Manufacture, Kafue from Coal Milling and Compound Fertilizer Formulation. Kabwe and Copperbelt in general from Mining Cement and Lime Manufacture
3. Nitrogen Oxides (NOx)	Kafue from Nitric Acid Manufacture Copperbelt and Kabwe from explosives during blasting and oil refining.
4. Hydrogen Sulphide (H S)	Kafue from Lead Mining Lusaka and all the major cities of the Copperbelt from motor vehicles
5. Lead (Pb) and Cadmiun (cd)	Kabwe from Lead Mining Lusaka and all the major cities of the Copperbelt from motor vehicles.
6. Methane (CH)	Kafue from Coal gasification and Ammonia Manufacturing Maamba from Coal Mining.
7. Carbon Monoxide (Co)	Kafue from Coal gasification, Lusaka, Kabwe and all Major cities from motor vehicles and other industrial activities
8. Offensive odour as a result of roting proteins and other wastes.	Lusaka, Kabwe and the Copperbelt from from Livingstone and Food processing forms.

Source: NATIONAL ENVIRONMENTAL COUNCIL OF ZAMBIA, SEMINAR REPORT, 28/3/94.

According to studies carried out by Balarman (1971) in Luanshya, some people complained of throat irritation from vapours in the air. Nawankwo (1971) has also pointed out that

air pollution might be a problem in the Copperbelt towns and Kabwe. Ground water quality could also be affected in the long run by prevailing levels of sulphate and ammonia.

2.4   AIR POLLUTION IN KAFUE INDUSTRIAL TOWN

If air pollution is examined first, one notices that in Kafue the situation has some parallels with that pertaining at, say Los Angeles. Surrounding the industrial estate of Kafue, a valley contains domestic dwellings. Thermal inversions occur and the valley and old town area fall within industrial emission, trapped by the thermal inversion and unable to be displaced horizontally. (Kaoma and Salter, 1979).

Women at the National Irrigation Research Station along Kafue river next of Kafue town have commented that distinct brown haze could be seen hanging over the Kafue area on a number of occasions. The occurrence of early morning Smog have also been reported in Kafue: Emission from the Nitrogen Chemicals Factory Supplies a continuous source of nitrogen dioxide (Kaoma and Salter, 1979). Kaoma and Salter (1979) Further point out that Nitrogen dioxide play a very important role in Smog Formation.

Two hundred and five (205) tonnes per diem ammonium nitrates are produced from NCZ Factory (1978), which means 38 tonnes per diem nitric oxide are released into the atmosphere giving 60 tonnes per diem nitrogen dioxide after oxidation in the air. The expansion of the factory would likely increase this value (Zambia

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Daily Mail, 1978).

2.5   AIR POLLUTION EFFECTS

Although the presence of air pollution has been recognised
as serious in some localities at least since the discovery of the
energy potential of coal, preventive and control measures still
have not been widely adopted or strongly enforced. Variations in
the quality of the air are not easily noticed by human sences,
and even when they are the process of adjustment and acceptance
has been rapid.   Accordingly little gets done until the effects
of air pollution become manifest.   Positive action has seldom
been anticipatory, instead has occured only after dramatic
disasters or large — Scale Sensory insults have caused public Clumour
    based on fear. (Lestie 1968)

√The present day concern for atmospheric quality initially
appears to have been triggered by such disustrous winter
inversion, Smog episodes as those in London (1952) causing more
than four thousand deaths, New York (1963) with eight hundred
excess deaths.   (U.S. congress, Senate 1968). At the time of
occurance, acute pollution episodes are not only evident by their
visual and Olfactory impact, but also by widespread chemical
irritation of eyes, nose, throat and respiratory tract. The more
serious results of these episodes are associated with subsequent
health impairment and spectacular contemporary excess mortality
rates, particularly in the case of chronic respiratory disease
suffers and certain age groups.

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✓While acute pollution disasters are relatively rare phenomena, the atmospheres of all modern cities are pervaded by the continuous presence of various contaiminants. These may be either gaseous or particulate, and depending upon their nature and concentration, some biological and material damage may be incurred. Sulphur dioxide for instance may directly cause health effects, or may also reach sufficient concentrations to become an odour nuisance, or may through oxidation and combination with suspended water froplets form sulphuric acid which in turn may produce material vegetations as physcological damage.

✓Air pollution has adverse affects on various living organisms. Murdoch (1971) points out that acute effects such as irritation of the respiratory systems, reduced visibility and diminished mental and visual activity and the overall effects on the Ecosystems are among the characteristics which are primarily used in formulating air quality standards. Scorerer (1973) points out that various kinds of pollution causes much squalor and an unpleasantness in cities. They may cause additional serious long-term health problems which could be chronic and may result from long-term exposure to rather low concentrations of atmospheric pollutants.

✓Scores (1973) continues to point out that air pollution disasters in developing countries are greater in human than environmental terms.

In Zambia, the increase in chest pains, coughing and skin irritation among the residents of Kafue have been blamed on

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pollution by the town's major industries and children between two and five years are said to be the most affected (Sunday Mail, July 3, 1994).

The pollution related problems in Kafue are most prevalent among residents of Eastates, Solobom and Zambia Compound which are close to the industrial area (Sunday Mail, July 3, 1994).

2.6 PHYSIOLOGICAL PERCEPTION OF POLLUTANTS

A review of available studies on air pollution shows that while pollutants may be variously perceived at any stage following emission, it is probable that the strongest stimuli, as observed in Toronto are provided by visible particulates such as smoke, vehicle exhaust gases, reduced visibility by haze and the sorting of buildings, cars and clothing by deposited matter. It is pertinent to note however that, in general, the visually most readily perceived particles are least likely to constitute health hazards due to their relatively easy elimination from the human system, but rather a soiling nuisance (Gold smith, 1968).

As in most North American cities, the unburnt gaseous exhaust emissions of motor vehicles may be considered a major source of pollution. However, due to the absence of conditions in Toronto, which lead to the formation of smog, the hydrocarbons are not regarded as a health danger, but in view of their aromatic properties, they may be classed instead as odour nuisance - (Department of Energy and Resource Management). The discharge of the highly poisonous carbon monoxide is ofcourse

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imperceptible, since the gas is both colourless and odourless, and since physiological impairment may not be recognised untill the onset of such acute symptoms as headache, dizzness, neusea, fainting to mention but a few.

Apart from hydrocarbons and carbon monoxide, the most serious toxic and corrosive gaseous pollutants monitored in Toronto are Oxides of Sulphur (SO_2) and Nitrogen (NO_2), and oxidants. The perception of gaseous matter depends mainly upon the sense of smell, which may, or may not precede physiological damage. Biological impairment and (material deterioration) is related to the duration of exposure to a pollutant, and it is possible that serious damage may eventuate from very low and imperceptible concentrations.

The determination of olfactory threshold levels of the atmospheric pollutants presents difficulties, not only due to possible aditive, entagonistic, potentiation and synergetic combinations of the substance, but also the individual variability and state of health of the perceivers (Auliciens 1970). It was however observed in Toronto that given the nature and concentrations of the pollutants, it is paradoxical that direct seasory perception of the containminants is related more to the visual and olfactory stimuli of the less hazardous pollutants (Auliciens, 1970).

The above argument implies that, in the absence of very unusual atmospheric conditions, people are actually unable to perceive differences between the degree of pollution by the

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contunuously monitored gases. This supposition is supported by the previous study of Attitudes in Rufalo in which correlation between degree of sulphation and subjective perception, showed important inconsistencies (ido de Groot and Sheldon, 1962).

The concentrations of nitrogen dioxide and oxidants do not appear to be seasonal, but the Gromatic hydrocarbons and the deposition of particulate matter peak in spring. Similar results were recorded in the St. Lousi Study, which pointed out that awareness of pollution may be more related to seasonal behaviour of people than to actual pollution concentrations (Aliciens, 1970).

2.7.1 DETERMINING POLLUTION ON VEGETATION

✓As far as plants are concerned, they react significantly to air pollution sooner than any other organisms. Lichens and mosses are particularily sensitive and may be used as living indicators of Sulphur dioxide pollution. Laboratory developed concentration time requations have beeen determined for a variety of plants.

According to studies carried out by Rates (1972) some sensitive species such as Alfalfa, Lettuce, dhubarb, Spincich can be used as indicators of Sulphur dioxide pollution. Approximate concentration at which effect is observable is 0.5 ppm for four hours.

Lichens which are often very sensitive to atomorphere Sulphur dioxide have also been used to asceitain the amount of

Sulphur dioxide very cheaply. Where the Sulphur dioxide concentration is very high no Lichens are found in what has been called a "Lichen desert". Based on the above principle, Kapungwe (K1981) carried out studies in which Lichens were used as indicators of Sulphur dioxide pollution in Mufulira.

2.7.2   THE USE OF PLANT SPECIES AT BIOINDICATORS IN ZAMBIA

In Zambia, the environmental Council has in plan to carry out a project which will involve planting plants, sensitive to various pollutants, as bioindicators where certain pollutants will have to be monitored. The project has been estimated to run throughout the years (1995).   Mr. Thole, L. personal (Communication, E.C.Z) said that specific emphases will be made on monitoring the following:

(a) Sulphur dioxide (S)) - using Alfalfa, Lucerne, Clover, Pea, Ruck, Wheat and Great Plantain.

(b) Nitrogen dioxide (NO) - Using wild celey and Ornamental Tobacco.

(c) General accumulators - using Italian Dye Grass and Cabbage.

2.7.3   DETERMINING EFFECTS OF POLLUTION ON MAN

✓ In human health, effects of air pollution can be determined by a number of approaches.

Statistical studies of past illness and death as related to notable air pollution incidents, correlation of respiratory

epidemic as a function of air pollution concentrations, and laboratory studies of air pollution concentrations, and laboratory studies of the response of aninmals (and in some cases human beings) to expose to various pollutants.

For instance asthmatic attacks among susceptible patients correlate with air pollution caused by refuse combustion. The incidence of employee absentseeism due to respiratory illness has closedly followed Sulphate pollution levels. Tomany (1975), among others, have conclusively demonstrated the association of air pollution with such respiratory diseases as long cancer, emphysema, chronic brunchitis and asthma. Sulphur dioxide at 0.5ppm noticed as unpleasant odour: at 1ppm wrist and breathing quickens, 10ppm causes irritation to eyes, nose and throat. There are also other long-term effects such as persistant cough for years to Sulphur dioxide levels as far as 40ppm. In his studies, Silego, (1983) also showed that Sulphur dioxide was the mian cuase of chronic respiratory ailments and diseases in the main residential areas situated in the vacinity of the Mufulira smelter.

CHAPTER THREE

THE STUDY AREA

.3.1   LOCATION

Kafue town is an industrial area situated over 40 kilometres South of Lusaka (Fig 01). The objective in the creation of Kafue Estate was to create a growth point in the Lusaka peri urban area to absorb a part of the rural out migration to Lusaka. The second objective was to Establish Industries especially those which were found unsuitable for location in Lusaka mainly for environmental reasons. Before that, Kafue served chiefly as an agricultural community.

The Kafue industrial and residential area was designed by the Greek multinational firm of Doxiadis Associates, and they were also involved in the decision involving the seting and layout of the Estate. The main industries sited in the Industrial Complex are Kafue Textiles of Zambia, Nitrogen chemicals of Zambia, Leeyeast and Bata tamery.

The surrounding environment is undulating. There are hills in the north and east, and flat in the west and south.

3.2   CLIMATE

Climatic factors such as temperatures, relative humidity and sunshine have been observed and recorded around Kafue town. Maximum temperatures are at their lowest in June and July. They rise rapidily to reach their highest values in October. The minimum temperatures are also at their lowest in June and July

VEGETATION

SOILS

3.5 BRIEF HISTORY ON KAFUE INDUSTRIAL AREA

Soon after independence a decision was made and plans were worked out to establish a concentration of large scale industry in Kafue. The type of industries to be attracted to the town were to be those that needed to be close to the main consumer markets or to the Geographical Centre of the Country. Lusaka would have offered the most attractive location were it not that the industries were particularly unattractive to Lusaka. The main characteristics for an industry to be unsuitable for Lusaka seem to be that it:

(a) require large quantities of water

(b) produce large quantities of water and air
     pollutants.

these two factors are directly related to the limitations and cost of waer supply in the capital and the lack of possibilities for natural (biological) self purification. The factor of air pollution stems from a felt need among planners and politicians to keep Lusaka a clean city (Williams et al 1977).

In 1987, a Company of Planning Consultants, Doxiadis Associates, presented to the Zambia Government a master plan for an enlarged Kafue town incorporating a new industrial Estate. The plan was based on the building of three new large scale industries at Kafue, Nitrogen Chemicals, a Textile Factory and a Steel Plant (William et al 1977).

It was for the above reasons that the present Kafue town was created.

Figure 01   STUDY AREA   (KAFUE)
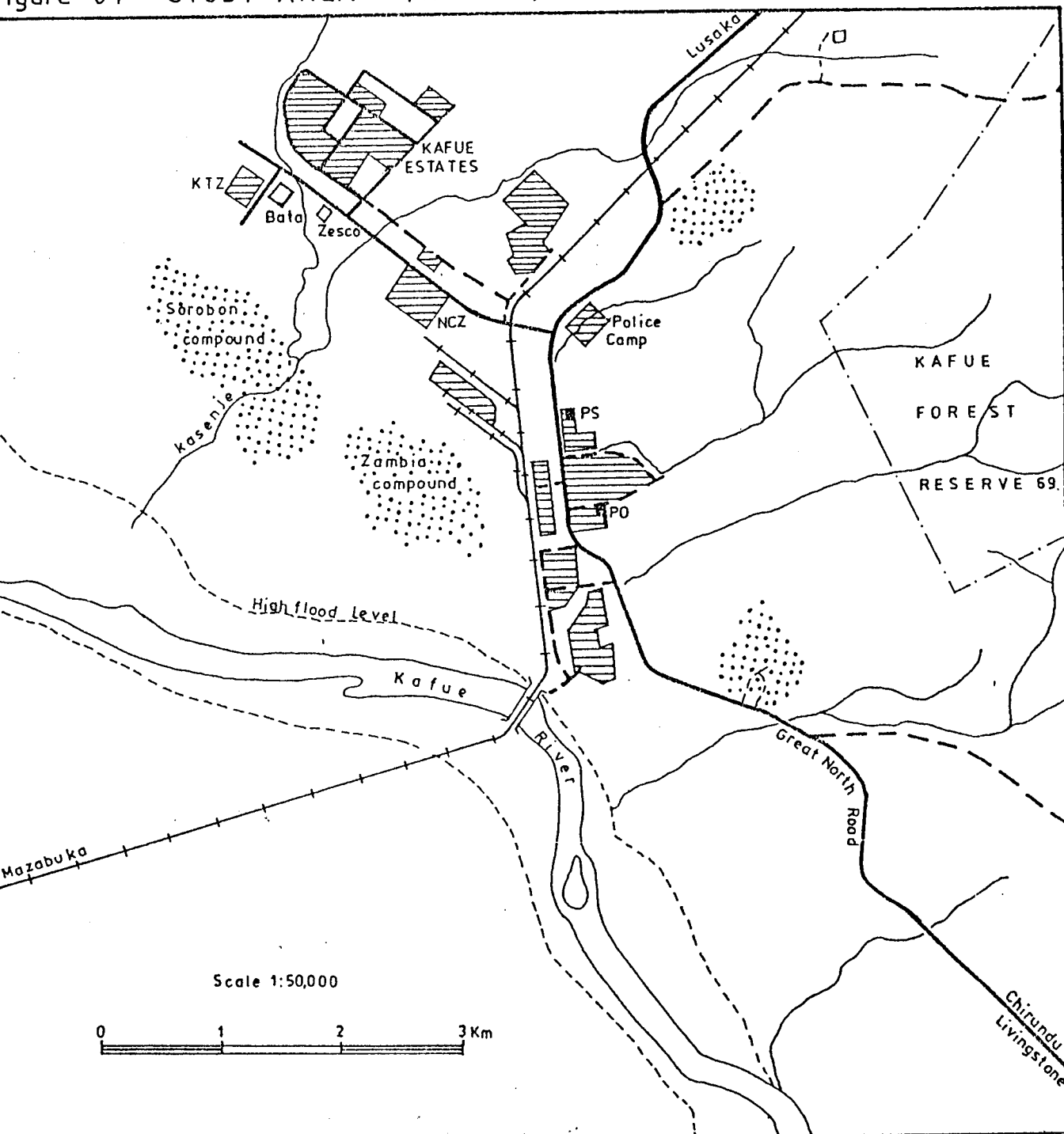
Scale 1:50,000

0   1   2   3 Km

Legend:

Tarred road	———————	PS	Police Station	Areas with Permanent buildings
Gravel road	— — — —	PO	Post Office	
Rail line	├──┼──┼──┤	—·—·—	Forest boundary	Other populated areas

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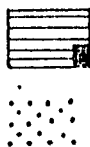
CHAPTER FOUR

METHODOLOGY

This Chapter discusses the Methods of data collection, the type of data as well as the sources of data analysis.

4.1 DATA AND METHODS OF COLLECTION

The data collected was mainly qualitative. In the collection of data for the study, the following methods were used:

(a) Library research

(b) Scheduled structured interview questionnaire

(c) Interviews.

4.1.1 LIBRARY RESEARCH

A variety of information was obtained by making reference to available articles and publications which were found to be of relevance to the study. The information collected assisted in coming up with the literature review and got information about the study on air pollution.

4.1.2 SCHEDULED STRUCTURED INTERVIEW QUESTIONNAIRES

As the study involves the assessment of people's perception and awareness of air pillution, data for the study was mainly obtained by administering the scheduled structured interview questionnaires to the randomly selected Kafue residents.

This part of study was meant to achieve the objectives of the study. The questionnaire (appendix 1) was designed in such a way as to help achieve the objectives of the study. The results as obtained from the local residents have been summariesed and presented in Chapter 5.

4.1.3 UNSTRUCTURED INTERVIEWS

This was also an important part of the study and it helped in many ways to consolidate loose data obtained through other methods. It helped to enhance the understanding of the whole concept of air pollution how it is being addressed by different people and organs of the Government. Unstructured interviews were conducted with the environmental Council of Zambia. The interview was aimed at extracting information on the activities and operations of the Council especially those related to air pollution control and what attempts they are making at harmonizing environmental protection. Interviews were also conducted with medical personnel on health Aspects of pollution.

4.2 SAMPLING DESIGN

Sampling for interviews was done in residential areas surrounding Kafue industrial area. The respondent were sampled from Kafue Estates, Sorobon Compound and Zambia Compound. In the choice of the respondents, the random sampling method which gave equal opportunity for the individual residents to be picked as subjects was used.

4.2.1   SAMPLE SIZE

Thirty (30) randomly selected local residents were interviewed.

4.3   DATA ANALYSIS AND PROCESSING METHODS

Data processing was done manually through the evaluation of the responses on the questionnaire and interviews that were conducted. Most of the data collected were qualitative which were analysed and tabulated manually. The percentages of responses and different characteristics were worked out and data were presented in tabular form (Chapter 5).

4.4   LIMITATIONS

The major problem encountered was that some respondents became suscipicious and were reluctant to answer questions promptly.

CHAPTER 5

DATA ANALYSIS AND RESULTS

This Chapter constitutes the presentation and analysis of the research findings which were obtained through interviews.

5.1   SOURCES OF AIR POLLUTION IN KAFUE

Table 5.1 shows the perceived major air polluting sources in Kafue.

Table 5.1   **SUBJECTIVE IDENTIFICATION OF MAJOR POLLUTING SOURCES IN KAFUE**

SOURCE	Number of Respondents Identifying Source	Percentage of Respondents Identifying Source
N.C.Z.	24	80
Kafue Textiles	0	0
Bata Tannery	3	10
Lea Yeast	3	10
TOTALS	30	100

Table 5.1 above clearly shows that, the majority of the Kafue local residents identified the N.C.Z Factory as the Major air polluting source in Kafue. From the table above, 80% of the subjects identified N.C.Z as the source of air pollution in Kafue. This shows that there is a strong feeling and growing concern among residents about pollution generation from the N.C.Z factory. As for the other industries which share the same location with N.C.Z factory, Kafue Textiles was not identified as

an air polluting source. However, people's feelings were that, Bata Tannery and Lea Yeast also contribute to air pollution, to a lesser extent though. Three (3) respondents identified Bata Tannery, the other 3 Lea Yeast as being air polluting sources in Kafue.

5.2   THE PERCEIVED MAJOR POLLUTANTS IN KAFUE

It is important to point out here that pollutants are varied in nature, the degree or the perception level in terms of significance also vary considerably from individual to the other. The major air pollutants, as perceived by the local people in the study area, Kafue, are outlined and analysed.

Gaseous streams from N.C.Z factory were perceived as the major air pollutants in the area. The feelings of the respondents showed that, the industrial waste gases were responsible for the bad smells around the area, especially near N.C.Z factory. This might help to explain why respondents strongly feel that, N.C.Z, was the major air polluting source in Kafue (Table 5.1).

Dust particles which could most of the time be seen suspended in the air, was also seen as disturbing the environment.

It is important to mention here that, from among the industrial waste gases, 70% of the respondents were able to identify sulphur dioxide (SO_2) and Nitrogen Oxides (NOx) emissions from N.C.Z factory as the major pollutants in the area.

This indicates high degree of public awareness. However, this kind of awareness may be due to a combination of factors other than perception alone. It is very likely that the media play a role in arousing the awareness in people.

5.3 MEDICAL ASPECTS OF ENVIRONMENTAL POLLUTION

Results obtained from the Medical personnel on effects of pollution show that, a number of diseases are likely to occur as a result of air pollution, especially the kind due to sulphur dioxide. The most likely disease as obtained from the medical personnel are as follows.

1. Chest pains

2. Coughs

3. Skin, eyes, nose and throat irritation

4. Chronic Bronchitis

5. T.B.

6. Lung Cancer

7. Asthmatic attacks

8. Chronic respiratory symptoms, ailments and lung diseases.

And as for Kafue town, table 5.5 has figures on the number of people who had health problems which could possibly be as a result of air pollution during the 1993 period.

Table 5.2   CASES OF HEALTH PROBLEMS RELATED TO AIR POLLUTION RECORDED AT THE TWO KAFUE CLINICS

Year: 1993	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
N.C.Z. Factory Clinic	309	330	283	416	432	473	399	790	377		324	254	-
N.C.Z Estates Clinic	338	510	588	525	572	628	455	527	737	590	357	-

Source: N.C.Z Factory and Estates Clinics

Table 5.2 reveals that the number of health problems that could come as a result of air pollution (ie. respiratory diseases such as chest pains, coughs, skin irritation, bronchitis and T.B.) reported at both clinics are very high. The frequency is even higher at Estates Clinics.

T.B. of all of the respiratory disease, was more prevalent and generally there has been an increase in T.B) cases handled previously, cases handled were one per month on average unlike recently (Sr. Mubanga Personal Communication N.C.Z Factory Clinic). However, there are fluctuations depending on the season. Generally there is a decline during the cold season and an increase in the warm/hot season.

5.4   AWARENESS AND HUMAN RESPONSE TO AIR POLLUTION

5.4.1   ODOURS

Responses on the general odour of the air Ground the Kafue industrial area were as given in table 5.3.

Table 5.3   RESPONSES ON THE ODOUR OF THE AIR AROUND KAFUE

RESPONSE GIVEN	RESPONSE NO	%
1. Very unsatisfactory	9	30
2. Moderately satisfactory	7	23
3. Unsatisfactory	14	47
4. Satisfactory	0	--
TOTALS	30	100

✓ Table 5.3 above indicate that most people of Kafue living around the industrial area (ie. Solobon, Zambia Compound and Estates) believed that the air was unsatisfactory because of the smells. Respondents expressed their displeasure at the odour of the air especially near the N.C.Z Factory. Data in table 5.3 shows that 100% of the respondents feel the air is unpleasant, not satisfactory and this have been attributed to air pollution. This therefore indicate growing public awareness of air pollution

5.4   HEALTH ASPECTS

The responses given whether any of the family member of the respondents have ever suffered from any pollution related diseases are given in table 5.4.

Table 5.4   RESPONSES OF WHETHER ANY FAMILY MEMBER HAD EVER
SUFFERED FROM ANY POLLUTION RELATED DESEASE.

Type of Response	No	%
Yes	18	60
No	12	40
TOTAL	30	100

Table 5.4 shows that, 60% of the respondents have had a
family member suffering from pollution related diseases in the
recent past.   On the other hand, 40% of the respondent's have had
no pollution related disease reported in their households.

Table 5.4 also indicates that, the number of respondents who
have had pollution related problems reported in their household
is quite high.   And in Fig. 02 is shown the problems which were
reported to be more common among the residents.

Figure 02: MOST COMMON DISEASES AMONG THE RESIDENTS
OF KAFUE
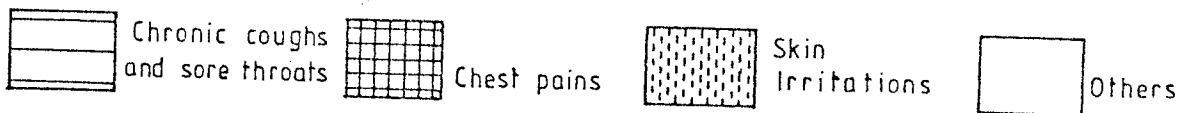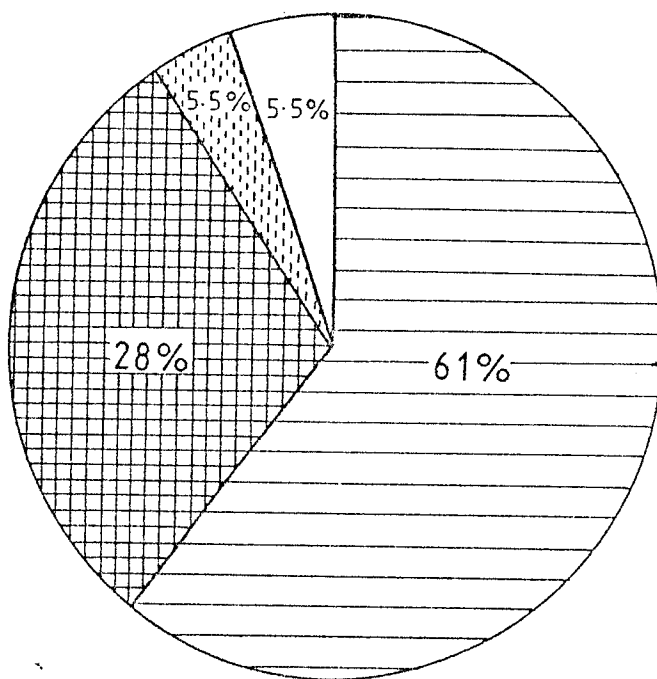
SOURCE: Compiled from questionnaires

5.5 FINDINGS FROM THE LOCAL PEOPLE ON THE STATE OF THE ENVIRONMENT AND QUALITY OF CROPS

Information on the state of the environment was further obtained by getting feelings of the people about the quality of their crops in relation to air pollution.

5.5.1 ASSESSMENT OF CROP QUALITY

The local residents with gardens within the study area were asked to indicate the quality of the crops. The results were as shown in table 5.5.

Table 5.5   RESPONSES ON THE QUALITY OF CROPS

Response Type	Ext Poor	Very Poor	Poor	Fair	Fairly Good	Good	Very Good	Ext Good	TOTAL
Number of Respondents	0	0	3	0	9	5	0	0	17
%	0	0	0	18	0	53	29	00	100

From table 5.5, 18% indicated that their crops were poor, 29% that crops were good and the largest number, 53% indicated that crops were fairly good. In summary, table 5.5 shows that, the quality of the crops grown was not so good.

5.5.2 EFFECTS OF AIR POLLUTION ON THE VEGETATION OR PLANT LIFE AS PERCEIVED BY THE LOCAL RESIDENTS

Table 5.6 shows the varied opinions given by the local residents on wheather the gases and dust from N.C.Z factory have

had negative effects on the Vegetation, Crop or plant life in the area.

Table 5.6   RESPONSES ON WHETHER THE GASES FROM N.C.Z. HAVE HAD NEGATIVE EFFECTS ON THE VEGETATION CROP OR PLANT LIFE IN THE AREA.

Response Type	Number	V. Unsatisfactory	Mod.	Statisfactory	%
Agree	18	--		17	60
Don't Konw	5	--		--	17
Disagree	7	--		--	23
TOTAL	30	--		17	100

Table 5.6 shows that the majority of the local residents, 60% agreed that the gases from N.C.Z factory have had negative effects on the vegetation, crops or plant life in their surrounding area. However, 17% of the respondents could neither agree nor disagree where as the remaining 23% was not aware of any such effects.

5.6   GOVERNMENT EFFORTS ON POLLUTION CONTROL

In the past, environment protection and nature conservation in Zambia was carried out by several Government Ministries and departments, according to their own specific legislation. Although some Acts provided some tools for fighting against pollution, no effective Coordination was conducted between communities, and thus the administrative efforts had been quite

inadequate.

The above problem, together with declining Economy caused uncontrolled discharges of untreated industrial and municipal waste, water and air emissions to the environment. This had resulted in severe localized pollution of streams and rivers, diverse effects on vegetation and the resultant decreased well being of the people of Zambia.

There was then an attempt at harmonizing environmental protection in Zambia, this was the preparation of the National conservation strategy, which was adopted by parliament in 1985. The strategy defined general plicies for wise Management of natural resources and proposed a new Coordinating body; the establishment of an environmental council which could monitor the environment and prepare standards for pollution control.

At the same time a proposal was made for Environment protection and Pollution Control Bill, which would establish an inspectorate to Control Liceasing procedures for industrial and Municipal emissions.

The proposal to create the Council and that to create a general environmental protection and Pollution Control Act, and was passed in parliament in June, 1990.

CHAPTER SIX

1. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This Chapter summaries and outlines the conclusions from the study. It also provides some recommendations, and lastly, it provides suggestions for further work on the subject matter.

6.1 SUMMARY DISCUSSION

From the foregoing analysis of results, it is apparent that people are aware of the problem of air pollution in Kafue. There is a strong feeling among Kafue residents that N.C.Z. Factory is the major air pollution sources in Kafue and that air pollution have had some effects on the lives of people.

6.1.2 REPORTED EFFECTS OF AIR POLLUTION

Respiratory diseases such as Chronic Coughs and sore throats, chest pains and skin irritations are very common among residents in Kafue. Statistical data obtained from the two clinics (table 5.3) show that there is high frequency in the occurance of respiratory diseases. And the increase in respiratory diseases among residents of Estates, Soloboni and Zambia Compounds have been blamed on pollution by the town's major industries particularly N.C.Z factory (Sunday Mail, 1994). This apparently has been supported by data in table 5.1, N.C.Z is perceived by the local residents to be the major air polluting source.

It is not easy to determine the effects of air pollution on human health because there are a number of other factors that

might contribute to either good or ill health. Smoking for instance can contribute to respiratory diseases. However, the frequency of occurance can help us on this matter. The higher the frequency the more likely it is due to air pollution.

It is been observed for instance that air pollution is associated with increased incidence of respiratory diseases, with increased symptoms in people already suffering from respiratory diseases, with increased incidence of cancer and with high mortality rate.

The increase in the number of respiratory diseases among Kafue residents may therefore suggest that the environment is polluted to certain levels.

As already pointed out, determining pollution effects on human beings is not an easy task, it is a complex issue. However, Akhtar (1990) observed that asthmatic attacks among susceptible patients correlate with air pollution caused by incomplete refuse combustion. He further observed that incidence of employee absenteeism due to respiratory illness has closely followed sulfate pollution levels. This suggests that the increased number of respiratory diseases among Kafue residents is a result of air pollution.

Environmental pollution, occurring both indoors and outdoors, causes human sickness and sometimes premature deaths. People of both sexes and all ages can be affected, but the danger is greatest for the groups such as the very young, the very old, pregnant women and those already suffering from a debilating illness such as asthma or heart diseases.

Since everyone must breath the air around us, everyone is exposed to air pollution to some degree. However, those living in or near big cities are likely to have a higher exposure to polluting factories which tend to concentrate in these areas. In Zambia, nearly 20 percent of out patient morbidity cases in children under 15 years is caused by respiratory diseases indicating high expeosure to poor air quality (E.C.Z. 1994). This would help to explain why there is a high rate of respiratory diseases among Kafue residents.

6.1.3   POLLUTANTS AS PERCEIVED BY THE LOCAL RESIDENTS

While pollutants are variously perceived at any stage following emission; it is probable that the strongest stimuls in Kafue is provided by visible particulates and dust particles. The media have no dount played a part in influencing people's perception and arousing of awareness. In general, visible particles are mòst readily perceived.

6.1.4   PUBLIC AWARENESS OF POLLUTION IN KAFUE

The study has revealed that people are aware of air pollution in Kafue. On the quality of the air, the public believed that the air was unsatisfactory because of the smells as evidenced by the results in table 5.4. Smells do not however cause any direct damage, but they are undesirable and as such are much a nuisance as noise.

smells affect the frame of mind. Unfornately no instrument have been devised for measuring the causes of smells

quantitatively, and evidence could be very difficult to obtain.
Smells are therefore very subjective partly because the person's
attitude to the cause of a smell affectss his view of the smell.
The residents of kafue have attributed the bad smell around their
environment to air pollution. This therefore is the beginning of
public awareness of air pollution.

6.2   **CONCLUSIONS**

From the analysis and summary discussion of results, it can
be concluded thatl the increase in health problems among Kafue
residents is more likely due to air pollution from the town's
major industries particularly N.C.Z Factory than anything else.
Scorer (1973) points out that air pollution disasters in
developing countries are greater in human than environmental
terms. A number of other studies have indicated that certain
diseases such as respiratory diseases are more frequently
reported or appear to be more severe in cities with high air
pollution. Therefore, an increase in the number of repiratory
diseases among the residents of kafue may lead to the conclusion
that there is a problem of air pollution in Kafue. There is
little doubt that air has contributed to human ill health though
the magnitude of this effect is very difficult to quntify.

The fact that respondents are willing to say they suffer
from coughs, irritations and attribute this to air pollution,
indicates the high degree of public awareness of air pollution.
Respondents also indicated that air pollution has contributed to
the poor quality of their crops, the bad smells were also blamed

on pollution from the town's industries? This also points to the conslcusion that, there is growing anwareness among Kafue residents of air pollution.

It is pertinent to point out here that the awareness is the result of factors other than or in addition to direct sensory experience. It seems clear that the statements of experts as reported in the media and the rising level of journalistic accounts have been major forces contributing to the growth of public awareness and concern.

Since there appear to be no attitudes or perception studies of air pollution in kafue prior to this study, it is not possible to chart with any accuracy the growth of public concern. It seems safe to assume however that it has followed closely the growth in nespaper coverage.

The major conclusion of the study is that Kafue residents are aware of air pollution. there awareness, however, has been generated to a considerable degree by the mass mdeia and the potentially most dangerous pollutants are not those that can be readily detected by the senses. There is some danger that the public will become apathetic about the problem of air pollution. The consequences of such an event would probably be that little would be done to curb the growth of the problem, and a steady decline would take place towards a disster in the future. There is therefore need to sieze the present opportunity. Government action has so far been cautious, deliberate and slow.

6.3   RECOMMENDATIONS

(i)   The process of cleaning up the atmosphere is one that will take along time. It is to be hoped therefore that the present furor over air pollution will not collapse into unconcern or indifference, but that it will settle into a quieter but more solidily based and well informed mould in which cities organisations can play a useful watchdog role. To achieve this state of affairs, it is recommended that strong Government action on air is needed. This should include not only legislation and it's enforcement and ofcourse of more research, but also should involve the systematic provision of information to the public and a contunual monitoring not of the pollution only but of the levels of public awareness and concern.

(ii)   In Zambia, pollution is rather low in summer and winter. As a result of these observations, it is recommended that, where emission of pollutants could not be avoided, periods of high emission should be during these months (ie. summer and winter) and not any other times.

(iii)   There is need to awaken sensitivity towards the environmental problems in all the personnel starting from the management, by means of tailored training courses and written communications. This is important because it would promote the use of better industrial waste management

6.3.1   FURTHER WORK

It is however emphasised that the reults of this study are strictly preliminary and should not be regarded as representing

the exact situation in Kafue. An indepth study of perople's
perception and awareness of air pollution in the area should be
done.

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SCHEDULED STRUCTURED INTERVIEW QUESTIONNAIRE

1   TITLE OF THE PROJECT:

AN ASSESSMENT OF PEOPLES PERCEPTION AND
AWARENESS OF AIR POLLUTION IN KAFUE
TOWN, ZAMBIA.

1(a)   Resident's Name _____
 (b)   Area of Residence _____
 (c)   Location _____

2(a)   How long have you been living in Kafue?
 (b)   When did you come in your present house? _____

3.   How is the general feel of air around this
place? _____

4(a)   Do you think there is a pollution problem in this
area? If Yes which of the following industries
do you think play a major role in contributing
to the General level of air pollution in Kafue)

 (i)   NCZ
 (ii)   Kafue Textiles
 (iii)   Bata Tannery
 (iv)   Lea Yeast

 (b)   Of the pollutants you know, which are you most
concerned about?

5(a)   Are there any ill effects of air pollution that
affect you personally? _____

5(b)   Have you or any other member of the family
suffered from any of the following problems?

 (i)   bronchitis
 (ii)   pneumonia
 (iii)   cough
 (iv)   any other respiratory problem

6(a)   If the answer to (Q4) is yes, did the problem
start when you came here or did you have it before
and for how long?

_____

 (b)   did you go to the hospital when you realised you
had this problem and what were you told the
possible cause of the problem was?

_____

(c)   Generally what is your response to air pollution
        ....

7(a)   Do you have any garden around the house?
        ....

(b)   If yes, what is the quality of the crops?
        ....

8.   Could you say the gases and dust from any of the
        major industries around have negatively affected
        vegetation, crop or plant growth in your areas?