A STUDY OF WORKERS IN PESTICIDE FORMULATING PLANTS/ INDUSTRIES IN NAIROBI AND THE SURROUNDING AREAS.

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD OF THE DEGREE OF MASTERS OF PUBLIC HEALTH (M.P.H.) OF THE UNIVERSITY OF NAIROBI.

1990

DECLARATION

I certify that this dissertation is my original work and has not been presented for a degree in any other University.

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DEDICATION

To my mother, without whom this would not have been possible.

ACKNOWLEDGEMENTS

I express my heartfelt gratitude to the entire staff of the Department of Community Health, especially the Chairman of the Department, Dr. E.K. Muchunga, my internal supervisors Mr. M.A. Mwanthi and Dr. S. Kanani who gave me a lot of support during the study period.

I would also like to thank my external supervisor Dr. A.W. Choudhry for his assistance especially during the formulation of the study.

I would like to acknowledge the contribution of the Factory Inspectorate and the Pest Product Control Board withou whose help, entry into the factories would not have been possible.

I would also like to thank the management of the factories I visited who allowed me to interview their workers.

Last but not least, I would like to thank Tom Omurwa for his help with computers, Hellen Nyaboke for her secretarial work and Brenda and Loius for their support.

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GLOSSARY

WHO	=	World Health Organization
ILO	=	International Labour Organization
GIFAP	=	International Group of Association of Manufacturers of Agrochemical products
CBS	=	Central Bureau of Statistics
D & V	=	Diarrhoea and Vomiting
E.C.G	=	Electrocardiogram

ABSTRACT

Pesticides are used by farmers for purposes of gaining the most out of their land in terms of higher productivity and higher profits. They are also used by man to control disease vectors. The use of pesticides worldwide has been increasing rapidly due to the need to feed a bigger world population and also increased use in vector control. Most pesticides are not selective and are capable of harming both the target pests and other species as well. Pesticides can be harmful to man at any stage of contact beginning from the manufacturing stage, transportation, application and later, as residues in food and water.

The study was done to evaluate the possible effects of pesticides on workers in the pesticide industries and the safety measures used against contamination and poisoning both by the management of the industries and the workers.

The study was done between November 1988 and April 1989 and was carried out in Nairobi and its surroundings. The research was descriptive in nature and was carried out by interviewing the workers and by observations.

The results were recorded on a pre-tested questionnaire and analysis was by computer.

There were eight factories visited with a total of 91 workers interviewed. The results showed that the pesticide industry in this country is mainly male dominated with only 16% of the workers being female. Most of the workers interviewed had a low level of education and no institutional training. Most of the industries provided the workers with some form of protective clothing although medical supervision was not done by some of the industries.

Of the workers interviewed, 34% had sought medical assistance for the complaints related to the pesticides they handled while 12% had been hospitalized. The workers had medical complaints related to the skin, the respiratory tract, the central nervous system and the gastro-intestinal tract. 79% of the workers got at least one medical check-up per year while 80% had their blood tested for activity of the enzyme acetyl cholinesterase.

The recommendations made are applicable to the pesticide formulators/manufacturers/distributors, the factory inspectorate and the pest control board.

CHAPTER ONE

INTRODUCTION

Problem Statement

Since the introduction of DDT as an insecticide in 1941, a large number of compounds have been synthesized and used as pesticides, Pesticides have won worldwide acclaim as being essential for the production of adequate food for the rapidly increasing world population and for the control of insect and vector borne diseases. The manufacture and use of pesticides have been rising over the years with market growing in real terms by an annual average of 5%. Global pesticide use was expected to top 2,300 million kilogrammes in 1985.[1] Pesticides are important to Kenya's economy since Kenya's economy is agriculturally based. Kenya, by virtue of being a tropical country, also requires pesticides for the control of tropical diseases many of which are caused by insect vectors.

The amount of pesticides imported into Kenya has gradually risen over the years reaching a value of KShs.700 million in 1987[2]. About 20% of all pesticides used in this country are formulated locally by several national and multi-national companies mainly based in Nairobi.

Many pesticides are very toxic not only to pests but also to human beings. The people at most risk of pesticide poisoning are those involved in the manufacture, formulation and transportation of pesticides, and the agricultural workers who use pesticides on farms. The families of agricultural workers are also at risk. This excludes pesticide poisoning due to suicidal intent which is a separate problem.

During the formulation and re-packing of pesticides, there may be considerable contamination of the workers which may at times lead to intoxication, acute poisoning or chronic poisoning. This is however, dependant on the working environment and on the work practices of the people employed in the various formulation plants. Pesticide handling and pesticide intoxication in human beings in this country has not been adequately evaluated. The data available on occupational pesticide poisoning is not adequate to make recommendations for appropriate safety measures and the prevention of pesticide poisoning in Kenya.

This study will look at the working environment in pesticide formulating plants, the work practices of the employees and also look for any signs and symptoms of pesticide poisoning among other workers.

LITERATURE REVIEW

Pesticides comprise all those types of synthetic naturally occuring chemicals that are used in man's fight against those organisms which are harmful to his health or are detrimental to food production.[4] Pesticide formulation is the process by which the active ingredients of the pesticide are made up for sale and use.[5] The formulation and dispensing of formulated pesticides may cause considerable contamination and subsequently health hazards to workers.[6] Pesticide poisoning occurs mainly via three routes namely the oral route, the respiratory route and by dermal exposures. Liquid formulations are of greatest hazard to the workers mainly by dermal contamination.[7] Occupational exposure is part of accidental exposure/poisoning which covers both industrial and agricultural workers. Work is already being done to evaluate the knowledge, attitude and practice of coffee farm workers who use pesticides, and thus this study will focus on pesticide formulation plant workers.[8]

Tobin (1979) reported three cases of persons poisoned with carbofuran (a carbamate). Two were formulation plant employees preparing 10% granules who developed profuse sweating, weakness, blurred vision and nausea.[9] Morse and Baker (1979) in a survey of occupationally acquired diseases among the workers of a pesticide plant found that 11 out of 102 workers had been hospitalized for illnesses related to chemical exposure with the commonest

cause being methonyl. On clinical evaluation, 5 out of 11 packaging workers with the highest exposure to methonyl experienced blurred vision or pupillary constriction.[10]

In another study done in Jordan Valley, Michael Thun and Arthur Watanabe found that the few workers handling pesticides received any formal training concerning pesticides. They also found evidence of chronic cholinesterase activity suppression in the exposed workers.[11]

Jeyaratnam working in Sri Lanka demonstrated the risk of pesticide poisoning in countries using agrochemicals. These studies showed that about 13,000 patients are admitted annually to hospitals in Sri Lanka due to pesticide poisoning with 1,000 deaths annually attributed to pesticide poisoning. Occupational and accidental poisoning accounts for 24.9% of the cases with the commonest type of pesticide responsible for the poisoning being organophosphates.[12]

The 1980 report on health and safety in pesticide formulation factories in Sri Lanka given at an International Labour Organization seminar in Colombo painted a very bad picture with reports of faulty design of exhaust ventilation systems, inadequate protective clothing for the workers, and wrong work practices. In two pesticide formulating industries, 50% of the workers exposed to organophosphate pesticides had pronounced reduction in blood cholinesterase activity. There were even reports of

deaths which on investigation revealed exposure of the victims to pesticides in the formulating factories.[13]

In Kenya, there are an estimated 350,000 incident cases of pesticide poisoning among the agricultural workers with an annual economic impact estimated at KShs.336 million.[14] There are no figures quoted for workers in pesticide formulating plants but we can deduce from studies done elsewhere that it is a growing problem.

In Nairobi, it is estimated that two patients are seen every day at the three major hospitals with either intentiona or accidental pesticide poisoning. That gives a figure of about 2,184 cases of pesticide poisoning annually in Nairobi alone. In 1981, 221 cases of pesticide poisoning were reported at Kenyatta National Hospital with 13 deaths.[15] The Government Chemist Laboratory has the following figures for the deaths due to pesticide poisoning.

Table 1: Number of Deaths due to Pesticide Poisoning from 1981 to 1985

	1981	1982	1984	1985
Deaths due to Pesticide Poisoning	81	136	168	103

Source: Government Chemist Laboratory

These figures are however, only related to cases where death was thought to be due to poisoning and thus specimen sent to the laboratory for analysis.

In pesticide poisoning, there are also cases where due to mild symptoms and/or lack of awareness, are unreported.

JUSTIFICATION

Low level prolonged exposure to some chemicals may exert adverse effects on human health. Pesticide poisoning has been known to occur in pesticide formulation plant workers in other countries. The Director of World Health Organization asked member nations to notify the WHO of cases and deaths occuring during 1974 due to accidental pesticide poisoning. However, many countries were unable to provide the necessary data.[3] Pesticide poisoning has not been adequately evaluated in Kenya and information on pesticide poisoning among pesticide formulation plant workers in this country is not available at present. The study will thus provide information that will be useful to both Government Agencies and the Ministries of Health, Agriculture and Labour. The information could also be useful to the formulation plant management to implement safety measures and to reduce the risk of pesticide poisoning among their workers.

STUDY OBJECTIVES

2.1. General Objective

The main objective of the study is to establish the different types of health hazards in pesticide formulating factories that workers are exposed to during the working time.

2.2. Specific Objectives

2.2.1. To determine the major types of pesticides (organophosphates, organochlorines and carbamates) formulated in the different formulating plants in Nairobi.

2.2.2. To examine the safety measures used by the employees' management to protect their workers.

2.2.3. To determine the work practices of the workers against contamination and poisoning by the pesticides that they formulate.

2.2.4. To ascertain the existence of signs and symptoms, if any, related to pesticide poisoning among the workers exposed.

2.2.5. To recommend protective and remedial measures to safeguard against pesticide poisoning among factory/formulation plant workers in Nairobi.

CHAPTER THREE

MATERIALS AND METHODS

3.1. Study Area

Nairobi is the capital city of Kenya and is one of the largest cities in East and Central Africa. Some United Nations bodies, including United Nations Environmental Program and Habitat, have their headquarters in Nairobi. It is also the seat of the Government of Kenya and all ministry and parastatal headquarters are situated here.

Historically, Nairobi started in 1899 as a small settlement with the building of the Kenyan-Uganda Railway and became the headquarter of the Uganda Railway. Thereafter, it slowly expanded and in 1907, took over from Machakos as the capital of what today is Kenya and Uganda. Since then, it has slowly grown to its current massive proportions.

3.1.1 Location

Nairobi is situated on the edge of the Athi plains at an altitude of about 1,700m above sea level. It borders on the agricultural highlands which produce dairy products, pyrethrum, coffee,

and tea. It is connected by rail, road and air to most towns in Kenya, and by oil pipeline to Mombasa. Nairobi covers a total land area of 684 km² which is about 0.1% of Kenya's total land area (see Maps 1 and 2 on page 10 and 11).

3.1.2. Demographic Characteristics

The population of Nairobi continued to grow from the 1940's and at the 1979 population census, stood at 827,775 people. The population changes are illustrated in Table 2.

Table 2: Population Changes in Nairobi

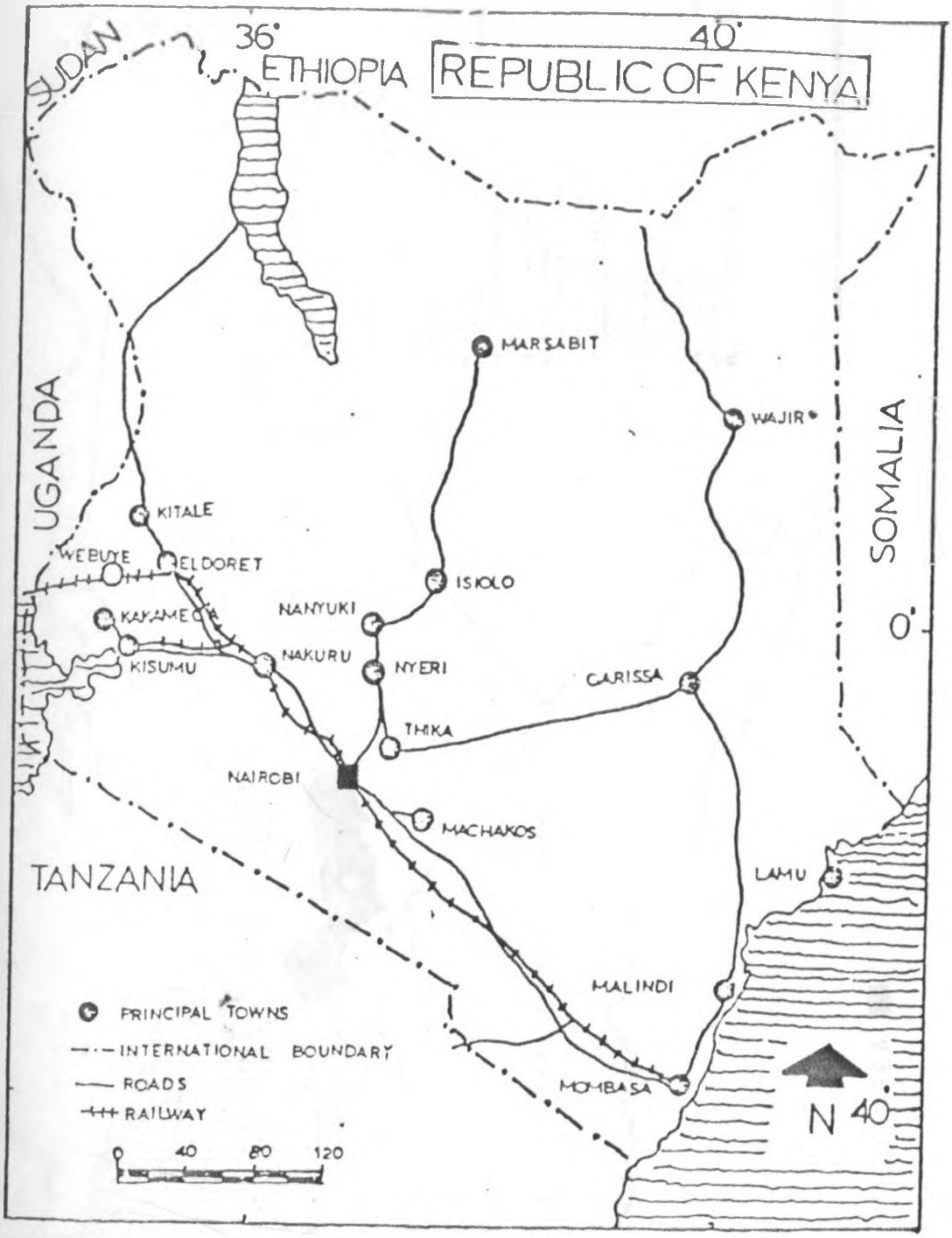
Year	1948	1962	1969	1979
Population	118,976	343,500	509,286	827,775

Source: Population Census Report, 1979

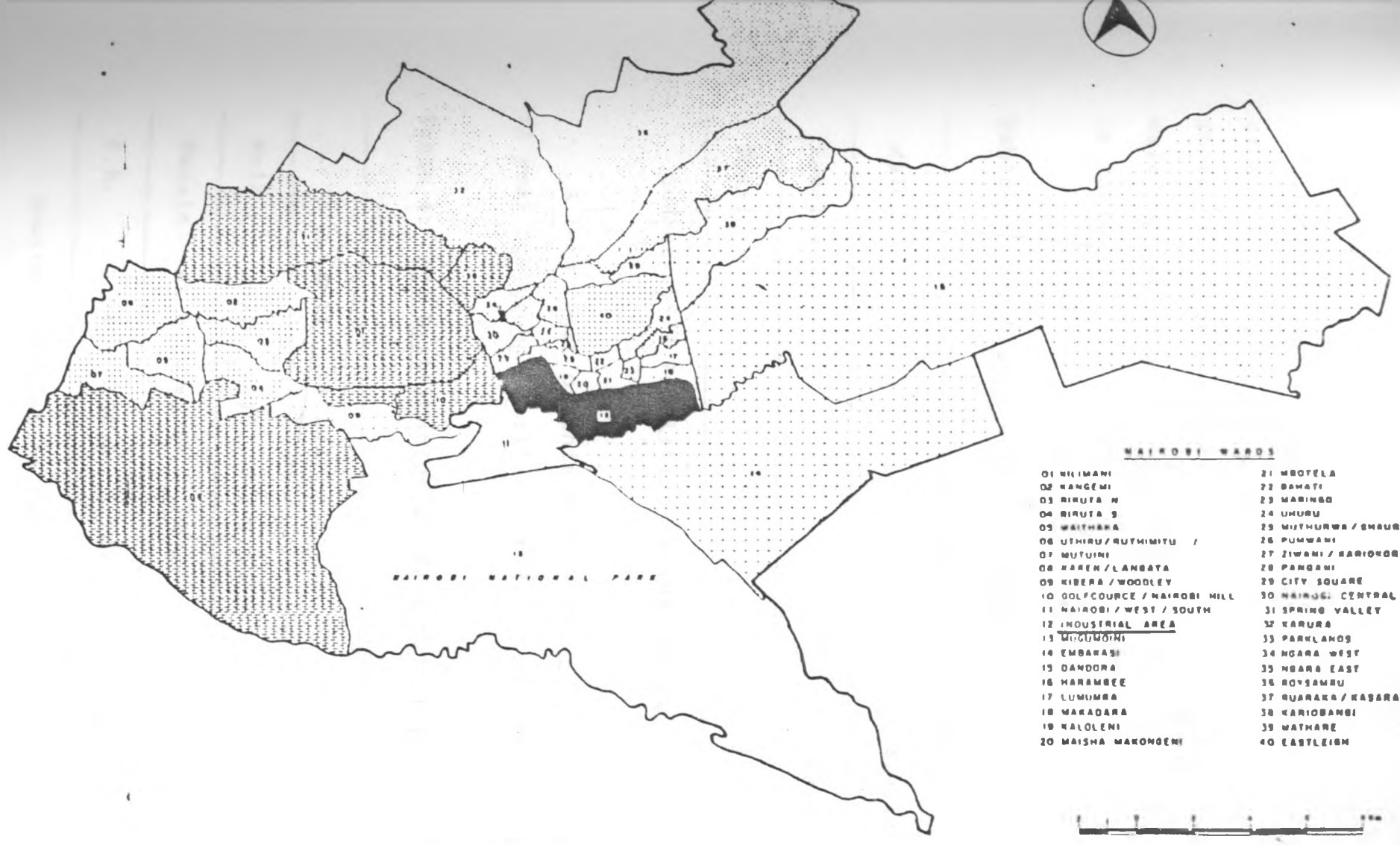
Among the factors that account for this rapid population increase are:

1. Rapid industrialization of Nairobi;
2. Increase in number and size of schools and institutions in Nairobi;
3. Increase in number of people working in companies and government offices;
4. Expansion of the commercial sector;
5. Rural-urban migration by people in search of employmen

MAP 1:



Map No.1. Map of Kenya showing position of Nairobi.



LOCATION OF STUDY AREA

With a land area of 684 km², the population density of Nairobi in 1979 was 1,210 persons per square kilometre. There was a total of 200,474 households in Nairobi and the male population outnumbered the female population as shown in Table 3.

Table 3: Sex Distribution of Nairobi's Population

Males	479,448
Females	348,327
Total	827,775

Source: 1979 Population Census Report

A large part of this population falls in the 15 to 44 year age group as illustrated in Table 4.

Table 4: Age Distribution of Nairobi's Population

	0-14	15-44	46+	N/S	Total
Male	28.4	61.7	9.6	0.2	100
Female	41.6	52.9	5.6	9.2	100
S.R.	94	160.6	249.6	183.2	137.6

Source: Population Census Report 1979

The projected population for Nairobi for the year 1989 assuming constant fertility and mortality is 1,429,041, an increase of 601,226 from the last population census. The projected numbers of males vis-a-vis female is given in Table 5.

Table 5: Projected Nairobi Population by Sex

Sex	Size of Population
Male	825,649
Female	603,392
Total	1,429,041

Source: 1979 Population Census Report

3.1.3 The Functional Zones of Nairobi

Nairobi can be divided into several functional zones or sectors (see map 2). There is the city centre which houses business premises, office buildings and hotels. The other functional section of the city is the industrial area. The industrial area extends from the Railway head-quarters to beyond the Jomo Kenyatta International Airport, with its boundaries being Jogoo Road and Mombasa Road. The industries include food processing, milk

processing, metal works, oil and petroleum storage plants, detergent and soap manufacturing, garages and car assembly plants among others.

The residential area include the low income areas of Lumumba, Makadara, Mbotela, Bahati and Uhuru, the middle class areas of Buruburu, Golf Course, Otiende and Ngei, and the high class areas of Loresho, Runda, Lavington, Muthaiga, Karen and Langata.

3.1.4 City Services

The city has a good network of roads and most of the residents depend on motor vehicles for transportation. Nairobi is well supplied with water and electricity and has a good sewage disposal system.

The educational facilities are catered for by the City Commission (mainly nurseries and primary schools), the Government and private organizations. There are three universities and many middle grade colleges providing training in hotel management, engineering, nursing and teaching.

Medical services in the city are provided by the Government, City Commission, private organizations and private practitioners.

The Government through parastatals runs the Kenyatta National Hospital which is the biggest hospital in East Africa. The City Commission runs the health centres, and the Pumwani Maternity Hospital. There are several large hospitals run by private organizations, while private practitioners and non-governmental organizations run private clinics.

3.2. Study Population

The employees who work in pesticide formulation plants/factories were recruited into the study after gaining permission from their employers. In these plants, most of the workers included in the study deal directly with pesticides. In some cases, storekeepers who store pesticides and clerical staff were also included. Management staff were meant to be interviewed to provide a control group, but this was not practical and the information that would have been gathered would not have been pertinent to the study.

3.3. Study Design

This was a cross-sectional descriptive study.

3.4. Sampling Procedure

Eight plants were visited and a total of 91 workers were interviewed using a structured questionnaire. Of the 91 workers interviewed, 76 were male while 15 were female. The workers interviewed were those found handling pesticides. The managerial staff were not interviewed. A list of plants visited is attached in Appendix 1. Most of the factories visited had a very small number of employees, so they were all recruited into the study. The workers found to be dealing with pesticides were recruited into the study. This was done after seeking permission from the management. Most of the workers interviewed were willing to be interviewed, and understood the reasons for the study. An attempt was made to visit all the pesticide factories in Nairobi, although this was not possible due to closure of some industries during the study period. In some cases, the Companies' policies were restrictive and so help had to be sought from the Pest Product Control Board.

3.5. Sample Size

The minimum sample size was calculated using the formula:

$$\text{Sample Size (N)} = \frac{Z^2 P(1-P)}{C^2}$$

Where,

N = Required minimum sample size

Z = Z value

P = The prevalence of the study condition. In this case, a P value of 50% was used as it is a WHO recommendation when prevalence of a condition is not known.

C = Expected error (level of precision). In this study, the C value was 0.1.

$$\text{Sample Size (N)} = \frac{1.96^2 \times 0.5 \times 0.5}{0.1^2}$$

$$= \frac{0.96}{0.01}$$

$$= 96$$

3.6. Data Collection

Data was collected by a structured questionnaire which had already been pre-tested. The Principal Investigator administered the questionnaire in either English or Kiswahili. The questionnaire was divided

into several parts which dealt with the factory/work space, employee's work practices and the medical history of the worker. The safety precautions employed by the management was recorded by both interviewing the workers and by direct observation which involved the checking of fire escape provisions, fire extinguishers, first aid boxes among others. The workers were also questioned on their medical history and if they developed any medical problems when dealing with specific pesticides.

Ethical issues were also taken into consideration when formulating the questionnaire and when administering it. Most of the issues the questionnaire dealt with were issues where specific recommendations have been made both by the Factory Inspectorate and by the International groups of National Association of Manufacturers of Agrochemical products. The study was undertaken with the assistance of the Factory Inspectorate. A factory inspector accompanied the Investigator to the factory on his first visit to enable him gain entry into the factory at any time. The factory inspector then introduced the Investigator to the management and explained the purpose of the study. However, the factory inspector did not participate in the interviews.

3.7. Constraints (Limitations)

Most of the pesticide plants employ very few workers and thus the sample size needed was not met. The plants also make use of casual workers who could not give any meaningful information since they have worked for a very short period (usually employed in the morning).

Some of the industries visited were closed for renovation during the study period and thus had to be left out. In some cases, the senior management of some pesticides formulating plants were very resistant to the issue of their employees being interviewed, thus making the process unduly trying. The management in some cases cited Company policy as the reason why the Investigator should be kept out. The information gathered is very useful to the management.

Initially, the study intended to collect blood samples from the workers and for assaying for the enzyme acetyl cholinesterase. The assay kits were not available during the study period and thus this activity was left out.

3.8. Data Analysis and Interpretation

The data collected was coded. Analysis was done by computer. The results were mainly frequency distributions. Cross-tabulation was done to try and correlate exposure to pesticides, work practices and safety measures to signs and symptoms of pesticide poisoning. Simple analytic tools like percentages, chi-square, two by two tables, frequency distribution and summary indices were used in analysis of the data.

CHAPTER FOUR

RESULTS

4. Results

There were ninety one (91) workers interviewed. A total of 8 factories were visited (Appendix 1). The research was carried out between November 1988 and April 1989.

SEX DISTRIBUTION OF THE WORKERS

Table 6: Sex Distribution of the workers interviewed.

Sex	Absolute Frequency	Relative Frequency
Male	76	84
Female	15	16
Total	91	100

Table 6 shows that 84% of the workers were males and 15% were females.

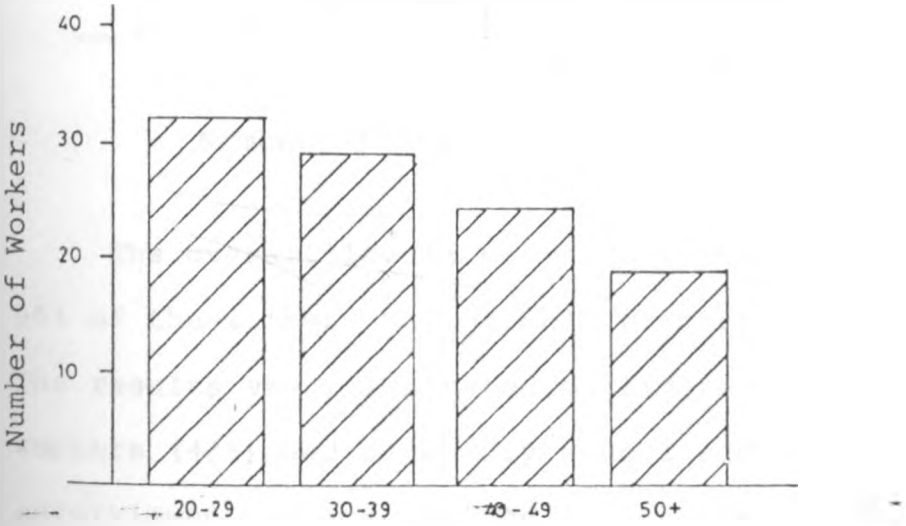
As illustrated below, 85% of the workers were married.

Table 7: Distribution of the Workers Interviewed by Marital Status

Sex	Absolute Frequency	Relative Frequency
Single	14	15
Married	18	85
Total	91	100

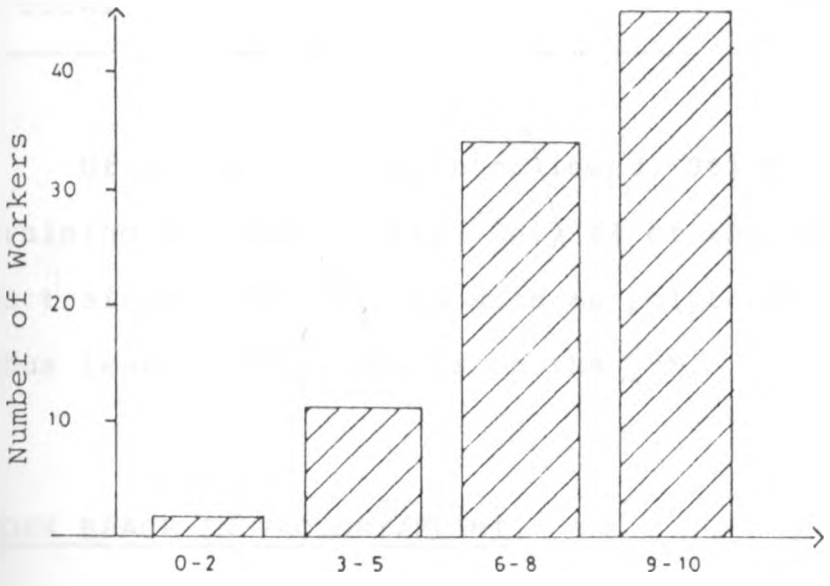
The ages of the workers ranged from twenty one to sixty one years. The age distribution is illustrated on the bar chart below.

Figure 1: Age Distribution of the workers



The mean age of the workers was 35.67 years. 62.64% of the workers were relatively young, being less than 40 years old. Only three workers were 50 years and above.

Figure 2: Level of Education



The overall levels of education were low with over 50% of the workers having only primary school education. The results are illustrated on figure 2. Thirty nine workers (43%) had secondary school education. No worker interviewed had gone beyond fourth form and none had college education.

Table 8: Workers with Institutional Training

	No. of workers
Number of workers without training	87
Number of workers with training	4
Total	91

Of the 91 workers interviewed, 96% had no formal training for their jobs. Only 4% of the workers had been to training institutions such as polytechnics. The workers thus learned their skills on the job.

WORK SPACE IN FACTORY/PLANT

Ventilation

Six out of the eight industries visited had adequate ventilation and 85% of the workers were thus working in places with adequate ventilation.

Exhaust (Hood Extractors) Ventilation

All the factories had some form of exhaust ventilation. They were of two types: (a) hood extractors over the working benches (ideal), and (b) fans in the walls.

In three industries, the exhaust ventilation was found not to be working while in one industry, it had never worked since installation.

First Aid Boxes

First Aid boxes were present in all the industries visited.

Floor Status

87.9% of the workers were working on clean floors while 12.1% worked in places with dirty floors.

Smoke Detectors

Only two factories were equiped with smoke detectors.

Fire Extinguishers

All factories visited were equipped with fire extinguishers.

Air Sampling

No factory did air sampling to detect the levels of pesticides in the factory.

Fire Escape Provision

Only one factory out of the eight visited lacked fire escape provisions.

EMPLOYERS WORK PRACTICES

Protective Clothing

Overalls: Of the 91 workers interviewed, over 95% had cotton overalls. Only four workers were found to be working in their street clothes.

Aprons: Of the 91 workers interviewed, 96% had no aprons. These aprons would serve a purpose of preventing chemical spillage onto the their clothes and limbs. Of the workers w aprons, three had cotton aprons.

Gloves: Ninety one workers were interviewed and it was found that 26.4% of the workers were not wearing gloves while 73.6% were wearing gloves. The absolute numbers are given below.

Table 9: Number of Workers Using Gloves

	Absolute Frequency	Relative Frequency
Number without gloves	24	26.4
Number with gloves	67	73.6
Total	91	100.0

Table 10: Reasons Given for not Wearing Gloves

Reasons for not wearing gloves	% of workers
Gloves not provided	7.7%
Gloves not required	8.8%
Inconvenient	6.6%
Not applicable	76.9%

The reasons given for not wearing gloves are as given above. Thus 33.3% of the workers not using gloves gave the reason for this to be that they were not supplied wi any gloves. In one industry, polythene bags were used as a substitute to gloves.

Mask/Respiratory: All factories provided masks to their workers but 22% of the workers were found not to be usin masks.

Meals, Shower Facilities and Changing Rooms

No factory allowed workers to smoke or eat while at work and no worker was found eating or smoking during th study period.

At the time of the study, 54.9% of the workers were found to have had their meals at the factory's canteens while 45.5% had to go to nearby kiosks for their meals.

All factories had bath facilities although 13.2% of the workers did not take showers/baths before going home. The reason they gave was that they did not have adequate time to take the shower. 96.7% of the workers changed from work clothes before going home and the same percentage of workers did not go home with their work clothes.

Table 11: Frequency with which the work clothes are washed per week.

Frequency of Washing Clothes	Number of Workers
1	38
2	50
3	2
7	1

Of the 91 workers interviewed, 19 washed their work clothes themselves while 72% had their work clothes washed by laundry services. The frequency with which work clothes were washed is given on table 11. Over 95% washed or had their clothes washed for them at least twice a week. Ideally, the clothes should be washed daily.

Table 12: Medical History and Types of Diseases Workers were hospitalized for

Type of Disease	Frequency
Anaemia	2
Chemical Burns	4
Peptic Ulcer	1
Pneumonia	1
Gout	1
Pesticide Poisoning	2
Total	11

Of the 91 workers interviewed, 78 had never been hospitalized since they started working. 11 of the workers had been hospitalized twice. The diseases the workers were hospitalized for are shown on Table 12.

Table 13: Number of Workers with Complaints Against Specific Pesticides

Type of Pesticide	Total Number handling pesticide	% with no complaints	% with complaints
Sevin	30	90	10
Copper Compounds	40	50	50
Mangozep	14	57	43
Pangozep	1	57	43
Captafol	9	56	44
Furadan	23	74	26
Daconil	25	32	68
Greenman	26	77	23
Ambush	4	25	75
Sumithion	28	7	93
Doom Powder	28	14	86

Table 13 contd

Type of Pesticide	Total Number handling pesticide	% with no complaints	% with complaints
Delnaf	29	17	86
Pyrethroids (Aerosol)		85	15
Caprocol	22	86	14

Table 14: Type of Pesticide as Related to Worker Complaints

Type of Pesticide	Complaints (Signs/Symptoms)
Sevin	Headache, Epistaxis, Rhinorrhoea, Dizziness, Coughing, Diarrhoea, and Vomiting.
Copper Compounds	Difficulty in Breathing, Coughing, Chest Pains, Running Nose, Epistaxis, Skin Rashes.
Mangozep	Skin Irritation, Eye Irritation, Rhinorrhea, Sneezing.
Pangozep	Headache, Vomiting, Coughing
Captafol	Headache, Dizziness, Skin Irritation and Rashes, Eye Irritation.

Table 14 contd.

Type of Pesticide	Complaints (Signs/Symptoms)
Furadan	Increased sleep, Drowsiness, Dizziness, Nausea and Vomiting.
Daconil	Itching of the Skin, Skin Rashes, Skin Desquamation.
Ambush	Running Nose, Sneezing
Sumithion	Abdominal Discomfort and Pains, Vomiting.
Doom Powder	Skin Irritation, Itching, Scratching.
Pyrethroids (Aerosol)	Running Nose, Sneezing
Caprocol	Coughing, Sneezing

SIGNS AND SYMPTOMS WORKERS COMPLAINED OF AS RELATED TO SPECIFIC PESTICIDES

Sevin

Thirty workers were found handling Sevin. Of these, twenty experienced no problems, while 10% had complained of headache, epistaxis, running nose, dizziness, diarrhoea, vomiting and coughing. These are some of the effects of acute exposure to Sevin (See Appendix 3). However, epistaxis, diarrhoea and vomiting are not mentioned in literature.

Copper Compounds

Forty workers were found to be handling Copper Compounds. 50% of them experienced no problems while the rest had complaints related to the respiratory system, the skin and the central nervous system. Most of the affected workers complained of difficulty in breathing, headache, coughing, chest pain, running nose, epistaxis, itching of the skin and skin rashes while dealing with Copper Compounds. This is to be expected from acute exposure to Copper Compounds. Workers dealing with Copper should have blood tests for levels of copper to arrest the situation early.

Mangozep

Fourteen workers were found to be handling Mangozep and eight of them had no complaints. Seven of the workers had complaints of itching and scratching of the skin, eye irritation, and rhinorrhea and sneezing. This concurs with the expected effects of Mangozep poisoning.

Pangozep

Only seven workers dealt with Pangozep with three of them complaining of headache, vomiting and coughing.

Captafol (Difolotan)

Nine workers were found to be handling Captafol. Of these, 5% experienced no problems, while the rest had complaints of headache, eye irritation and redness. Dermal and eye irritation is the main effect of acute and chronic exposure to Captafol.(25)

Only two workers our of twenty two who handle Difolotan had complaints of nausea and skin desquamation.

Furadan

Twenty three workers were found to be handling Furadan. Seventeen of them had no problems, while six had complaints of headache, dizziness, nausea, vomiting and increased sleep. This compares well with the reported symptoms of early Furadan poisoning. (24)

Daconil

Twenty five workers were found to be handling Daconil. Of these, only eight experienced no problems. 68% of the workers had complaints related to the skin and eyes, with most of the workers complaining of itching of the skin, skin rashes, desquamation of the skin, and darkening of the skin. Exposure to Daconil mainly has effects on the skin and on the eyes.(23)

Greenman

Of the twenty six workers found to be handling Greenman, six had complaints related to the central nervous system and respiratory system.

Ambush

Three workers who handled ambush had complaints of running nose and sneezing.

Sumithion

Twenty three of the twenty eight workers who were found to be handling Sumithion complained of abdominal discomfort, while handling this pesticide. Only two experienced no problems, while the rest complained of abdominal pains and vomiting. These are only two of the many possible effects of organophosphate poisoning. (Appendix 3)

Doom Powder

Of the twenty eight workers found to be handling Doom Powder, twenty four had manifestations of skin irritation with complaints of itching and scratching. Only four had no complaints.

Delnav

Twenty nine workers were found to be handling Delnav and twenty four complained of itching of the skin, nasal stuffiness and abdominal discomfort.

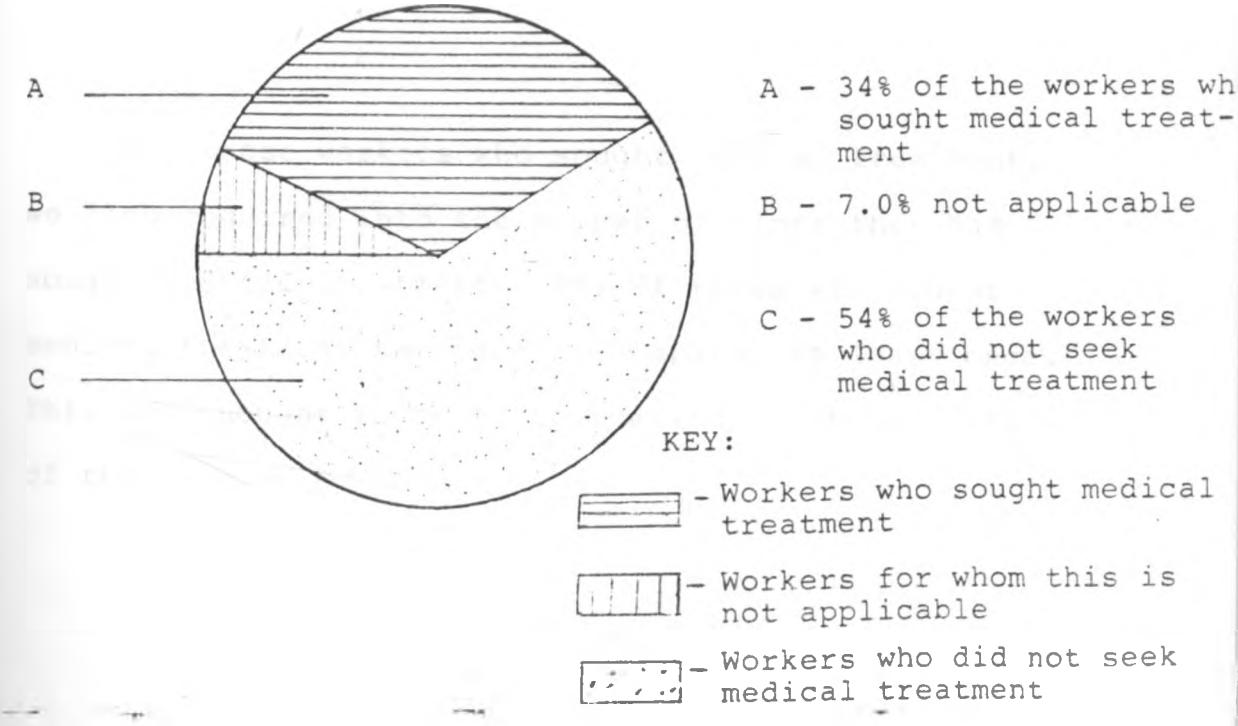
Pyrethroids

Workers had very few complaints about Pyrethrum products. The most feared reaction to pyrethroids is an anaphylactic reaction which was not encountered.

Malathion and Caprocol

Workers handling Malathion had no complaints. Three of thirty two workers handling Caprocol had respiratory tract complaints.

Figure 3: Medical Assistance



I enquired from the workers if they had ever sought medical treatment for the problems they experienced when working with pesticides. The results are given in figure 3.

Table 15: Frequency of Seeking Medical Assistance

Number of Times Treatment Sought	Absolute Frequency	Percentage
1	8	25
2	18	31
3	7	22
4	5	16
7	1	16
8	1	3

For those workers who sought medical treatment, we also enquired into the number of times they had sought medical treatment. 56% of those who sought medical treatment had been to hospital at least once. This was thought to be an indication of the magnitude of the problem.

MEDICAL CHECK-UPS

Table 16: Number of Respondents who Received Medical Examination.

	Frequency	Percentage
Workers who got Medical Check-ups	72	79%
Workers who did not get Medical Check-ups	19	21%
Total	91	100%

Among the workers interviewed, 21% did not get routine medical examinations. Of the eight factories visited, two provided at least one medical check-up per year for each employee. Two of the factories had their employees examined when they started working. The rest of the industries had no provision for this. For the factories that provided medical check-ups for their employees, the check-up was done by the factory doctor.

Blood Sample Analysis for Acetyl Cholinesterase Activity

Table 17: Blood Sample Analysis

	Absolute Frequency	Percentage
Workers whose blood sample was regularly tested	73	80.2%
Workers whose blood was not tested	18	19.8%
Total	91	100.0%

Three industries took regular blood samples from their workers for analysis of acetyl cholinesterase activity. Table 17 does not reflect this because most of the industries that took workers' blood for testing were large and therefore had a big number of employees. The incidence of low cholinesterase activity among the workers was not high. This was discovered by checking Company records. Those workers with low cholinesterase Activity were transferred to areas where they did not handle pesticides such as gardening.

CHAPTER FIVE

DISCUSSION AND RECOMMENDATIONS

5.1. Discussion

From the research findings, the pesticide formulating industry is mostly male dominated. The reason given for this is that some industries do not employ females because of the hazardous chemicals they may have to handle. This is thought to cause prenatal damage and could cause spontaneous abortion. Pesticides may also be excreted in breast milk, thus also affecting the babies.

Most of the workers interviewed had a low level of formal education and 96% of the workers had no formal training for their jobs. It is expected that workers with higher levels of education and formal training for their jobs will be more careful when dealing with pesticides. Since it may be feasible to get such employees, it is one of the duties of the employers to ensure that pesticide workers, and in particular, the newly employed or illiterate workers, are properly instructed about the hazards of their work and the relevant safety and health precautions.

Six out of eight factories visited had adequate ventilation. In three industries, the exhaust (source) ventilation was found not to be working, while in one factory, it had never worked. Adequate ventilation is important in reducing harmful fumes and dusts in the work place. It also reduces worker fatigue. Ideally, to povide adequate ventilation, the factory buildings should be open-sided or have a combination of roof and wall vents. This was found to be the case in most of the industries. Local exhaust ventilation is the only effective way of stopping harmful dust and fumes from being released into the work place. There should be exhaust ventilation at all sources of dusts and fumes, namely filling machines, mixing machines and packing areas.

All factories visited were found to have First Aid boxes and 80% of the workers had received First Aid training. This is very commendable as it shows the interest the factories have in dealing with emergencies. All the factories visited also had fire extinguishers and seven had fire escape provisions. This is important as some chemicals used in pesticide formulation may be inflammable.

Protective clothing are very important as they form the last link in personal worker protection. Whereas 95% of the workers had cotton overalls, 96% of the workers had no aprons, 26% had no gloves while 22% had no masks. For routine work, the following clothing and equipment

should be available to the worker:

1. Protective helmet or cloth cap.
2. Eye protection - safety spectacles, goggles, or face shield.
3. Dust or light fume mask.
4. One piece of work suit with closely fitting trouser bottoms.
5. Rubber or plastic gloves or gaunlets.
6. Rubber or plastic apron.
7. Work boots with protective toecaps.[19]

No factory allowed its workers to eat or smoke while at work. All factories had bath facilities, although 13% of the workers did not take showers or baths before going home. 97% of the workers changed from work clothes before going home and 80% of the workers had their work clothes washed by laundry services provided by the management. All factories visited had changing rooms and lockers.

According to the international group of National Association of Manufacturers of agrochemical products, changing and washing facilities must be provided with separate lockers for personal and work clothes. The workers should not be allowed to go home wearing the same clothes they wore while at work. The group also insists that the management set aside a separate "clean" area for eating, drinking and smoking and also make provision for

the regular and frequent washing of dirty clothings either by the plant's own facilities of by those of an approved contract service.(20)

Eleven (11) out of the ninety one (91) workers had been hospitalized once since they started working in the pesticide industry. Among the diseases they were hospitalized for included anaemia, chemical burns, pnemonia and pesticide poisoning. Although the number of employees hospitalized is small most of them were hospitalized as a result of acute short term exposure to pesticides. The effects of chronic exposure take long to manifest themselves and at times, it may be difficult to relate the effects to exposure to pesticides.

Among the workers who handle copper compounds, 50% had complains related to the respiratory system, the skin and central nervous system. All the complaints are to be expected from acute exposure to Copper Compounds (Appendix 3). The only exception was epistaxis. However, this can be explained by the fact that Copper Compounds cause irritation of the mucous membranes in the nasal cavity.

Sevin, a carbamate classified by WHO as being moderately hazadous was found to cause headache, epistaxis, running nose, dizziness, diarrhoe, vomiting and coughing. These are mainly effects of acute exposure to Sevin.(2) Chronic exposure to Sevin can lead to carcinogenesis,

central nervous system lesions, heart defects, muscle weakness and renal damage.

Mangozep, a combination of maneb and zinc classified by the WHO as being slightly hazardous, was found to cause skin and eye irritation in 50% of the workers who handle it. The Royal Society of Chemistry advises formulators to avoid its contact with the eyes, skin and respiratory tract mucous membrane.[22]

Daconil (chlorothalonil) was found to cause itching of the skin, skin rashes, desquamation of the skin and itching of eyes in 68% of the workers who handle it. This concurs with the reported effects of acute exposure to Daconil.[23] Among the suspected effects of Daconil include ataxia, carcinogenesis, growth suppression, prenatal and postnatal damage and renal damage.

Furadan (carbofuran), a carbamate was found to cause headaches, dizziness, nausea, vomiting and increased sleep in 25% of the workers who handle it. This, according to Matsumura are some of the early symptoms of Carbofuran poisoning.[24] Later, symptoms include constriction of the pupils, blurred vision, abdominal cramps and vomiting.

Captafol which is in the chloro Alkyl Thios class of active ingredients was found to cause dizziness, headache, itching and rashes of the skin, epistaxis and eye irrita-

tion. Dermal irritation is one of the effects of chronic exposure to Captafol.[25] The rest are effects of acute exposure.

Dieldrin was found to cause visual disturbance, eye irritation, and headaches in some of the exposed workers. These a some of the early signs of Dieldrin poisoning. Chronic exposure effects include renal degeneration, mutagenesis and mental changes.

Gramoxone (paraquat) was found to cause nasal stuffness, epistaxis, skin irritation and desquamation in some of the workers, and in one worker, loss of finger nails. These are the effects of short term exposure to Paraquat. Long term exposure can lead to pulmonary fibrosis, adrenal necrosis, myocarditis, convulsions and hypertension.

Some of the workers who handle organophosphates complained of stomach upsets, severe headaches, nasal stuffness and skin irritation. The organophosphate pesticide involved include malathion, delnav, dimethoate and sumithion. There were very few complaints about malathion. Chronic exposure to organophosphates may lead to frontal lobe impairment and other neurological deficits.

Pyrethroids have very few side effects which are mainly related to the upper respiratory tract. However, they may cause an allergic reaction. A full list of the effects of the pesticide dealt with is given in the Appendix 3.

Thirty one workers out of the ninety one workers interviewed have sought medical assistance for the problems they experienced when dealing with pesticides, with most of them having sought medical assistance more than once. Twenty percent of the workers interviewed did not get any medical check-ups on a routine basis. The rest got at least one medical check-up at least once a year. Two factories had retained the services of doctors so that when the workers got sick, they went to see these particular doctors. The rest of the workers in other factories had no medical supervision. Eighty percent of the workers have their blood samples taken for analysis of the enzyme Acetyl Cholinesterase.

5.2 Conclusion

Chemical formulae for pesticides have been found on papyrus dating 1500 A.C. Homer, a poet, advocates the burning of sulphur for fumigation in 1000 B.C. Since then, pesticides have been very useful to man in ensuring adequate food for an ever increasing population. Pesticides have, however, emerged as a very serious problem. In the developed world, this is due to pesticide residues. In the third world, the issue is pesticide poisoning, especially among the agricultural workers. The world should move away from chemical pesticides to integrated pest management which is both cheaper and safe.

5.3. Recommendations

1. The Factory Inspectorate should ensure that the buildings are well designed before approval, especially in respect to ventilation. Frequent checks on exhaust ventilation and fire equipment should also be made. The Inspectorate should also make use of air sampling machines.

2. The Factory management should be strict about protective clothing. It was observed that in factories where the management was strict, all the workers wore protective clothing. The management should have a training programme for newly recruited employees, especially the ones with low education.

3. A first medical check-up and continuous medical evaluation of each worker with medical records being kept should be a priority in all pesticide firms. This may be the only way one might find out about effects of chronic exposure to pesticide. This is a protective measure both to the employer and to the employee. Cholinesterase surveillance of the workers should be done on routine basis.

Persons who work regularly with hazardous pesticides should come under regular medical supervision services. This should be done in order:

a. To prevent injury or illness from exposure to chemicals.

b. To detect any potentially ill effects early by periodic examination and tests including blood and urine sample analysis.[26]

It is only by continuous medical monitoring that some of the ill effects of pesticides can be detected early and remedial measures taken. Some pesticide firms do not seem to take this seriously. It is an issue that will have far reaching effects on them in future by way of litigations. This and the issue of casual workers make it very difficult for any information on workers' health to be compiled on a continous basis. Awareness should thus be created among the factory management about the hazards of pesticides.

Aggressive trade unions may have a role to play in ensuring the protection of the workers in the pesticide industry.

4. This issue of casual labourers should be looked at comprehensively with a view of finding a lasting solution. They are at present a group that is impossible to monitor.

5. Other methods of pest control should be explored and given priority.

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APPENDIX 1

List of Factories Visited

1. Farmchem
2. Saroc
3. Orbit Chemicals
4. Twiga Chemicals
5. Rhone Poulenc
6. Dera Chemicals
7. Johnsons Wax
8. Nova Chemicals

WHO RECOMENDED CLASSIFICATION OF PESTICIDES BY HAZARD

This classification differentiates the more and the less hazardous pesticides. Depending on their toxicity to test animals, pesticides are put in one of four categories or classes.

LD_{50}(mg/kg) is the lethal dose of poison in milligrams needed per kilogram of animal body weight to kill about 50% of a large population of test animals (usually rats and easily available). Oral and dermal refer to the method of application of the poison 'solids' and 'liquids' refer to the physical state of the product or formulation being classified.

LD_{50} for rats (mg/kg body wt)

		ORAL		DERMAL	
CLASS		SOLIDS	LIQUIDS	SOLIDS	LIQUIDS
i(a)	Extremely Hazardous	5 or less	20 or less	10 or less	40 or less
i(b)	Highly Hazardous	5 - 50	20 - 200	10 - 100	40 - 400
ii	Moderately Hazardous	50-500	200-2000	100-1000	400-4000
iii	Slightly Hazardous	over 500	over 2000	over 1000	over 4000

It should be noted that controversy exists as to the value of LD_{50} data. Many experts feel that the LD_{50} test is not a true indication of toxicity, especially when extrapolated from rats to human examples.

	CLASS
Aldicarb	IA
Carbyl	II
DDT	II
Dimethoate	II
Fenitrothion	II
Malathion	III
Paraquat	II

[27.27]

TYPES OF PESTICIDES, USE AND THE HEALTH EFFECTS

TYPE OF PESTICIDE	USES	EFFECTS OF ACUTE EXPOSURE	SUSPECTED EFFECTS
a) PARAQUAT (GRAMOXONE)	Herbicide	Dehydration, skin irritation, skin discoloration, finger nail softening and loss, haematemesis, epistaxis, brain haemorrhage, lung irritation, chest pains, cough, pulmonary oedema, pulmonary haemorrhage, death is usually due to respiratory failure Effects of chronic exposure Abdominal pains and cramps, adrenal necrosis, anorexia, convulsions, pulmonary fibrosis, E.C.G. abnormalities, hypotesnion, conjuctivitis and corneal opacities, myocarditis, peripheral nervous degeneration, rhinorrhea, splenic enlargement	Reproductive system defects Ataxia Weight loss Hyperexcitability Mutagenesis Postnatal damage Prenatal damage
b) DACONIL (CHLOROTHALONIL)	Used against many plants pathogens attacking vegetables and crops	Dermatitis Eye irritation	Ataxia, carcinogenesis, renal hypertrophy and nephritis, growth suppression, postnatal and prenatal damage, dermal sensitization

TYPE OF PESTICIDE	USES	EFFECTS OF EXPOSURE	SUSPECTED EFFECTS
		Early Signs of Poisoning	
c) FURADAN (CABOFURAN) (Highly toxic)	Insecticide Ascaricide Nematicide	Weakness, nausea and light headache Late Signs of Poisoning Constriction of pupils, blurred vision, abdominal cramps, increased salivation, perspiration, vomiting.	-
D) DIELDRIN (an organo-chlorine)	Ascaricide Insecticide	Effects of Acute Exposure Acidosis, abdominal pain, agranulocytosis, ataxia, abnormal behaviour, convulsions, bradycardia/tachycardia/arrhythymias coma, delirium, dermatitis, facial congestion, gastro-enteritis, headache, hepatic injury, hyperthermia, insomia, leucocytosis, muscle spasms, nausea, pallor, paresis, parasthesia, renal injury, cough, dyspnoea, pulmonary oedema, salivation, sweating, thrombocytopenia, vomiting, weakness, respiratory depression. Chronic Exposure Effects Abdominal pains, anorexia, weigh loss, chest pains, nystagmus, hepatic insufficiency, hormonal distubances, incoordination, insomnia, joint pains, mental changes, mutagenesis, paralysis, paresis, splenomegaly, weakness, tremors, renal degeneration and myocardial irritability.	Carcinogesis Reproductive system defects

TYPE OF PESTICIDE	USES
e) MANGOZEP (combination of zinc salt and maneb) WHO class III	Protective fungicide on potatoes and tomatoes
f) CAPTAFOL (class of chloroakyl-thios)	Non-systemic fungicide used to control foliage and fruit diseases of tomatoes, potatoes blight and coffee berry disease

EFFECTS OF EXPOSURE

Effects of Acute Exposure

Eye Irritation,
skin irriration, respiratory
tract mucous membrane
irrıtation

SUSPECTED EFFECTS

Effects of Acute Exposure

Adipsia, anaemia, anorexia,
weight loss, cholinesterase
activity depression, dermal
irritation and rashes, eye
irritation, conjuctivitis,
haematuria, liver injury,
hypertension, hypothermia,

irritability, listlessness,
prostration, proteinuria,
urobilinogen in blood and
urine, bronchitis.

Carcinogenesis
Mutagensis
Dermatitis
Prenatal damage

Effects of Chronic Exposure

Dermal irritation
Weight loss

TYPE OF PESTICIDES	USES	EFFECTS OF EXPOSURE	SUSPECTED EFFECTS
		Effects of Acute Exposure	
g) Pyrethroids	Insecticide	Ataxia, muscle fibrillation, paralysis, tinnitus, tremors, vomiting, dermatitis, oedema, pulmonary collapse, diarrhoea, dyspnoea, allergic reactions leading to anaphylaxis, bronchospasm, oesinophilia, fever, hypersensitivity, pneumonia, dyspnoea, pallor, sweating, tachycardia and facial oedema	
h) Triatox (Amitraz)	Ascaricide Fungicide Insecticide	Effects of Acute Exposure Abdominal pains, anorexia, fever, backache, cystitis, neuromascular disorders, prostagladins depression, rashes, haematuria. Effects of Chronic Exposure Bladder irritation, heat intorelance, muscle weakness, increased sleep, rashes on arms and face.	Carcinogenesis Mutagenesis

	TYPE OF PESTICIDE	USES
i)	SEVIN (CARBARYL) -Moderately hazardous	Fungicide Herbicide Insecticide Molluscide Nematicide

EFFECTS OF EXPOSURE

Effects of Acute Exposure

Abdominal cramps, Aphasia, Bradycardia, Ataxia, Cyanosis Cholinesterase inhibition, convulsions, coma, dermal irritation, diarrhoea, epigastric pain, headache, dizzyness, and disorientation, blurred vision, eye pain, hypertension, lassitude, urinary incontinence, muscle twitching, cough, chestpain, dyspnoea, pulmonary oedema, broncho consctriction, sweating, tachycardia, and tremors.

Effects of Chronic Exposure

Anorexia, cholinesterase inhibition, muscle wasting, renal damage leading to albuminuria and crystalluria.

SUSPECTED EFFECTS

Prenatal Damage Reproductive system defects, carcinogenesi mutagenesis, CNS defec heart lesions, decreas immunity, paraplegia, prostation, kidney damage, and vasogenic shock.

TYPE OF PESTICIDE	USES
j) COPPER COMPOUNDS Example Copper Sulphate	Algicide Fungicide Insecticide Molluscide

EFFECTS OF EXPOSURE

SUSPECTED EFFECTS

Effects of Acute Exposure

Anaemia, brain damage capillary damage, hyper excitability, convulsions and coma, muscle, spasms, tachycardia, copper in blood and urine, itching of the skin, green discoloration of the skin, skin necrosis, dermatitis, keratinization of hands and feet, eye irritation, conjuctivitis, corneal trubidity and ulcers, hepatomegally, contrilobular necrosis, fibrosis and granuloma formation in the liver, cough and sneezing, renal tubular necrosis, renal degeneration, hypotension, leukocytosis, haemolysis, shock, metal fume, fever, nausea, vomiting paralysis and metallic taste in the mouth.

Carcinogenesis mutagenesis, liver cirrhosis, pulmonary fibrosis portal hypertensio prenatal damage, reproductive system defects.

Effects of Chronic Exposure

Anorexia, chills, dermatitis and skin necrosis, conjuctivitis, corneal ulceration, cough, pneumoconiosis, fever, gastritis, hepatic damage, hypersensitivity, decreased immunity, joint pains, muscle pains, weakness and weight loss.

TYPE OF PESTICIDE	USES
ORGANOPHOSPHATES such as Delnav Dimethoate Malathion Parathion Fenitrothion	Ascaricide Fungicide Herbicide Insecticide Nematicide Rodenticide

EFFECTS OF EXPOSURE

SUSPECTED EFFECTS

Effects of Acute Exposure

Acidosis, anorexia, aphasia areflexia, ataxia, bradycardia/ tachycardia, heartblock, acetyl-cholinesterase, inhibition, CNS impairment, coma, confusion, convulsions, cyanosis, dermatitis, diarrhoea, dizzyness, vertigo, miosis/mydriasis, ocular pain, cataracts, hallucinations, headache, liver damage, hyperglycaemia, hyper-tension, hyperthermia, leucopenia, muscle atrophy, paresis, psychosis, renal damage, apnea, dyspnea, atelectasis, bronchoconstriction, cough, rales, rhonchi, pulmonary oedema, larynogeal spasms, shock, somnolence, insomnia, sweating, vomiting, weakness.

Effects of Chronic Exposure

Same as in acute exposure but with frontal lobe impairment.

APPENDIX FOUR

QUESTIONNAIRE

1. Name of formulating plant/industry .....

2. Number of workers who handle pesticides .....

3. Name of worker .....

4. Age in years .....

5. Sex .....

6. Marital Status: Single .....Married .....

   Divorced/Separated .....

7. Level of formal education (years).....

8. Did you get any occupation or professional training? .....

9. Job category .....

10. Which type of work do you do? .....

11. How many years have you worked in this plant? .....

    0-2 3-5 6-8 9-10 10 years

    Do you usually do this particular job?

    If no, what other job do you usually do?

    Describe.

12. Have you worked in any other pesticide formulating plant?

Yes No

13. Pesticide currently being formulated:

Type
- Organophosphate
- Organochlorine Pyrethroids
- Carbamate
- Others (specify)

State
- Solid
- Liquid
- Powder

EMPLOYEES WORK PRACTICES

1. Is worker wearing overall: Yes No

2. Is worker wearing an apron: Yes No

If yes, cotton Rubber/Plastic

3. Is worker wearing gloves: Yes No

Can you see any sign of

chemical spillage above

gloves on unprotected area: Yes No

4. If worker is not using gloves, why not? Explain.

Mask/Respirator: Is one supplied Yes No

If yes, is worker using it: Yes No

5. Is smoking at work allowed: Yes No

Is worker smoking while at work: Yes No

6. Is eating at/in work place allowed: Yes No

Where do the workers go for lunch: Yes No

Others (specify)

7. Are there shower/bath facilities at the plant Yes No

8. Did you take a bath/shower yesterday before going home: Yes No

9. Do you change from work clothes before you go home: Yes No

3. Do you ever experience the following when working with pesticides:

Central Nervous System

Headache	Nose bleeding
Dizzyness	Confusion
Restlessness	Muscle paralysis
Undue anxiety	Muscle twitching

GIT

Diarrhoea	Sneezing
Coughing	Difficulty in breathing

SKIN

Itching	Scratching
Darkening of the skin	Lighting of the skin
Burns	Others (specify)

EYES

Itching	Weeping
Redness	Others(specify)

Which pesticide was worker dealing with when they had above symptoms:

Has worker ever sought medical treatment for the above:

If yes, how many times:

Do you get medical check-ups:

If yes, how often:

Is your blood sample taken: Yes No

When was it last taken:

WOMEN

How long have you been working here:

Do you work when pregnant: Yes No

How many children do you have:

WORKING SPACE/FACTORY/PLANT

1. Ventilation: Adequate Inadequate

   Describe

2. Exhaust ventilation/hood extractors: Present Absent

   If present, is it working: Yes No

3. Warnings about handling of chemicals

   in writing Present Absent

   First Aid Box: Present Absent

4. Did you receive any First Aid Training: Yes No

5. Floor Status: Clean Dirty Wet

6. Smoke Dectors: Present Absent

7. Air Sampling done: Yes No

8. Fire Extinguishers: Present Absent

9. Fire escape provision: Present Absent

10. Do you go home with your work

    clothes: Yes No

11. How often are your work clothes

    washed (number of times/weeks):

12. Who washes your work clothes:

13. Do you have changing room: Yes No

14. Do you have lockers: Yes No

MEDICAL HISTORY

1. Have you ever been hospitalized since you started working here: Yes No

If yes, how many times:

Which diseases were you hospitalized for:

What were you complaining of when you were hospitalized:

For how long were you in hospital:

2. Is there any medical problem that you have developed since you began working here (specify disease or symptoms)

3. Do you ever experience the following when working with pesticides:

Central Nervous System

Headache	Nose bleeding
Dizzyness	Confusion
Restlessness	Muscle paralysis
Undue anxiety	Muscle twitching

GIT

Diarrhoea	Sneezing
Coughing	Difficulty in breathing

SKIN

Itching	Scratching
Darkening of the skin	Lighting of the skin
Burns	Others (specify)

EYES

Itching	Weeping
Redness	Others(specify)

Which pesticide was worker dealing with when they had above symptoms:

Has worker ever sought medical treatment for the above:

If yes, how many times:

Do you get medical check-ups:

If yes, how often:

Is your blood sample taken: Yes No

When was it last taken:

WOMEN

How long have you been working here:

Do you work when pregnant: Yes No

How many children do you have: