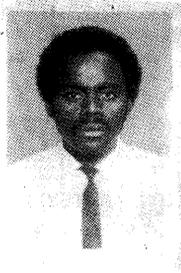


INDUSTRIAL POLLUTION OF THE KAFUE RIVER



BY

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ABSTRACT

INDUSTRIAL POLLUTION OF THE KAFUE RIVER

There is a growing concern in the quality of aquatic environment of the Kafue river. Most of known problems are associated with the discharge of industrial and domestic sewage effluents directly or indirectly into the river.

The mining activities in the Copperbelt to mention a few have been and are still among the main theme of discussion in most water reaserch studies being conducted.

Since water courses have long been used as transport for industrial wastes, it is common knowledge that water pollution is not a new subject, but rather a changing trend which requires constant monitoring.

A great deal on water pollution and motoring has already been done at strategic points along the Kafue river, by NCSR, ZCCM, Fisheries Research centre and Water Affairs etc.

It is hoped that through the formation of the Environmental Council all water resources will not only be economically appreciated, but adequately protected through a policised co-ordination of all beneficiaries and potential polluters.

INTRODUCTION

In Zambia's effort to revamp her fast deteriorating economy through increasing agricultural, mining and industrial activities, it must be borne in mind that there are dangers of destroying our clean, virgin environment by indiscriminate disposal of waste materials.

- 1.1 Zambia is a land-locked country with only one river basin of high importance in the support of economic development. The Kafue river from its upper course down to its confluence with the Zambezi river is surrounded by a lot of activities such as the mining industries, agricultural schemes, fish industries, hydro electric generation, urban and rural settlements.
- 1.2 Despite this dependence on the Kafue water source, little attention is being paid on the pollution impact due to industrial effluents on the river. Several studies have been conducted by scientific and Technological experts in order to determine the nature, load, control and abatement of pollution in the Kafue river.

Unfortunately the lack of an established system in the enforcement of environmental pollution control policies in the past, has attributed to perpetual negligence and indiscriminate discharge of industrial effluents into the aquatic environment.

2.0 GENERAL POLLUTION AWARENESS

The 1990 Act of parliament culminated into the formation of an Environmental Council, charged with the responsibility of enforcing the pollution control policies.

Historically the 1985 Act of parliament for example described pollution as "The presence in the environment of one or more contaminants in such quantities that may cause discomfort to or endanger the health, safety and welfare of persons or which may cause injury or damage to the plant or animal life or property or which may interfere unreasonably with the normal enjoyment of life or use of property or conduct of business".

- 2.1 Considering the definition of pollution it is obvious that water pollution poses an essentially biological problem related to its effects of wildlife especially fish and humans through contaminated water supplies or impaired recreational facilities and amenities.

3.0 WATER POLLUTION ABATEMENT

Several terminologies are often used in defining the water pollution control procedures.

3.1 DEFINITIONS

The terms "survey" "surveillance" and "monitoring" as often used by water chemists were defined according to Mellawel (1978) as follows:

3.1.1 SURVEY:

An exercise in which a set of samples or several standardized

observations are taken from a station (or stations) within a short period of time to furnish qualitative or quantitative data.

3.1.2 Surveillance: A continued programme, of surveys systematically undertaken to provide a series of observations for a specified period of time.

3.1.3 Monitoring: Surveillance undertaken to ensure that previously formulated standards are being followed.

The water pollution in the Kafue river can be effectively described by considering the extent of the social and economic developments stated in unit 1.1, through the above definitions.

4.0 THE MINING ACTIVITIES

The pollution impact on the Kafue river on the copperbelt, cannot be over emphasized. The river water is continuously being polluted with heavy metals such as copper (Cu), Lead (Pb), Iron (Fe), Cobalt (Co) Nickel (Ni) and Zinc (Zn) from metal processing plants, thus posing health hazards to plant, fish, animal and human life.

Some estimates of forty to seventy thousand cubic liters of effluent are being discharged every second from the eight metal processing plants throughout the copperbelt. The big question is: "Where does this waste water go?".

5.0 JUSTIFICATIONS

5.1 The effect on livestock

The problems of copper-poisoning in cattle and sheep belonging to farmers bordering the Mwambashi river (tributary of the Kafue) have long been identified. The effects of such poisoning have resulted into frequent abortions, stillborns and even death to affected animals.

5.2 In 1981, specimen samples analyzed by the Veterinary Research Institute of the Department of Agriculture and Fisheries (South Africa), for a complainant in Zambia's copperbelt province had the following data:-

Species	Organ	Element concentrations in ppm		
		Cu	Fe	Co
Cow X	Liver	290	249	0.15
	Kidney	12	82	-
Sheep X	Liver	438	103	0.00
	Kidney	83	170	-
Cow Y	Liver	344	183	0.12
	Kidney	7	70	-
Cow Z	Liver	910	377	0.12
	Kidney	47	250	-

From the above data, the Liver copper concentrations are all above the normal (0.70 - 30ppm), evidence that the above livestock specimen died from copper poisoning.

- 5.3 The tailing residues discharged into tailing dams associated with each mine, occupy a total area of 10,00 hectares. These are not all protected from draining into water channels. During the flood seasons, huge amounts of slag and silt are being washed into the Kafue river, via tributaries resulting into high turbidity and color of the river water.

5.4 The effect on drinking water

The quality of drinking water supplies on the copperbelt is equally affected by the mining activities, particularly the Chingola Township. Studies conducted by Dr G. M Sawula (previous NCSR researcher) for the period 1984-85 and for which I was directly involved in sample collection, analysis and data compilation, indicated that the quality of treated water at Chingola water works fell short of the stipulated (WHO) standards for drinking water. The sediment load from the mines greatly increased the turbidity of the raw water thus reducing flocculation and filtration efficiency.

5.5 The effect on the flora and fauna

The flora and fauna along the Kafue river estuaries in the mining areas have continued to deteriorate due to fluctuations in pH and turbidity brought about by high concentrations of dissolved solids. Biological samples analyzed by the National Council for Scientific Research on the (Nature load control and abatement of pollution in the Kafue river) Project conducted by Mr J Kasonde; of which I was directly involved in sampling analysis and data compilation for biological parameters indicated that the Zoobenthos plankton, algae and phytoplankton species were predominantly of heavily polluted water type. The average chlorophyll concentrations were less than 1 mg/l for most of the sites.

6.0 INDUSTRIAL ACTIVITIES

The Industrial activities both on the Copperbelt and Kafue town have equally contributed to the pollution impact on the Kafue river.

In the Kitwe, Chingola and Ndola towns are several food processing manufacturing and chemical industries. These directly or indirectly discharge effluents into the Kafue river; partly due to the poor state of Council sewage treatment plants.

- 6.1 The problem of water weeds at the Kafue road bridge and Kafue gorge for example, can be attributed to the high concentrations of nitrates and phosphates from the Nitrogen chemicals of Zambia. The Bata Tannery, National Breweries and Lee-Yeast collectively discharge effluents of high BOD values due to high content in oxidizable nitrogenous compounds. The table below shows some bacteriological data on the Iolanda water works for Lusaka water supply (for the period January - June 1981).

IOLANDA WATER WORKS

DATE	RAW WATER			TREATED WATER		
	Colif	E. Coli	P/count	Colif.	E. Coli.	C/count
28/1	0.093×10^4	0.093×10^4	0.017×10^4	0	0	0.002×10^4
182	0.093×10^4	0.023×10^4	0.015×10^4	0	0	0.0008×10^4
10/2	1.1×10^4	1.1×10^4	0.0×10^4	0	0	0
31/3	1.1×10^4	0.029×10^4	0.032×10^4	0	0	0
12/6	0.2×10^4	0.015×10^4	0.01×10^4	0	0	0
MEAN	0.4×10^4	0.21×10^4	0.023×10^4	0	0	0

From the above data it is clear that the quality of the raw water is highly contaminated with faecal-originated microorganisms threatening the quality of the treated water in case of under-chlorination.

7.0 HUMAN RESETTLEMENTS

The extensive farming activities along the Kafue river together with intensive application of fertilizers and deforestation have contributed to the number of diffuse sources of water pollutants.

The outbreak of cholera in early 1993 for example is partly due to

poor sanitary facilities and poor disposal methods of wastes in heavily populated areas.

8.0 REMEDIES AND POLLUTION CONTROL MEASURES

Remedies and control measures of pollution in the Kafue river should include:

8.0.1 Control of sediment erosion

Sediment erosion particularly in mining areas can be controlled by:

- i) Installation of perimeters around dumps and slaging areas.
- ii) Avoiding clearing of steep areas next to dumping and slaging sites
- iii) Improving drainage and stabilizing of haul roads
- iv) Stabilizing old dump sites by reclaiming methods such as vegetative establishment.
- v) Interception and deviation of run off from active dump and slaging sites
- vi) Removing of sediment from drainage channels or streams.

8.0.2 Pretreatment methods

Pretreatment process. particularly the control of pH in waste water from metal processing plants should be checked from time to time for possible changes in efficiency. Expansion of industrial plants should automatically include expansion of pretreatment processes.

8.0.3 Reduction of Nutrients and Heavy metals

Excessive nutrients and dissolved heavy metals in stabilization ponds especially for municipal sewage treatment should be reduced prior to discharge into natural streams. Several aquatic weed species such as the water hyacinth, duckweed, cuttail, bulrush and submerged weeds have been extensively studied and found suitable for this purpose when they are allowed to saprophy on the water surface in ponds.

8.0.4 Waste material utility Technology

The development of technologies that would utilise waste materials would improve the quality of wastes. Waste materials from milk oil brewery and some food processing plants are rich in wheys which can be used in producing crude acetic acid.

8.0.5 Self - monitoring

It is most important that all types of industries should carry out their own surveys surveillance and self-monitoring programmes in order to maintain effluent (water and wastes mater) standards for discharge into the environment.

8.0.5 Recycling Technology

The recycling of waste water reduces the demand for raw water gives time for proper pretreatment of final effluents and recovery of receiving water source or disposal site.

8.0.6 Public Awareness

Water pollution abatement can be enhanced by educating the public on the hazards of careless disposal methods of waste water and solids. With the newly constituted environmental Council, It is hoped that many water pollution problems will be corrected through the enforcement of the Water Pollution Control (Effluent and waste water) Regulations.

SUMMARY

The industrial pollution of the Kafue river has long been identified and many environmental effects on plant animal and human health through contaminated water supplies have been pointed out. What has been the major problem in the past was the lack of a strong environmental pollution control policy to support the many attempts towards pollution abatement in the whole Kafue basin.

The environmental Council of Zambia has finally established standards and regulation for the disposal/dischage of waste; solids water (effluent) pesticides and toxic chemicals into the environment with the understanding that these will be used as guidelines in the control of pollution country wide.

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