FACTORS INFLUENCING AWAERENESS OF CLEANER PRODUCTION IN INDUSTRIES.

CASE STUDY OF NAKAWA DIVISION, KAMPALA DISTRICT, UGANDA

BY

MUHANJI. S. REUBEN

BEM/3693/32/DF

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT
FOR A BACHELOR'S OF SCIENCE HONOUR
IN ENVIRONMENTAL MANAGEMENT
OF KAMPALA INTERNATIONAL
UNIVERSITY.

NOVEMBER 2007.

DECLARATION

I, MUHANJI. S. REUBEN do here declare that this research is my own presentation and that to the best of my knowledge, this piece of work has never been presented to any institution for any award. It is my own original work done solely by me with the guidance of my supervisor.

Signature..... Date...16TH OCTOBER, 2008.....
Name: MUHANJI. S. REUBEN

Signature..... Date...17/10/2008.....
Supervisor: MS. ABONGO ELIZABETH
Lecturer, Kampala International University
Faculty of Social Sciences

DEDICATION

This piece of work is dedicated to my parents MAJOR (RTD) MUHANJI and ERIKA HASTIE who sacrificed a lot to get me where I am today and whose role in my academic struggle remains unchallenged.

'MAY THE ALMIGHTY FATHER ABOVE SHINE HIS FAVOR UPON YOU.'

ACKNOWGEMENT

I am very grateful to acknowledge the advice, support, guidance and encouragement extended to me by several individuals during the compilation of this research.

A great deal of thanks and appreciation goes to my supervisor Ms. Abongo Elizabeth for her guidance and support. Dc. Twaha Ali Basamba for disseminating the knowledge of research methods that was required for the specified study. I very much appreciate their contributions.

I will not forget to appreciate the work done by the staff of Environment department especially my course coordinator Ms. Anne Tumushabe and the other lecturers for their hard work in building my university career.

I wholeheartedly wish to express my gratitude to my father who has worked so hard to see me through to this phase. Special thanks go to my friend Shamsia Manu for the support that she accorded me through my life up to now.

I will not forget to extend a word of appreciation such as Philip, Mbuthia, Kehika among others for all the kind advice and companionship. They have molded me into what and who I am now.

Above all, I thank God the almighty for his continued grace and mercy which endures forever.

LIST OF ACRONYMS

BOD	Biochemical Oxygen Demand
CFL	Compact Fluorescent Lamps
COD	Chemical Oxygen Demand
CP	Cleaner Production
EPS	Environmental Priority Strategies
EST	Environmentally Sound Technologies
ILO	International Labour Organization
NAPE	National Association of Professional Environmentalists
NCPCs	National Cleaner Production Centres
NEMA	National Environment Management Authority
NGOs	Non Government Organizations
PPC	Pollution Prevention Centres
SCP	Sustainable Consumption and Production
UCPC	Uganda Cleaner Production Centre
UEPF	Uganda Environmental Protection Forum
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WBCSD	World Business Council for Sustainable Development
WEC	World Environment Centre

ABSTRACT

The study was carried out to investigate the factors influencing awareness and adoption of cleaner production in processing and manufacturing industries: a case study of Nakawa division, Kampala district.

The objectives of the study were to examine the methods of cleaner production employed in industries, to find out the benefits brought by cleaner production to the industry, to determine the factors influencing awareness and adoption .of cleaner production in processing and manufacturing industries and to suggest possible measures that can be used to improve on the awareness and adoption of cleaner production in industries.

In investigating the above, the study used a general survey design employing both primary and secondary methods of data collection. The study population comprised of officials in the department of occupational safety and health in the ministry of gender, labour and social development, an official from NEMA, officials from UCPC and the people employed in industries. The study had 60 respondents who were sampled randomly and purposively; they consisted of skilled worker's casual labourers and managers of processing and manufacturing industries.

Data collected was analyzed qualitatively. According to study findings, the methods of cleaner production employed in Ngege Fish Industry Ltd. Uganda Fish Packers Ltd and Uganda Batteries Ltd include, input substitution, technology modification, good house keeping and onsite recycling.

The benefits of cleaner production as revealed by the study include: reduction in water consumption, energy consumption, gaseous emissions and reduction in generation of solid wastes and effluent, then general improvement in occupational health and safety.

The findings further revealed the factors influencing awareness and adoption of cleaner production which include, lack of technical skills and knowledge, lack of education and training, poor management, inadequate support staff, inflexible company culture and general resistance to change, financial limitations and poor policy framework. Basing on the findings of the study, the researcher made some recommendations among others: creating awareness of cleaner production in industries, improving on the management, strengthening of policy framework and implementation.

TABLE OF CONTENTS

CHAPTER THREE

CHAPTER FOUR

LIST OF TABLES

LIST OF FIGURES

LIST OF GRAPHS

LIST OF MAPS

CHAPTER ONE

1.0 INTRODUCTION

According to UNEP (1996), cleaner production is defined as, the continuous application of an integrated preventive environmental strategy to processes, products and services to increase overall efficiency and reduce risks to humans and the environment. Cleaner Production can be applied to the process used in any industry, to products themselves and to various services provided in society.

The International Declaration relative to cleaner production which was adopted at the fifth International High level seminar held in South Korea in autumn, 1998, defined Cleaner production as the continuous application of an integrated, preventive strategy applied to processes, products and service in pursuit of economic, social, health, safety and environmental benefits. This shows us that cleaner production include not only the improvement in the production process, but also various categories in a wide range. UNEP is attempting to disseminate the concepts and concrete technologies of cleaner production much further on the opportunity of this international declaration adoption.

Cleaner production is a comprehensive continuous approach, which deals with those challenges that industries face today. It enables businesses to maximize economic gains while at the same minimizing negative environmental impacts.

Cleaner production has six major principles, which include:

- Aiming to avoid the generation of waste at each stage of the production or service process.
- Conservation of raw materials, water and energy through improved process efficiency.
- Substitution of toxic and dangerous materials for example raw materials, house keeping or cleaning reagents.
- Reduction of the level of toxicity of all emissions and effluents at the source during production.
- To recover, recycle and re-use by-products and wastes as much as possible in order to turn wastes into profits.

- Reduction of the environmental, health and safety impacts of product over their entire life-cycles.

Cleaner production is approach to environmental management that aims to improve the environmental performance of products, processes and services by focusing on the causes of environmental problems rather than the symptoms. In this way, it is different to the traditional pollution control approach to environmental management where pollution control is an after-the-event react and treat approach, cleaner production reflects a proactive, anticipate and prevent philosophy.

ENVIRONMENTAL AWARENESS AMONG INDUSTRIALISTS

ILO has been working closely with the Employers Federation, Trade Union Federations, the export promotion bureau, Chamber of Commerce and Industry, the manufacturing association and exporters association which have, over the last three years, contributed $2.5million to support the implementation of its global compact principles on labor standards. ILO is also working with workers and employers organizations to provide vocational training programmes in all over the world and under the platform of skill development councils.

UNIDO, in collaboration with the Ministry of Environment, Green Earth and with the financial commitment, launched a joint campaign for promoting awareness on recycling issues and investment potential on this sector. Benefits of this initiative are multi-told. It improved the overall living and working conditions of its population in various areas in Pakistan. This project also increased environmental awareness among the population and created environmentally sustainable industrial development, while developing a state of art affluent collection system and cost-effective common primary treatment facility.

Greater awareness has been created among the industries and their employees about benefits of establishing industrial green belts. With advisory services now available, industrialists have an opportunity to green their surroundings in order to conserve the environments.

About 3000 industrialists from JTC industrial estates attended a 3day green seminar cum exhibition which was held at the JTC summit in March 2002 which was jointly organized by JTC cooperation and the Ministry of Environment, the green event titled "Towards environmental sustainability industries can play a part" aims to raise awareness in the industrial sector on the importance of waste minimization, recycling and energy conservation (limes 2002).

Although pollution prevention as an alternative way of promoting pollution control has taken great strikes in the developed countries particularly in the Europe and US this concept is still new and slowly merging in developing countries with Uganda inclusive.

CLEANER PRODUCTION IN PROCESSING AND MANUFACTURING INDUSTRIES

UNIDO, (1994) has facilitated establishment of a national cleaner production center for fuels to tackle pollution issues in the fuel sector. This initiative the first of its kind in developing countries aims at introducing cleaner production technologies and cleaner products and shall be expanded to other sectors and including textile and leather.

A full-scale project leading to self-sustaining cooperation has been formulated in coordination with the ministry of petroleum, ministry of environment, the private sector and potential donors.

Environmental protection is on top of the development agenda throughout the world and the biggest challenge of the 21st century is to protect the environment. Fortunately all corporate citizens have realized the need of taking the initiative not only to reduce pollution but also to improve their products through cleaner production.

The response could have been better if adequate infrastructure was available by way of technology and specialized services in environmental management. Some of the catalysts organizations providing activities in waste minimization, good house keeping, resource reduction, recycling, reuse conservation etc. are the result of several bilateral efforts.

The most common environmental concerns in manufacturing and processing industries are water consumption and waste water discharge, chemicals used in processing and

cleaning, packaging and disposal, food scraps and refuses. Energy efficiency and green house emissions are increasingly important issues as well.

Many food processing plants have low technical quality process equipment, process knowledge and operation procedures. Experience shows that it`s possible to reduce energy consumption and organic substance discharge to the wastewater by simple technical actions and improved operating procedures (Audun .A. et al 1996)

It's important that in the sense that proper cost information can convince management as well as employees that producing cleaner can make money. Unfortunately many companies' in particular small and medium size enterprises do not know how much money is wasted. Typically only costs charged by external waste contractors are taken into consideration yet actual cost can be significant the more.

Although cleaner production technologies promise controlling pollution within industries, they can only become effective if they are implemented. This means that projects should go beyond demonstration models. They need to reach a critical number of small and medium industries in a short time as possible.

LABOUR LAWS IN INDUSTRIAL SETTING

In England, parliament was averse to legislating on subjects relating to workers because of the prevailing policies of lissez-faire. The earliest factory law (1802) dealt with the health safety and morals of children employed in textiles mills and subsequent laws regulated their hours and working conditions.

By the early 20th century many states had passed laws regulating Child Labour, minimum wages and working conditions. Maryland was the first state to pass (1902) workers compensation for employees injured on the job. Occupational health and safety (common wealth employees) act 1999 secures the health safety and welfare at work of employees of the common wealth authorities and to protect the persons at or near work places from risks to health and safety arising out of the activities of such employees at work.

Work health act (1986) promotes occupational and safety of the workers in the industry to prevent work place injuries and diseases and also protect the health and safety of the public in relation to work activities and also promotes rehabilitation and maximum recovery from incapacity of injured workers.

ILO convention No. 59 fixes the minimum age of employment for industry at 15years but allows younger children to be employed in undertakings in which only members of the employers' family are employed provided that such work is not dangerous to the life, health or morals of the children employed therein.

ILO declaration adopted in 1998 stipulates fundamental principals and rights at work and it's an expression of commitment by government's employers and workers organizations to uphold basic human values that are vital to our social and economic lives.

BACKGROUND TO THE STUDY

Industries today need to remain profitable in an increasingly competitive world, while accounting for the environmental impact of their activities. This challenge requires solutions that enable companies to maximize their economic gains while taking the necessary steps to minimize the environmental degradation caused by their production processes, products and services. Cleaner production meets this dual objective.

Cleaner production has a wide spread implication at all decision-making levels in industries, with the chief focus on adoption of cleaner technologies and techniques within the industrial sector. Costly end-of-pipe pollution control systems are gradually replaced with a strategy that reduces and avoids pollution and waste throughout the entire production cycle, from efficient use of raw materials, energy and water to the final product (UNEP 1996)

Technologies of air pollution, water pollution and waste treatment were called end of pipe technology because they disposed off pollutants at an outlet. Against that, in Agenda 21 adopted by United Nations conference on environment and Development (Global Summit in 1992) cleaner production was suggested to progress. Cleaner production includes not only the conventional technologies for each measure (Hard technology), but

the technologies by manageable methods (Soft technology), based on the idea of reducing the environmental burden in every process from extracting of raw materials to disposal of products and reuse. Currently, the collection and dissemination of the technology information are regarded as an international subject and the technology is being promoted in each country.

In Uganda, the establishment of a centre started in October 2001 and has now developed into a centre of excellence for promoting cleaner production in the country. The programmes aim at building national cleaner production capacities, fostering dialogue between industry and government and enhancing investments for transfer and development of environmentally sound technologies.
Many stakeholders in Uganda have made a series of inquiries whether cleaner production is only being applied in Uganda, but Uganda cleaner production centre (UCPC) now includes a section of cleaner production as an international concept.

Promoting the concept of cleaner production and its benefits to Uganda's business community is very important. The targeted business community would be industrialists, industrial associations, consultants, government, the financial institutions, higher education and NGOs. In-plant demonstrations form an important element showing the successful application of cleaner production options in various industrial situations.

1.2 STATEMENT OF THE PROBLEM

The rate at which industries are up coming is on the increase in the recent past. The conservation of raw materials, water and energy, eliminating toxic and dangerous raw materials and reducing the quantity and toxicity of all emissions and wastes at source during production process has become the major concern of the public and most especially environmentalists. This therefore calls for the increase on the level of awareness of cleaner production mostly among the industrialists in order to achieve sustainable development.

Cleaner production in processing and manufacturing industries in Uganda have not received much attention as a result of a number of reasons i.e. Inadequate legal provisions

and system of enforcement and inspection, lack of support in terms of finances, limited training of employees and employers on cleaner production especially on the conservation of inputs such as energy, water and raw materials.

However, no attempts have so far been put in place by industrialists in the processing sector to improve on the awareness of cleaner production despite the rapid expansion of the processing and manufacturing industries. There is a need therefore is to find out the factors influencing awareness of cleaner production with a case of Nakawa division which has the highest number of industries in Kampala district.

1.3 OBJECTIVES OF THE STUDY

1.3.1 GENERAL OBJECTIVE

The overall objective of the study is to asses the factors influencing the awareness of cleaner production in industries in Nakawa division, Kampala district.

1.3.2 SPECIFIC OBJECTIVES

i. To identify methods of cleaner production employed by industries in Nakawa division

ii. To find out the role of cleaner production to the benefit of industries in Nakawa division.

iii. To determine the factors influencing the awareness of cleaner production in industries in Nakawa division.

iv. To suggest solutions to improve the level of cleaner production in industries in Nakawa division.

1.4 RESEARCH QUESTIONS

i. Which methods are employed in order to ensure cleaner production in the industry?

ii. What are the benefits of cleaner production to the industry in terms socio-economic, ecological and environmental compliance?

iii. What are the factors influencing the awareness and adoption of cleaner production in industries in Nakawa division?

iv. What measures have been put in place to promote the level of awareness of cleaner production in the industries in Nakawa division?

v. What should be done to improve upon the level of awareness of cleaner production in the industries in Nakawa division?

1.5 SIGNIFICANCE OF THE STUDY

In Uganda especially Kampala district which has a number of industries ranging from small scale to large scale, cleaner production is not taken seriously because the industrialists are ignorant about the benefits. Therefore the outcome of this study is expected to be useful in appreciating the appropriate factors that influence the level of awareness of cleaner production in industries that should be adopted by industrialists in order to improve on the quality of the environment, raw materials and products used and discharged from industries. This study will show the benefits and the solutions to improve on the level of cleaner production in industries and this will make possible for the government as well as the investors operating industries to concentrate on reducing the weakness and finally take the idea of cleaner production seriously.

The study will also prove useful to other researchers, as it will add on the available knowledge on the subject and this will act as a basis for future reference. This will

activate further be of assistance to policy makers as they formulate and evaluate appropriate policies for the benefit of the environment and industrial sector.

1.6 SCOPE OF THE STUDY

The research will be carried out in Nakawa division. It will be confined to sample of industries such as fish processing, beef processing, battery manufacturing in Nakawa division. The priority areas will be water utilization, energy saving, raw materials, waste management and occupational health and safety. It will also include the measures that have been carried out to promote cleaner production and suggest recommendations on how the level of cleaner production can be improved to make industrialists better promoters of environmental management and conservation.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 GENERAL CONCEPTS ON CLEANER PRODUCTION

Cleaner production is mostly applied to production process by bringing about conservation of resources, the elimination of toxic raw materials and the reduction of wastes and emissions. However it can also be applied throughout the life cycle of a product, from initial design phase through to the consumption and disposal phase. Techniques for implementing cleaner production include improved house keeping practices, process optimization, raw material substitution, new technology and new product design.

The idea of cleaner production is promoted around the world by the United Nations, which supports hundreds of programs and projects on sustainable business. The UN has produced a status report on cleaner production implementation worldwide, with extensive details.

Analysis of the efforts during the last decade demonstrates a clear evolution in the general attitude of governments and industry regarding protection of the environment in a positive sense. This is perhaps due to the development of win-win strategies, such as cleaner production.

Cleaner production therefore describes a preventive approach to environmental management. It is neither a legal nor a scientific definition to be dissected, analyzed or subjected to theoretical disputes. It is a broad term that encompasses what some countries call eco-efficiency, waste minimization, pollution prevention or green productivity, but it also includes something extra.

2.2 METHODS OF CLEANER PRODUCTION EMPLOYED IN THE INDUSTRIES

Rabobank (1998) noted that in developed countries, many industries have not waited for government advice or assistance but have preferred instead to clean up their production methods as a voluntary response to a situation that was both environmentally untenable and financially wasteful.

UNEP (2002) stated that technology changes are oriented towards process and equipment modifications to reduce waste and emissions, preliminary in a production setting. UNEP further noted that technology changes can range from minor changes that can be implemented in a matter of days at low cost, to the replacement of process involving large capital costs which include the following,

- Changes in the production process.
- Modification of equipment, layout, or piping.
- Use of automation.
- Changes in process conditions, such as flow rates, temperatures, pressures and residence times.

UNIDO (1994), stated that good housekeeping also referred to as good operating practices, imply procedural, administrative, or institutional measures that a company uses to minimize waste and emissions. Many of these measures are used in industry largely as efficiency improvements and good management practices. Good operating practices can often be implemented with little cost. These practices can be implemented in all areas of the plant, including production, maintenance operations and in ray material and product storage.

UNEP (2002), explained good operating practices as the following;

Management and personnel practices: includes employee training, incentives and bonuses, and other programmes that encourage employees to conscientiously strive to reduce waste and emissions.

Material handling and inventory practices: includes programmes to reduce loss of input materials due to miss handling, expired shelf life of time-sensitive materials and proper storage conditions.

Loss prevention minimizes wastes and emissions by avoiding leaks from equipment and spills.

Waste segregation: these practices reduce the volume of hazardous wastes by preventing the mixing of hazardous and non-hazardous wastes for example polythene materials are separated from biodegradable and taken for recycling. .

Cost accounting practices: include programmes to allocate waste treatment and disposal costs directly to the department or groups that generates wastes and emissions, rather than charging these costs to general company overhead accounts, so these helps in assessment of benefits of cleaner production in terms of cost saving.

Production scheduling: by analyzing these factors, the departments or groups that generate wastes and emissions become more aware of the effects of their treatment and disposal practices, and have a financial incentive to minimize their wastes and emissions.

UNEP (2002), stated that changes in raw materials accomplish cleaner production by reducing or eliminating the hazardous materials that enter the production process. Also changes in input materials can be made to avoid the generation of hazardous wastes within the production process. Input material changes include material purification and material substitution. Input substitution goes as far as option for chemicals used for cleaning purposes in the industry, where by the choice for the chemicals is that they don't affect the environment once discharged for example the cleaning detergents.

2.3 BENEFITS OF CLEANER PRODUCTION TO THE INDUSTRY

World Bank (1998), stated that the important feature of cleaner production is that by preventing inefficient use of resources and avoiding unnecessary generation of wastes an industry can benefit from reduced operating costs, reduced waste treatment and disposal costs and reduced liability. Investing in cleaner production, to prevent pollution and reduce resource consumption is more cost effective than continuing to rely on increasingly expensive `end-of pipe` solutions. There have been many examples demonstrating the financial benefits of the cleaner production approach as well the environmental benefits.

Cleaner production aims to realize greater efficiencies in production through more efficient resource use, economies in processing and reduced or eliminated waste streams.

Klemes, J (2005), noted that cleaner production does not deny growth; it merely insists that growth be ecologically sustainable. It should not be considered only as environmental strategy, because it also relates to economic considerations. In this context waste is considered as a `product` with negative economic value. Each action is to reduce consumption of raw material and energy and prevent or reduce generation of waste, can increase productivity and bring financial benefits to the enterprise.

UNIDO (1994), stated that cleaner production is more than just a technical solution. It has widespread application at all decision-making levels in industry, with the chief focus on adoption of cleaner technologies and techniques within the industrial sector. Costly end-of-pipe pollution control systems are gradually replaced with a strategy that reduces and avoids pollution and waste throughout the entire production cycle, from efficient use of raw materials, energy and water to the final product.

Assessing environmental impacts for cleaner products can assist companies in their quest for continuous improvement by identifying ways to maximize profits through reducing waste and liabilities, raising productivity and demonstrating the company's sense of responsibility towards its customers and the environment.

Noyes, R (1993), stated that the system assists design engineers in the selection of environmentally preferable materials for product construction. In one such case, two technically equivalent constructions for the front end of a car, one using a plastic composite and the other galvanized steel were compared. Environmental load units were calculated for production, product use and product disposal at end of life for each material. The plastic construction proved a less favorable score because its heavier weight increased fuel consumption during product use.

Hunt, A (1993), noted that cleaner production activities include measures such as pollution prevention, source reduction and waste minimization. They involve better management and housekeeping, substitution of toxic and hazardous materials, process modifications and reuse of waste products. At its heart the concept is about the prevention, rather than the control of pollution.

Cleaner production helps in reducing the waste, the recovery of valuable by products, improved environmental performance, increased resource productivity, increased efficiency, lower energy consumption and overall reduction in costs.

Lees, F (1999), noted that cleaner production requires a structural, holistic, common sense approach using systems and people to both reduce risk and improve the triple bottom line that is, the economic, environmental and social costs and benefits. Reducing costs from wastes, emissions and environmental and health impacts can realize savings which open new markets, as well as having clear environmental benefits in industrial environ.

ANZECC (1998), stated that cleaner production provides a means by which this change of focus, from regulation to self-regulation, can be achieved, as it improves efficiency and productivity for industry while protecting the environment. Savings identified and realized through improved production process provide a solid, financial incentive for industry to internally incorporate cleaner production as a productivity tool.

Cleaner production is a win-win strategy. It protects the environment, the consumer and the worker while improving industrial efficiency, profitability and competitiveness.

2.4 FACTORS INFLUENCING THE LEVEL OF AWARENESS OF CLEANER PRODUCTION IN INDUSTRIES

Design of environment has been part of the commitment of Xerox for years. The 'Document Company' has set its environmental goal to be waste free products manufactured in waste free factories. Using 1990 as a base year, Xerox embarked on a five-year effort to create waste free factories. Operational criteria include 90% minimum reduction in solid waste to landfills, air emissions, hazardous waste and process wastewater discharges.

Dorfmann, M (1992) noted that product stewardship where by a company considers the upstream and downstream implication of its activities, is a key aspect of Xerox's programme. A number of factors have enabled the company to pursue this goal, among them making environmental considerations a product requirement and developing recycled material specifications for remanufacturing. This shift highlights the contrast between new and old systems. For instance, copy cartridges were disposable when first introduced but under various pressures, Xerox has introduced a take back system in which cartridges are taken a part and components recycled. This form of product stewardship illustrates the importance of life cycle thinking, assuming the manufacturers will share responsibility for products from cradle to grave long with suppliers, consumers and others in life cycle chain.

Extended product responsibility is an emergency concept that uses the life-cycle approach to identify strategic opportunities for cleaner production. It also highlights the crucial impact of consumer needs and preferences, the chain of production and distribution.

UNEP (1995), commented that while it is industry that implements cleaner production, governments play a crucial role in providing the environment that will encourage industry to move a head.

Chaudhary, H (1996), noted that a successful cleaner program requires commitment from senior management and all employees. A mission statement with clear cleaner production principles demonstrate the company's commitment and helps communicate to internal

ınd external stakeholders the importance of good environmental management. Vague :nvironmental policies may not produce the desired result. To be effective, the principles n the mission statement and environmental policy should be linked to guidelines and procedures at an operational level. Implementing an accountable environmental nanagement system goes along way towards meeting this latter objective.

A common problem in implementing any program is ranking tasks. Usually the ikelihood of a task being completed depends on its perceived priority. For example, a small procedural change may require only a day's work and provide the company with a quick benefit but it may be delayed because those projects requiring maximum effort are given priority. This is common but a serious problem in approach leads to a slow demonstration of results and leads to difficulties in sustaining work force commitment and motivation. Therefore, it is important to continually show results.

2.5 MEASURES TO IMPROVE ON THE LEVEL OF AWARENESS OF CLEANER PRODUCTION IN INDUSTRIES

UNEP (1994), encourages government leaders, company presidents, NGO executive directors, business association presidents and other community leaders to publicly affirm their commitment and exercise leadership in cleaner production by signing and implementing this declaration.

UNIDOs cleaner production program represents an innovative approach, which increases competitiveness, facilitates market access and strengthens the productive capacity of developing economies taking into consideration the two other dimensions of sustainable development, environmental compliance and social development.

Cleaner production can only be sustained if capacity is in place to adopt and adjust it to local conditions. To make the program a reality and promote the application of cleaner production by enterprises in developing and transition countries, UNIDO started, in 1994, to set up National cleaner production centres (NCPCs) and National cleaner production programmes (NCPPs), since then 31 NCPCs and NCPPs have been established, with others in the planning stage.

'he UNEP and the World Business Council for Sustainable Development (WBCSD) ave each been developing and promoting a similar concept of cleaner production. Both rganizations have been actively involved in the policy development of the concept and ave decided to work together to disseminate them. This new initiative combines UNEPs ublic sector interests and WBCSDs industry representation, which complement each ther.

:ompanies are starting to use environmental assessment in a systematic manner to define oals, collect data, asses impacts, control effects and ultimately communicate to its takeholders. Indeed, some companies are now requiring environmental impact ssessments as part of their product development cycle with action to mitigate findings vherever possible. The Volvo environmental priority strategies (EPS) system for nstance, assesses the impacts of products and process in terms of ecological and human ealth consequences. The results are built into a computer system that derives a omposite score of the environmental impacts of any given product design. On this basis, lternative materials and product configurations can be evaluated in an iterative process o establish an optimum design.

Kimer, A et al (1992) suggested that designers, mostly concerned with product erformance and aesthetics, must take into account the effect of design details on nergy/material requirement for manufacturing, use and secondary use (reparability, emanufacturability and recyclability). Companies should also pay closer attention to nergy use and emissions. Major improvements in energy efficiency can often be chieved at little or no cost, ever with net saving, through the use of targeted rogrammes.

n the report released in February 1996, the United States Presidents Council for Sustainable Development identifies extended product responsibility as a means to mprove the current fragmented approach to waste reduction, resource conservation and ollution prevention. This means manufacturers, suppliers, users and disposers of product nd waste streams. Ultimately the council believes that sharing responsibility for

nvironmental effects will yield a more efficient use of resources, cleaner products and echnologies, improved relations between companies or communities and responsible consumer choices.

WEC (World Environment Centre) suggested bringing an appreciation of the inherent economic value of cleaner production to selected sectors of industry by means of awareness workshops and the adoption of cleaner production principles through low-cost waste minimization demonstration projects. Existing pollution prevention centres (PPC) o be strengthened by establishing a local PPC, in a region of each country, which will help spread waste minimization to other companies in the region.

JNEP (1994), suggested building capacity at the local level is an effective way to ensure hat both public and private sectors adopt and continue cleaner production capacity building exercises entail showing the industry and government theoretical and practical sides of cleaner production which can foster changes in thinking, application and the overall framework.

WBCSD calls for co-operation, partnership or alliances between business, governments, NGOs and others to develop the economic, regulatory and political framework within which innovation is stimulated. This will allow companies to deliver more value and performance with fewer resources and less waste, and result in greater business efficiency.

CHAPTER THREE

3.0 METHODOLOGY

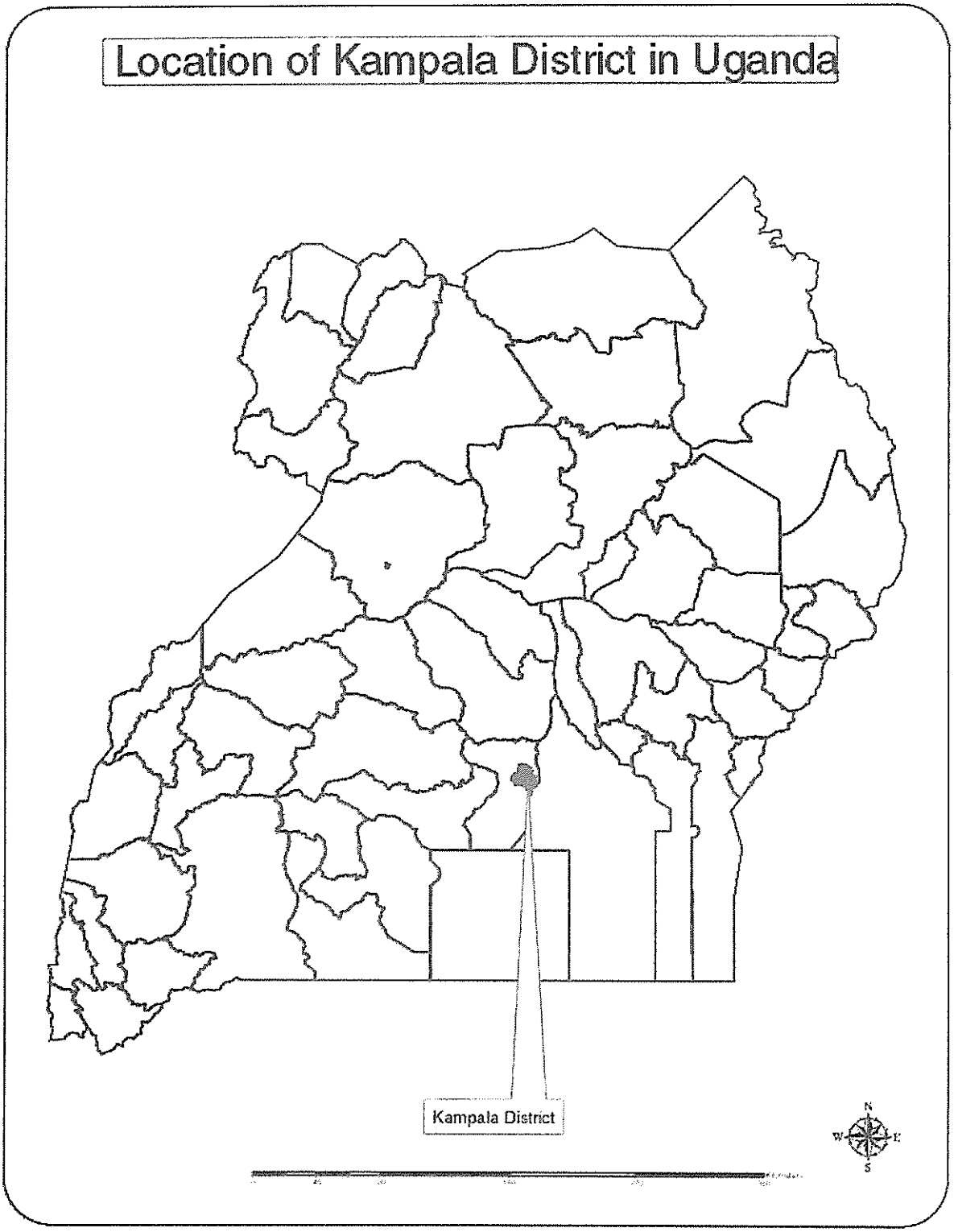
3.1 INTRODUCTION

This section provides a full description of the survey methodology and it also shows an overview of the tools, techniques and methods of analysis that were used to achieve the objectives and aims of the study.

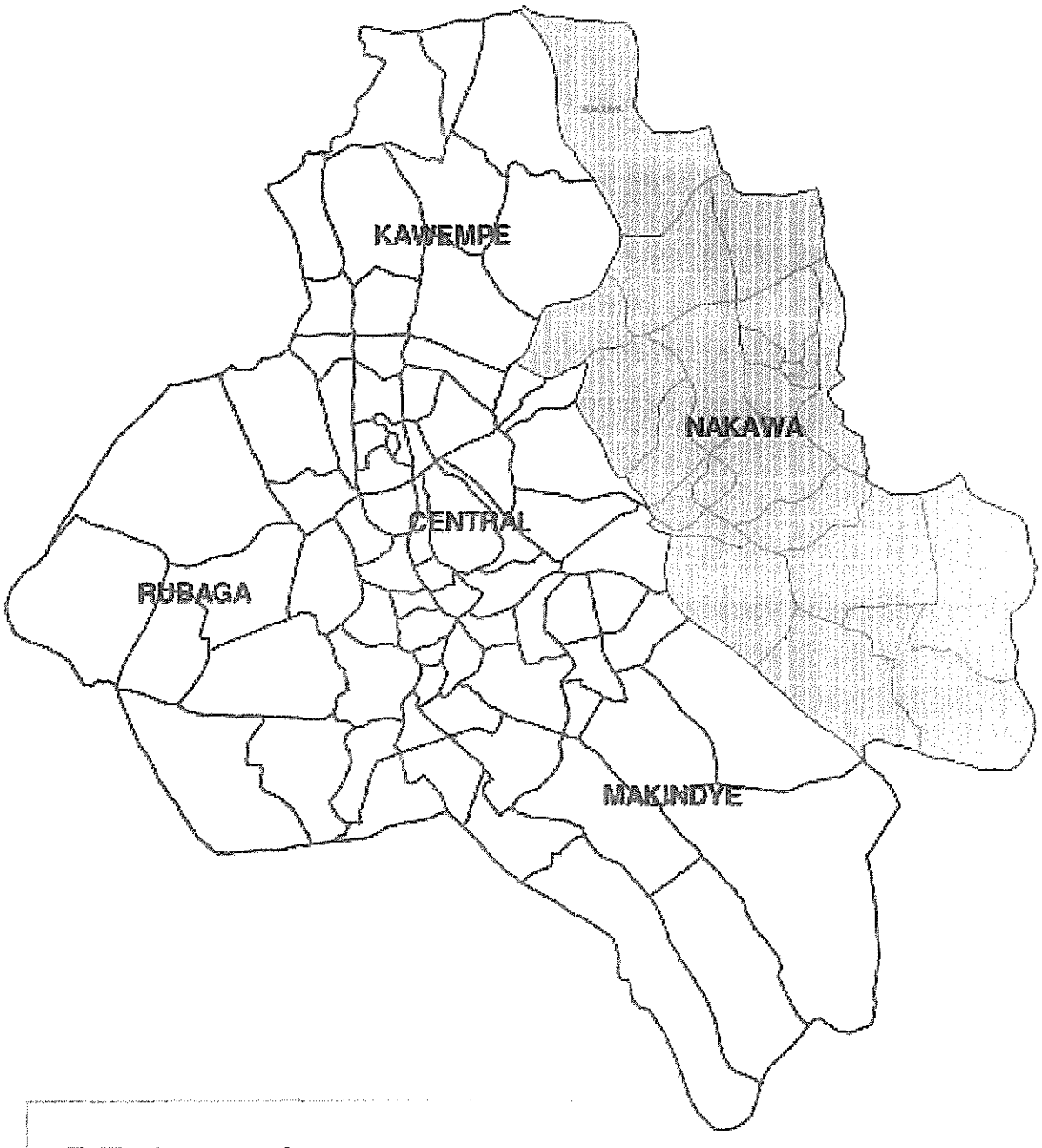
3.1.1 STUDY AREA

3.1.1.1 LOCATION AND SIZE

Nakawa Division is located in the North Eastern part of Kampala district in Uganda. It lies between longitudes 34°35' and 34°37' East of Greenwich meridian and Latitudes 0°204 and 0°26' north of the equator. It has an area of 35.28 square kilometers and is bordered by Kawempe division to the Northwest, Central division to the south west and Wakiso district to the East.


Location of Kampala District in Uganda
Kampala District
N
W
E
S

Location of Nakawa Division in Kampala District



Nakawa.shp
Administrative Boundaries

4 0 4 8 Kilometers

N

3.1.1.2 CLIMATE

The annual rainfall that ranges between 1500-2000 mm is distributed in 2 peaks, one being March to May and the other from September to November. The two are separated by short dry spells from June to July and December to January. Mean annual minimum temperatures are 15°C.

3.1.1.3 VEGETATION

The vegetation of Nakawa division is relic of the original vegetation, where there are remnants of communities related to the mixed savannah woodland climax and the tree savannah particularly on the hilltops and ranges. In the lower well drained areas, remnants of moist semi-deciduous forest climax and chlorophoral penmisetum fire conditioned suedo-savanah are visible. The impeded drainage valleys are covered by traces of Cyprus several herb and wetland grasses.

Due to increased industrialization and urbanization most of the natural vegetation has been cleared for industrial, commercial, residential and agricultural activities.

Trees, which have been planted for both shade and ornamental purposes, are found mainly along the roads and homesteads. The most common species includes acacia, agness makhanva platy calyx and Jacaranda mimosifolia.

3.1.1.4 SOILS

The formation of this "Buganda surface" dates back to the upper cretaceous era 135-6 million years ago. A part from the Jinja-kaloli hills in the North West of the division, which exposes granitic soils to the surface, other hills are capped by lateritic lithosols, whenever man has not yet tampered with them.

3.1.1.5 DRAINAGE

Slow winding rivers of which a total length of 14.6 km is of anti malarial drainage and 2 kilometers of these are lined drained in the division. Much of the drainage system is fully silted resulting into flooding in the rainy seasons.

The low lying wetlands have greatly been built from which the storm water has no natural run off. During rainy seasons, streams channels become too small to accommodate big volumes of water consequently; severe flooding is experienced in most low-lying areas.

3.1.1.6 RELIEF

The terrain upon which Nakawa division is located belongs to the remnant Buganda surfaces and valleys or the way lands peneplan. It is typical of L. Victoria plateau physiographic region and flat-topped hills of southern Buganda and Busoga sub-region. The relief has characteristically well developed slope elements, which comprise flat crest (summit) slopes, steeper upper slopes (free-face), often merging abruptly into a long and gentle pediment which is usually dissected by a relatively broad valley.

3.1.1.7 SOCIO-ECONOMIC CHARACTERISTICS

High population growth rate has led to settlement in low-lying swampy areas that had been used for industrial activity. The local authorities had not expected settlement in these areas hence no services had been planned for the area. Land use pattern varies with a mixture of high, medium and low density residential areas. Small to medium commercial areas, small scale to large scale industrial areas, institutional land use and small scale agricultural land use are the other forms of land use activities.

3.2.0 RESEARCH METHODS

3.2.1 RESEARCH DESIGN

A general survey research design was used in identifying the methods, assessing the benefits, determining the factors influencing awareness of cleaner production and in suggesting the possible measures in order to improve on the awareness and adoption of cleaner production in industries.

3.2.2. STUDY POPULATION

The study population was persons aged 18 years and above, who are workers in the industries. This is because this age group is considered mature and capable of answering questions logically and have knowledge of cleaner production. It also included Environmentalists those involved in the dissemination of information concerning cleaner production and environmental conservation, officials from occupational health and safety in ministry of Gender, Labor and Social Development and the managers of the industries. Environmentalists targeted were selected from NGOs like NAPE, Plan International Uganda, Uganda cleaner production Centre, Uganda Environmental Protection Forum (UEPF) and many other Organizations found in division. To compliment the above, officers from the NEMA were interviewed so as to fill up the gaps that existed in the process of data collection.

3.2.3 SAMPLE SIZE

Samples of 60 respondents were selected to represent both employees and employers in the processing and manufacturing industries in Nakawa division. This included 5 managers from the processing and manufacturing industries, 50 industrial workers both skilled and unskilled, one labor officer, one NEMA officer, two officials from Uganda Cleaner Production Center (UCPC) and one official from Uganda Environment Protection Forum. This sample size was viewed to be adequate to provide relevant insights and answers to the main objectives of the study without necessary involving large statistical analysis. This number was targeted because it was believed to be manageable and it could facilitate a deep interaction between the researcher and the respondents.

Table 3.1 below shows the summary of the selected sample.

Table 3.1: Selected sample

Respondent	Number
Managers	5
Industrial Workers	50
Labor Officer	1
NEMA Officer	1
UCPC Officer	2
UEPF Officer	1
TOTAL	60

The selected sample size was comprised of males and females, skilled and unskilled employees and employers in processing industries.

3.3.4 SAMPLING FRAMEWORK

3.3.4.1 SAMPLE DESIGN

Random sampling was utilized in selecting industries and respondents. The subjects of the study were drawn from Ngege Fish industry Ltd, Uganda Batteries Limited and Fish packers industry Ltd in Nakawa division. Nakawa division was purposively selected because of high concentration of industries in Kampala district. It was from this division that sampling frames were constructed with assistance of Uganda Cleaner Production Centre (UCPC). The age range for adult female and male potential respondents was 18 years and above.

3.3.4.2 SAMPLING TECHNIQUES

This involved a process of selecting a sample from the population. The survey respondents were selected using random sampling process. This method was used in order to give each respondent an equal chance of being selected in the sample.

In addition to the above sample, purposive sampling technique was used in selecting 10 key informants basing on their knowledge of the subjects as well as their policy making and implementation roles. They included: 5 managers of processing and manufacturing industries, one official from NEMA, UEPF, two from UCPC and one from Ministry of

Gender, Labour and Social Development, department of occupational health and safety, the researcher considers these to be knowledgeable and experienced as far as cleaner production is concerned.

3.3.5 DATA COLLECTION METHODS

This study took a cross sectional sample survey and which was carried out in depth interviews to collect its own data. The researcher used library research, questionnaires, interview guide and personal observation.

3.3.5.1 LIBRARY RESEARCH

This basically involved data collection from reading books and other documents that have the same information about what the study was looking for and this information was important because it was related to the main objectives of the study. Some data was obtained from some websites in the Internet. The data also was of help in obtaining the literature review.

3.3.5.2 QUESTIONNAIRES

Questionnaires were administered to 5 managing directors and 20 skilled personnel of the processing industries i.e. safety officers, factory engineers and skilled machine operators because these were able to read and write.

3.3.5.3. INTERVIEW GUIDE

Interview schedule was prepared for 35 respondents which included 30 unskilled workers, one official from NEMA, UCPC, UEPF and one general safety officer from department of occupational health and safety. This method allowed for a higher degree of flexibility, thus making respondents feel easy and free when answering questions.

3.3.5.4 PERSONAL OBSERVATION

Direct observation was used to come up with supplementary information. The researcher had to move into the area of the study and observe the phenomena of cleaner production as manifested in the area.

3.6 DATA ANALYSIS

Qualitative data analysis was mainly done using statistical tables from coded responses for easy analysis and interpretation of data. The data was interpreted basing on the relationship and frequency the phenomenon occurred. Tables were drawn to summarize some information for example the methods of cleaner production employed in industries which were the independent variables and their benefits which were the dependent variables. This was mainly done using stated research questions earlier on identified.

CHAPTER FOUR

4.0 PRESENTATIONS AND DISCUSSION OF RESEARCH FINDINGS

4.1 METHODS OF CLEANER PRODUCTION EMPLOYED BY INDUSTRIES

The study findings revealed that a number of methods of cleaner production are being employed by processing and manufacturing industries in Nakawa division such as Uganda Fish Packers Ltd., Ngege Ltd. and Uganda Batteries Ltd. The methods include Input substitution, technology modification, good house keeping, on site recycling among others.

4.1.1 INDUSTRIAL ACTIVITIES AND PRODUCTS

Uganda Fisher Packers Ltd and Ngege Ltd are fish processing factories. Uganda Batteries Ltd is a manufacturing industry dealing with production of automotive batteries.

Table 4.1 below shows industrial activities and description in industries surveyed.

'able 4.1: Industrial activities and description

NDUSTRY	ACTIVITY	DESCRIPTION
Jganda Fish 'ackers Ltd & Jgege Ltd	Skinning	Removal of the scales and the skin from the fish by use of knives
	Filleting	Removal of bones from the skinned fish
	Trimming	Fish fillets are chopped into preferred size and shape
	Freezing	Fish fillets put into the freezers to preserve it from going bad
	Packaging	The fillets are packed into the tins and boxes ready for export
Uganda Batteries Ltd	Blending pot	Lead is subjected to high temperature for melting
	Grid casting	Molten lead poured into various types of moulds for solidification
	Pasting mixing	Solidified lead is mixed with sulphuric acid to form paste
	Pasting	The paste is filled into the machine

Source: Study findings 2005

ıble 4.2 below shows the summary of the activities involved in the sampled industries ıd their products.

able 4.2: Industrial activities and products

NDUSTRY	NATURE	ACTIVITY	PRODUCT
ganda Fish ackers Ltd	Processing Industry	Skinning, Filleting, Freezing, Packaging.	Fresh and Frozen fish products
lgege Ltd	Processing Industry	Skinning, Filleting, Freezing, Packaging	Fresh Nile Perch fillets, Fresh Tilapia fillets, Fresh Head off Gutted Nile perch, Frozen Nile perch fillets, Frozen Tilapia fillets, Frozen Head off Gutted Nile perch.
Jganda Batteries ,td	Manufacturing Industry	Blending Pot, Grid casting, Paste mixing, Pasting	Automotive Batteries

Source: Study findings 2005

Fish processing which involves process like skinning, trimming, filleting, freezing and packing contributes significantly to the overall pollution load produced over the entire life cycle of fish production and consumption. Fish processing consumes a lot of water and energy.

In manufacturing industries like Uganda Batteries Limited, the production of automotive batteries involves potentially hazardous materials, mainly lead and sulphuric acid. These substances can be dangerous to the workforce within the factory as well as to the outside environment. Battery production processes are raw material intensive and consume considerable amounts of water as well as energy.

Cleaner production through the number of methods has helped the processing and manufacturing industries in increasing the efficiency of processes through more efficient use of materials, water and energy and thus helped to improve the environmental performance as well as improving the occupational health and safety conditions for workers.

These are summarized in table 4.3 below.

Table 4.3: Methods of cleaner production employed in Industries

Method of Cleaner Production	Frequency	Percentage
Input Substitution	28	56
Technology Modification	31	62
Good house keeping	36	72
On Site recycling	27	54

Source: Study findings 2005

4.1.1 INPUT SUBSTITUTION IN UGANDA FISH PACKERS LIMITED

In an interview with the supervisor by products of Uganda Fish packers Limited, he said that initially 9.8 tons of unprinted polythene sheets were used and disposed off annually at the total cost of US $ 15 474 but after implementation of cleaner production, the number of sheets per kg of the new material is twice that of the old material, 4900 kg or 50% less of polythene are used per year, thus saving the company US$ 7737 and 50% less polythene waste.

On the side of protective wear, the supervisor by-products said that, initially 13 tons of polythene in form of disposable aprons were used annually at a cost of 44.2 m UGX but after implementation of cleaner production options where the use of a lighter, less expensive disposal materials for aprons was introduced, the weight and the cost of aprons have been reduced by 50%, thus saving the company US$ 11631 and 6500 kg less of

polythene are used and disposed off, all as a result of change of quality of packaging material and protective wear.

The study findings revealed that input substitution goes as far as option for chemicals used for cleaning purposes in the industry, where by the choice for the chemicals is that they don't affect the environment once discharged for example the cleaning detergents.

Changes in raw materials accomplish cleaner production by reducing or eliminating the hazardous materials that enter the production process. Changes in input materials can be made to avoid the generation of hazardous wastes within the production process. Input material changes include material purification and material substitution.

4.1.2 TECHNOLOGY MODIFICATION IN UGANDA BATTERIES LIMITED

Technology changes are oriented towards process and equipment modifications to reduce waste and emissions, preliminary in a production setting. Technology changes range from minor changes that can be implemented in a matter of days at low cost, to the replacement of processes involving large capital costs. Technology modification includes the following;

Changes in the production process, modification of equipment, layout or piping, use of automation and changes in process conditions, such as flow rates, temperatures, pressures and residence times.

According to the maintenance supervisor of Uganda Batteries Limited, he said that cleaner production options are already under implementation at various process steps. Table 4.4 below summarizes cleaner production option used at various stages, in Uganda Batteries Ltd.

Table 4.4: Cleaner Production options used at various stages in Uganda Batteries

STAGE	CLEANER PRODUCTION OPTION	COST SAVINGS (U$)	ENVIRONMENTAL BENEFITS & OHS
BLENDING POT	Improve method of drossing, Replacement of broken cover, Improvement of temperature control, Installation of extraction system	32,500	Reduced dross formation results in: Reduced energy and water consumption. Reduction of air emissions. Improved Occupational and Safety conditions
GRID CASTING	Optimize machine settings for each type of moulds, close hood and lower temperature of molten lead	19,000	Reduced amounts of rejects and dross formation results in: Reductions in energy and water consumption.
PASTE MIXING	Providing adequate filter respirators, improvement of operating procedures, connection of acid pump to fill dosification container	Not quantifiable	Protection of workers against inhalation of lead dust and prevention of acid spills
PASTING	Optimize machine settings, Raise the paste container, Improve implementation of operating procedures to avoid spoiling of paste	70,000	Reduced amounts of waste paste result in: Reduction of lead contamination of waste water, Reduced energy and water consumption. Improved Occupational Health and Safety conditions

Source: Study findings 2005

4.1.3 TECHNOLOGY MODIFICATION IN NGEGE LIMITED

I n an interview with the general manager of Ngege Ltd he said that, energy consumption initially before cleaner production application was rated at 120kwh per ton of fish but through technology modification such as installation of segregation of circuits, insulation of doors for chillers, freezers and cold rooms, starting high-energy consuming equipment in sequence in order to improve on KVA, and installation of Compact Fluorescent Lamps (CFL). He further said that, the implementation of these options has resulted in reduction of energy consumption from 120kwh per ton of fish to 45kwh per ton of fish, which is equivalent to 62.5% reduction in energy consumption.

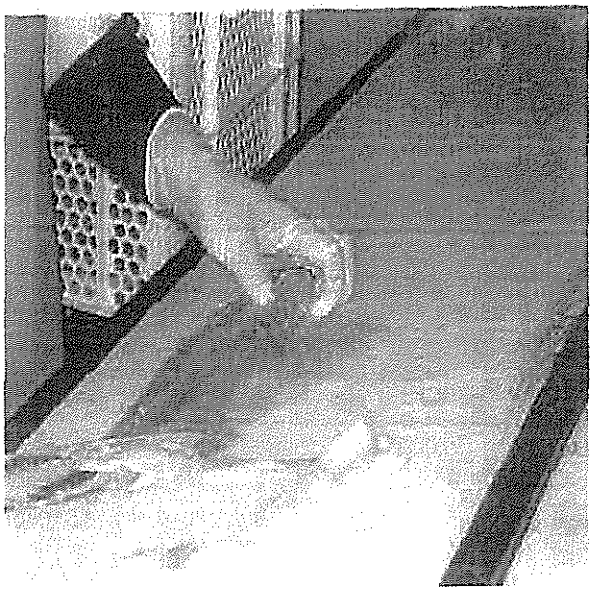
Concerning water consumption hose pipes have been replaced with pressure guns. Further improvement has been through additional implementation of other measures such as installation of sensors and sub metering all sections of the plant to improve further monitoring of water use. Before cleaner production in Ngege Limited fish processing factory, the water consumption was 11.8m3 per ton of raw fish but after cleaner production options were implemented the water consumption improved to 8.2m3 per ton of fish, achieving a reduction of 30.5% in water consumption thus saving the company US$ 6338 per year.

4.1.4 GOOD HOUSE KEEPING IN NGEGE LIMITED

In an interview with the supervisor skinning, filleting and trimming of Ngege limited, he said that due to inefficient methods and inadequate skills among the production employees the yield was not optimum and after implementation of cleaner production options were implemented to ensure hand in hand closer supervision of the production process, the methods and the skills used by workers, especially in filleting, trimming and packing have improved. The yield that was initially at 38% has now improved to 41% practically registering an overall increase of 3% and this yield has resulted in reduced rate of solid waste generation.

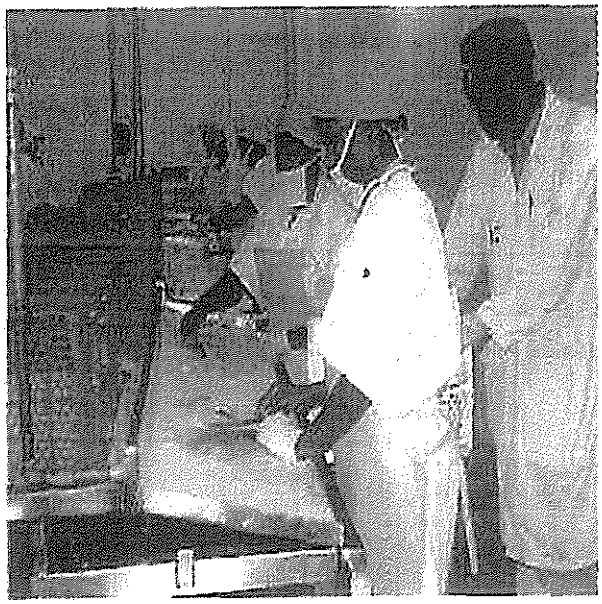
Below are figures showing the improved filleting and trimming techniques in Ngege limited fish processing factory located in Port Bell Road, Luzira.

Figure 4.1: Improved filleting techniques in Ngege Ltd



Source: Study finding 2005

Figure 4.2: Improved trimming techniques in Ngege Ltd



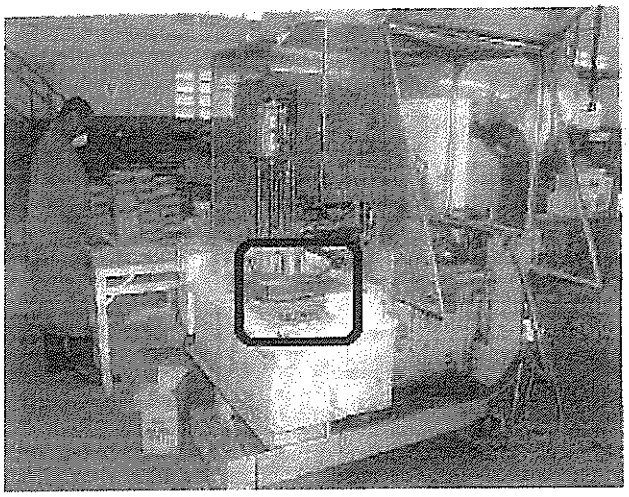
Source: Study finding 2005

4.1.5 GOOD HOUSE KEEPING IN UGANDA BATTERIES LIMITED

Material handling and inventory practices which includes programmes to reduce loss of input materials due to miss handling, expired shelf life of time-sensitive materials and proper storage conditions. Loss prevention minimizes wastes and emissions by avoiding leaks from equipment and spills.

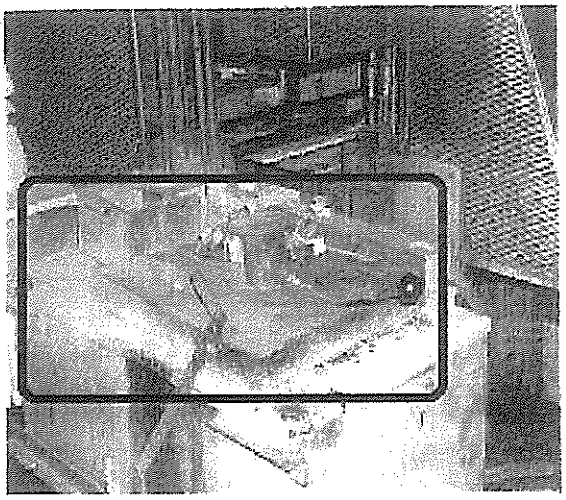
According to the research findings, Uganda Batteries Limited has adopted cleaner production measures in combination with improved performance of operators which has led to the reduction in the amount of rejects-waste, which is returned into the process. During the Grid casting stage, closing the hood over the lead melting pot and lowering the temperature of the molten lead during times when the machines are not in use has reduced the electricity consumption as well as the formation of dross-waste, which is returned into the process. The two figures below show Grid Casting stage during battery manufacture.

Figure 4.3: Lid on the lead melting pot open before before cleaner production in Uganda Batteries Ltd



Source: Uganda Batteries Ltd 2003

Figure 4.4: Lid on the lead melting pot closed after cleaner production in Uganda Batteries



Source: Study findings 2005

4.1.6 GOOD HOUSE KEEPING IN UGANDA FISH PACKERS LIMITED

Waste segregation: these practices reduce the volume of hazardous wastes by preventing the mixing of hazardous and non-hazardous wastes, the study findings revealed that in Uganda Fish Packers factory, polythene materials are separated from biodegradables and taken for recycling. .

In an interview with the general manager of Uganda Fish Packers Limited, he said that cost accounting practices have been introduced which include programmes to allocate waste treatment and disposal costs directly to the department or groups that generates wastes and emissions, rather than charging these costs to general company overhead accounts, so these helps in assessment of benefits of cleaner production in terms of cost saving. Flow meters have even installed in different sections of the processing hall to monitor consumption per section; water usage at major sections is monitored with set targets and incentives.

Production scheduling: by analyzing these factors, the departments or groups that generate wastes and emissions become more aware of the effects of their treatment and disposal practices, and have a financial incentive to minimize their wastes and emissions. The study further revealed that by, judicious scheduling of batch production runs, the frequency of equipment cleaning and the resulting wastes and emissions is reduced.

4.1.7 ON SITE RECYCLING IN UGANDA BATTERIES LIMITED

Recycling or reuse involves the return of a waste material either to the originating process as a substitute for an input material or to another process as an input material. According to the study findings UBL has made sure that the use of cooling water from other machines in various process steps like Grid casting, Pasting, Oxide Mill, TBS, P.G Welder is re-used with the installation of Negative dryer which has improved the re-use of water and this has reduced the water consumption and waste generation by 20% hence saving the company US$ 1,800. At the Blending pot stage the dross waste is returned to the process. This helps in reducing the waste from accumulating because the waste that would have accumulated is taken back into the production process.

4.2 BENEFITS OF CLEANER PRODUCTION TO THE INDUSTRIES

The study findings revealed that there are quite a number of benefits brought a bout by cleaner production in industries. These include; improved profitability, efficient use of resources i.e. raw materials, water, energy and humans, Environmental compliance with laws and regulations, improved productivity, motivated workforce, better working environment among others.

Table 4.5 below shows the response of the workers, as far the consumption of the inputs is concern. The respondents were asked whether there has been reduction in the amount of the inputs employed in the production since introduction of cleaner production in the industry.

Table 4.5: Response about the change in consumption of the inputs in sampled industries.

Response	Number of Respondents	Percentage
Yes	49	98
No	01	02
Total	50	100

Source: Study findings 2005

The study findings revealed that 98% of the respondents are aware of the benefits of cleaner production in terms of reduction in the consumption of the inputs such as water, energy and raw materials among others. Only 2% of the respondents were not aware of the benefits of cleaner production as shown in the table 4.5 above.

4.2.1 WATER CONSERVATION MEASURES IN NGEGE LIMITED

In Ngege Limited water is very essential for fish processing, making ice flakes used for chilling the fish and for other house keeping operations such as cleaning, bathing, toilets and cooling purposes. Before the implementation of cleaner production measures the company was using water extravagantly resulting in annual consumption of approximately 67000m3 of water according to the study findings of which 11.8m3 was used per tone of raw fish. Workers used jets of water from hosepipes to gather pieces of meat on the floor and washing of vehicles. The amount of water consumed in different sections of the factory was not being monitored. Through cleaner production measures the situation has changed, this is summarized in Table 4.6 below.

.2.2 WATER CONSERVATION MEASURES IN UGANDA BATTERIES LIMITED

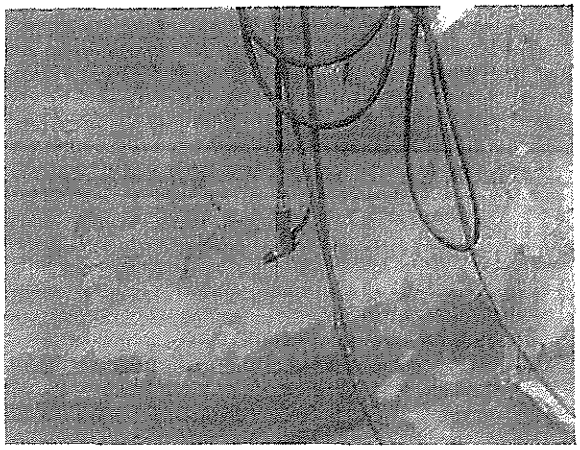
ı Uganda Batteries Limited, according to the study findings better scheduling of running mes of the Negative Dryer has increased the rate of water, which is re-used from this ıachine. Other implemented options include fitting of nozzles or spray guns on hose ipes, reducing the water flow in showers by installation of flow reduction devices and ptimizing the water flow rate in the urinal. The re-use of water from the various process teps such as Grid Casting, Pasting, Oxide Mill, TBS, P.G Welder.

'he two photos below show situation before and after cleaner production implementation ı terms of water use.

'igure 4.7: Water wastage through cleaning with pen-ended hosepipe before cleaner production ı Uganda Batteries Limited

Source: Uganda Batteries Ltd 2003

Figure 4.8: Water saving through use of hosepipe fitted with spray gun after cleaner production in Uganda Batteries Limited



Source: Study findings 2005

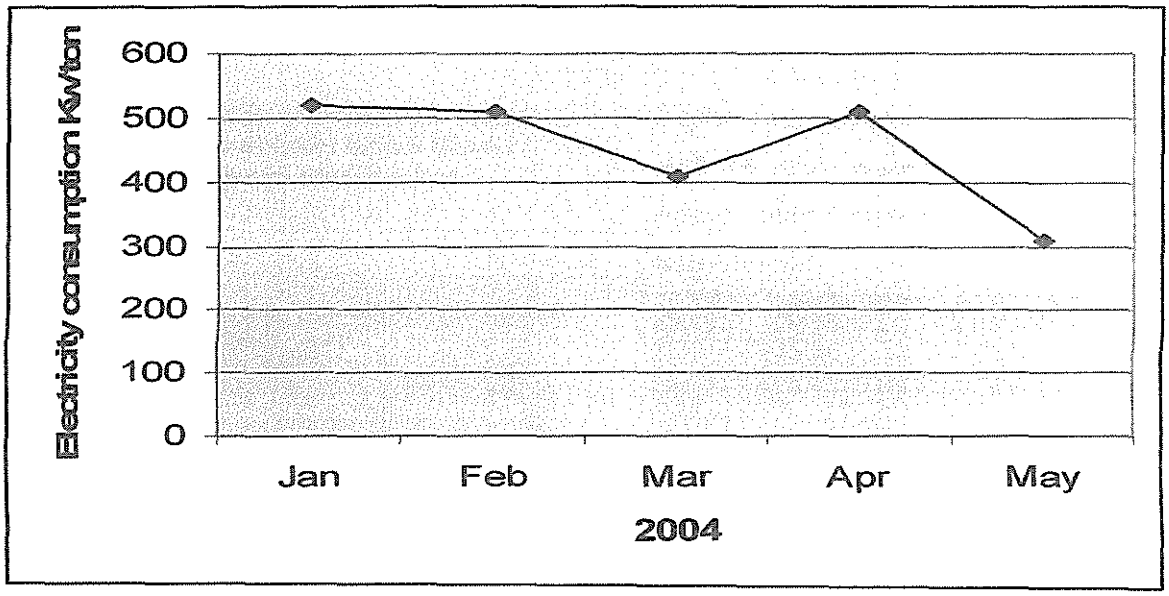
.2.3 ENERGY CONSERVATION MEASURES IN NGEGE LIMITED

Electricity consumption is an area of energy utilization, which needs to be controlled in ırder to improve its efficient use and the profitability of the company. In Ngege Limited ish processing factory, the study findings revealed that before cleaner production ırogramme started, the company was consuming about 600,000 kWh annually with .20kWh per ton of fish, it was difficult to monitor the energy utilization in production as he same meter was shared by the processing plant and other departments. High-energy osses occurred due to poor insulation on the chillers, cold rooms, plate freezers and also

due to non-insulated ice rooms. After implementation of cleaner production options such as installation of segregation of circuits, insulation of doors for chillers, freezers and cold rooms, starting high-energy consuming equipment in sequence in order to improve on kVA, and installation of Compact Fluorescent Lamps (CFL). In an interview with Assistant Production manager he said that, implementation of cleaner production options has resulted in reduction of energy consumption from 120kWh per ton of fish to 45kWh per ton of fish. He further said that, this is equivalent to 62.5% reduction in energy consumption.

Graph 4.2 below shows the trend in electricity consumption in Ngege Limited after implementation of cleaner production options.

Graph 4.2: Trend in electricity consumption in Ngege Ltd



Source: Ngege Ltd 2005

4.2.4 ENERGY CONSERVATION MEASURES IN UGANDA FISH PACKERS LIMITED

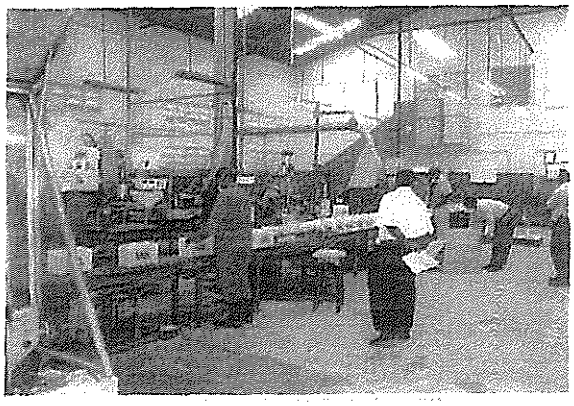
In an interview with the production manager of Uganda Fish Packers, he said cleaner production has helped their factory in energy saving through employing measures like; repair of cold and chill rooms doors, turning off unnecessary lights, use of energy efficient security lamps, delamping non critical areas, regroup lamps and rationalize

controls of fans, fixing set temperature of the cold room at -20°C instead of -25°C installation of capacitor bank to reduce total energy demand and separate installation of meter value added unit to monitor energy usage. The cleaner production option has reduced the energy consumption by 300,000 kWh.

4.2.5 ENERGY CONSERVATION MEASURES IN UGANDA BATTERIES LIMITED

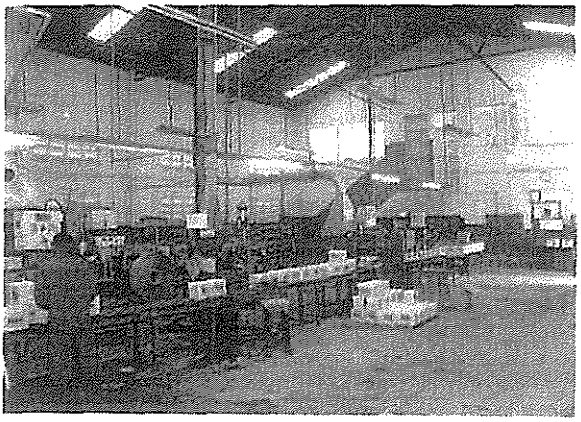
In Uganda Batteries Limited, cleaner production options mainly aimed at reductions in electricity consumption. Raising the general awareness regarding electricity use, for example introducing the "Switch off"-Policy for lights, which are not actually needed, and other electricity consuming equipment was first step. The illumination in the assembly hall and in areas of nighttime activities has been optimized, and allowed the removal of a number of tubes. This has enabled the company to save US$ 9,000. This is demonstrated by the figures below.

Figure 4.9: Lights in assembly hall high up with several rows of tubes before cleaner Production in Uganda Batteries Ltd



Source: Uganda Batteries Ltd 2003

Figure 4.10: Increased use of natural light, number with of tubes reduced and lowered over work places after cleaner production in Uganda Batteries Ltd



Source: Study findings 2005

4.2.6 RAW MATERIAL CONSERVATION IN UGANDA BATTERIES LTD

The study findings revealed that, control of spillage, keeping at hand enough quantities required and adjustment of some quantities required for a batch has been formulated as a result of application of cleaner production technology.

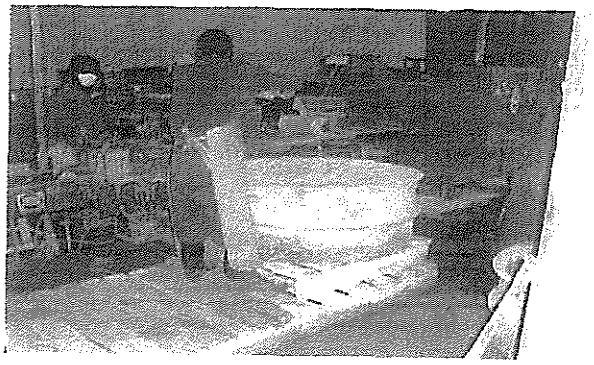
The risks of spillages and accidents during manual filling of sulphuric acid into the acid-mixing container have been reduced through better markings of the container and connection to an acid pump.

Before cleaner production implementation in Uganda Batteries, reduction of spillages, which needed re-work, was identified as the biggest challenge at the pasting stage. After implementation of cleaner production options, there was improvement of the machine condition and installation of new parts as the basis. The paste container, from which paste is filled into the machine, has been raised to reduce spillages of paste and improve the ergonomics of the work place as it is shown in the figures below

Figure 4.11: Paste container on the floor before cleaner production in Uganda Batteries Ltd

Source: Uganda Batteries Ltd 2003

Figure 4.12: Paste container raised after cleaner in Uganda Batteries Ltd



Source: Study findings 2005

Optimization of use of sulphuric Acid has been achieved by identification and monitoring of acid streams and the change of acid supply from container delivery to tank truck delivery. There has been connection of acid pump to fill dosification container hence preventing acid spills. This has helped in reduction of raw material losses hence increased efficiency of acid use.

4.2.7 RAW MATERIAL CONSERVATION IN UGANDA FISH PACKERS LIMITED

In Uganda Fish Packers Ltd, ice is covered with washable polythene sheets during transportation and salt is added to lower the melting point, then shelter for ice loading has also been built which was not there before cleaner production. Implementation of the above options has brought down the percentage of melting ice to 2% as revealed by the study findings. This has greatly helped in ice conservation.

In an interview with the production he said that, initially before cleaner production, Uganda Fish Packers Ltd was using 9.8 tons of unprinted polythene sheets and disposed off annually at a total cost of US$ 15 474, then 31 tons of poly bags annually for the total cost of US$ 57 368 and 708000 corrugated boxes were used annually at a total cost of US$ 130,000 but after implementation of cleaner production options such as adoption of lighter and cheaper polythene sheet material, use of better trays that do not require polythene sheets at all, careful monitoring of the quantity of cello tape used against the set target of 14 boxes per roll of cello tape on the daily basis, improved monitoring and record keeping, monitoring of the use of strapping material against a set target of 8 ton of fish fillet per roll of strapping material on the daily basis, monitoring of the use of polybags as well as the daily wastage of corrugated boxes and the new freezer plates have purchaced and that the canvas sheet was replaced with a Styrofoam door for effective insulation.

This has reduced on the wastage of raw material as summarized in table 4.7 below.

Table 4.7: Raw material conservation in Uganda Fish Packers Limited

Cleaner production Options	Cost savings US$/year	Environmental Benefits	Occupational Health & Safety benefits
Replace polythene sheets with new ones of 50% less weight	US$ 7737	4900Kg less waste of polythene used and disposed off per year	Improved ergonomics
Replace disposable polythene aprons with new ones of 50% less weight	US$ 11631	6500Kg less polythene used and disposed off per year	Better protective wear
Purchase of 150 new freezer plates in order to reduce waste of cardboard boxes in the freezer	US$ 6000	15000 card boards boxes less are used, less waste	

Source: Uganda Fish Packers 2005

The study findings further revealed that, introduction of cleaner production technology has helped in proper monitoring of raw material consumption, which is done on regular basis and regular repairs in production areas to avoid wastage of raw materials.

4.2.8 REDUCTION IN FUEL CONSUMPTION IN UGANDA FISH PACKERS LTD

The study findings revealed cleaner production has promoted reduction of fuel consumption through improved transport logistics involving careful monitoring, planning and optimal use of vehicle capacity, this in turn has helped in reducing air pollution. In an interview with a transport manager of Uganda Fish packers factory he said that, initially before cleaner production, the annual consumption of diesel for transport was 285551 litres per year, the annual consumption of the diesel for the generator was 40600 per year

and the total cost of diesel was UGX 435 m per annum. After cleaner production options were implemented such as, the use of optimum size trucks for transportation of fish and putting in place new controls for every vehicle and destination with appropriate fuel rations, this has reduced the operating costs of vehicles and ensured their efficient use. He further said that, implementation of the above options on fuel conservation has reduced fuel consumption considerably and the cost of transportation has already reduced by 44%. So savings on fuel costs and reduction in air pollution have been achieved.

4.2.9 WASTE MANAGEMENT

4.2.9.1 GASEOUS EMISSIONS REGULATION IN UGANDA FISH PACKERS LTD

Through cleaner production, regulation of furnace oil intake has been introduced and the use of suitable nozzles that gives less gas emission has been put in place in Uganda Fish Packers, where by control of leakage of ammonia has been achieved by identifying the leaking areas of the pipes and sealing off or replacing the pipes. It was further analyzed that, some emissions are neutralized before they are released into the environment.

4.2.9.2 GASEOUS EMISSIONS REGULATION IN UGANDA BATTERIES LTD

In Uganda Batteries Ltd, cleaner production options have helped in reduction of air emissions and improved Occupational Health and Safety conditions in the work place. For example at **Blending pot stage;** there has been improvement in the drossing method, replacement of broken covers, improvement in temperature control and installation of extraction system has been done and this has subsequently reduced the air emissions.

At the **paste mixing stage**, adequate filter respirators have been provided coupled with improvement of operating procedures has help in the reduction of generation of lead dust, hence protecting the workers against inhaling the lead dust.

4.2.9.3 SOLID WASTE MANAGEMENT IN NGEGE LIMITED

The study findings revealed that cleaner production has helped in solid waste management, where by in Ngege Ltd, separation of waste polythene bags from the source is done and these are taken for recycling then other non-biodegradable wastes are taken to the dumping site. The biodegradable wastes are dealt with as per ISO 14000.

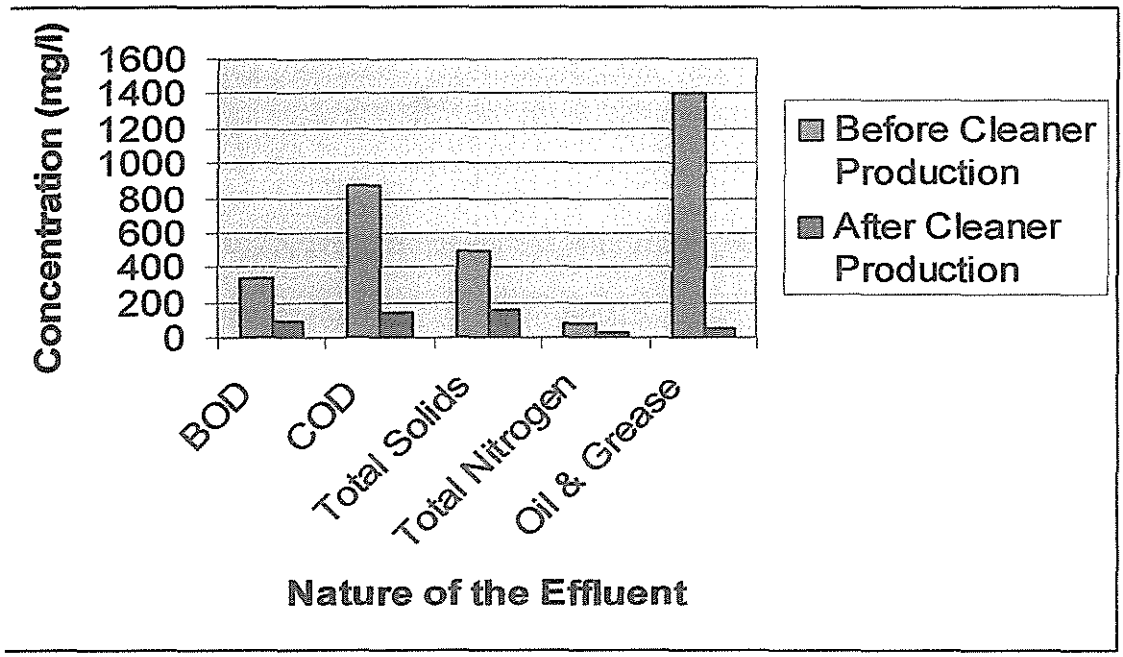
According to the research findings, Ngege Ltd was producing large amounts of solid waste especially heads, skins, scales and pieces of meat. Some of this waste was escaping with the wastewater and was responsible for the high BOD levels and the offending odour outside the lower part factory but after cleaner production implementation through improved skinning, filleting and trimming there is considerable reduction in wastes generated. The skins from the factory are sold to the Uganda Fish Skin Tannery Ltd in Jinja for the making of Finished Glaze and leather.

4.2.9.4 EFFLUENT MANAGEMENT IN UGANDA FISH PACKERS LIMITED

Cleaner production has helped in checking the effluent discharge and there after allows the counter check or traces the inconsistencies in the production processes.

According to the study findings, Uganda Fish Packers has introduced the treatment plant for the factory, where by the solid material is being removed with the help of sieves and liquid material is directed to the treatment plant. Additional aeration fan in wastewater plant has improved the quality of wastewater and installation of wastewater flow meter has enabled accurate report of discharge volumes. The introduction of sieves on the tables and the drainage system has helped in management of the effluent by reducing its volume. The fixing of fine mesh trays in the drain taps lower the BOD level in the effluent. Graph 4.3 below shows the comparison of the concentration of the effluent before and after cleaner production in Uganda Fish packers Ltd.

raph 4.3: Concentration of the effluent before and after cleaner production in ganda Fish Packers Ltd



ource: Uganda Fish Packers 2005

2.9.5 EFFLUENT MANAGEMENT IN UGANDA BATTERIES LIMITED

ne study findings reveal that Uganda Batteries Ltd has employed cleaner production at arious step processes, in order to minimize the toxicity and the volume of the effluent. t the pasting stage, the paste container has been raised and there is subsequent reduction the amounts of waste paste hence reduction in the lead contamination of wastewater.

nprovement in the maintenance of machines in the production department and nplementation of regular cleaning schedule for sedimentation areas has helped in duction of the volume and wastewater contamination. Separation of waste water reams has reduced contamination of wastewater through prevention of overflow at the fluent plant. Waste water or sediments from the factory will not be mixed or ntaminated with mud, which improves the potential for re-use of sediments.

.2.10 OCCUPATIONAL HEALTH AND SAFETY

'leaner production has created appropriate safe and healthy working environment onducive to good performance of staff through improved communications and working elationship among workers, production and administrative staff. Motivated and esponsible workers has resulted in efficient teams and enhanced productivity in the ıdustrial sector. This is revealed by the study findings in Table 4.8 and 4.9 that show the tate of the working environment that is the, floor, light, hygiene, shade/roof, building nd ventilation Uganda Batteries Limited before and after cleaner production respectively s given by the respondents.

'able 4.8: The state of working Environment before cleaner production in Uganda ;atteries Limited.

Place	Very Good		Good		Fair		Bad		Very Bad	
	No. of Resp	%	No of Resp	%	No of Resp	%	No of Resp	%	No of Resp	%
Floor	0	0.0	0	0.0	1	02	38	76	11	22
Light	0	0.0	2	04	17	34	31	62	0	0.0
Hygiene	0	0.0	0	0.0	5	10	21	42	24	48
Roof	0	0.0	5	10	28	56	17	34	0	0.0
Building	0	0.0	15	30	21	42	14	28	0	0.0
Ventilation	0	0.0	12	24	23	46	15	30	0	0.0
Total	**0**	**0.0**	**2**	**04**	**93**	**190**	**136**	**272**	**35**	**70**

ource: Study findings 2005

The results of table 4.7 above as revealed by the findings of the study indicate that there were poor working conditions in terms of floor, light, hygiene, roof, building and ventilation before cleaner production technology was introduced into Uganda Batteries Ltd industry. According to the study findings 22% and 48% of the respondents acknowledged the very bad state of the floor and the hygiene respectively before cleaner production. The floor, light, hygiene, roof, building and ventilation were in a bad state according to 76%, 62%, 42%, 34%, 28% and 30% of respondents respectively as revealed by the study as shown in table 4.3 above.

Table 4.9: The state of working Environment after Cleaner Production Uganda Batteries Limited.

Place	Very Good		Good		Fair		Bad		Very Bad	
	No. of Resp	%	No. of Resp	%	No. of Resp	%	No. of Resp	%	No. of Resp	%
Floor	41	82	8	16	1	2	0	0.0	0	0.0
Light	43	86	7	14	0	0.0	0	0.0	0	0.0
Hygiene	39	78	9	18	2	04	0	0.0	0	0.0
Roof	24	48	22	44	4	08	0	0.0	0	0.0
Building	18	36	21	42	11	22	0	0.0	0	0.0
Ventilation	21	42	26	52	3	06	0	0.0	0	0.0
Total	**186**	**372**	**93**	**186**	**21**	**42**	**0**	**0.0**	**0**	**0.0**

Source: Study findings 2005

The study findings revealed that cleaner production technology has created a more conducive working environment for the workers, as shown in table 4.4 above as compared to results in table 4.3. In that there was an improvement in facilities in the work environment where by the respondents rated the facilities to in a good or very good state after cleaner production.

Cleaner production has ensured adequate protective wear and gear in the work place and this has improved the welfare and safety of workers through provision of uniforms, boots,

ves, adequate meals, clean working environment and clean water among others. The rkers were asked if they are provided with protective wear and gear at the work place. ble 4.10 below shows the workers responses on provision protectives at the work ce.

ble 4.10: Response on the use of protective wear and gear at the work vironment

sponse	Number of respondents	Percentage
s	48	96
)	2	04
otal	50	100

urce: Study findings 2005

om table 4.10 above, the study findings revealed that 96% of the respondents are ovided with protective wear and gear at the work place. However 4% of the spondents said they are not provided with all the required protective wear. Provisions of otective wear, motivate the workers and increase their performance.

rrangement of appropriate work postures the most efficient rest periods during working me has also been put in place for the workers.

.3 FACTORS INFLUANCING AWARENESS OF CLEANER PRODUCTION

)espite attractive economic and significant reductions in environmental impacts, the videspread adoption of cleaner production still remains limited. The findings of the study evealed factors such as lack of technical skills and knowledge, lack of education and raining, poor management, inadequate support staff, inflexible company culture and esistance to change, absence of policy framework and limited financial support to be imiting adoption cleaner production technology. These are summarized in table 4.11 elow as given by the respondents.

Table 4.11: Factors influencing awareness of cleaner production in industries

Factor	Number of Respondents	Percentage
Lack of technical skills	35	70
Lack of education and training	42	84
Poor management	24	48
Inadequate support staff	31	62
Inflexible company culture and resistance to change	12	24
Absence of policy framework	17	34
Limited financial support	23	46

Source: Study findings 2005

4.3.1 LACK OF TECHNICAL SKILLS AND KNOWLEDGE

The study findings revealed that 70% of the respondents noted lack of technical skills and knowledge as a constraint to cleaner production as shown in table 4.6 above. The respondents further said that there is limited access to reliable information on "state of the art" of cleaner production and limited accessibility of equipment supportive to cleaner production where high quality engineering is needed for process instrumentation. It was revealed that there is absence of a sound operational basis with well established production practices and maintenance schemes. The respondents acknowledged the complexity of cleaner production where by it needs identification of cleaner production opportunities, so with limited know-how and methods of evaluation of cleaner production, it becomes a big constraint.

4.3.2 LACK OF EDUCATION AND TRAINING

Limited education and training on cleaner production technology was discovered to be one of the most limiting factor to cleaner production on industries, as revealed by the study findings with 84% of the respondents acknowledging it as illustrated in table 4.6 above.

The respondents were further asked how often they receive training on cleaner production. Table 4.12 below shows the responses.

Table 4.12: Training on cleaner production

Response	Number of respondents	Percentage
Often	8	16
Always	11	22
Rarely	31	62
Never	0	0.0
Total	**50**	**100**

Source: Study findings 2005

From table 4.12 above it can be noted that most of the workers 62% rarely receive training on cleaner production. 22% and 16% of the respondents said they always and often receive training on cleaner production respectively.

However, 16% of the respondents who said often receive training on cleaner production also admitted that they do not know everything about cleaner production because the kind of training they get is not sufficient enough due to limited time.

4.3.3 POOR MANAGEMENT

A cleaner production application can be initiated after a conscious decision has been made by the management to take action. The study findings revealed that there is lack of leadership for environmental affairs in the industries; this was noted by 48% of the respondents, who further said that the managers are only profit motivated rather than cleaner production application.

However, according to an interview with one of the managers, he said that perceived management risk related to cleaner production is one of the limiting factors. for example no incentive for managers to put their efforts into implementation of cleaner production.

4.3.4 INADEQUATE SUPPORT STAFF

The study findings revealed that there is limited human resources capable of maintaining the equipment technology, this was revealed by 62% of the respondents who further said ever since they trained them on cleaner production, the officials have never come back. According to an interview with the head of department of occupational safety and health,

he said that awareness of cleaner production in terms of employees' health is being influenced by lack of adequate support staff in the department to make routine field surveillance and assessment of safety and health conditions of workers. He further said that the department has less than 20 members of the support staff and these are inadequate and these are inadequate to carry out safety and health monitoring in the country.

4.2.5 INFLEXIBLE COMPANY CULTURE AND RESISTANCE TO CHANGE

According to the study findings, 24% of respondents revealed that inflexible company culture and resistance to change is one of the factors influencing awareness of cleaner production in industries and they attributed this to narrow interpretation or misunderstanding of the cleaner production concept. It was further revealed that, the managers perceive investment in cleaner production to be presenting high financial risk due to its innovative nature. There is also general resistance to change by some managers who are still stack to their traditional methods.

4.3.6 ABSENCE OF POLICY FRAMEWORK

The study findings revealed that absence of policy framework for cleaner production is another barrier to cleaner production and there is also limited negotiation skills of individual enterprises. As it was revealed by 34% of the respondents who said, the government has not played any major role in enforcing policies concerning cleaner production, so there is insufficient focus in technology, trade and industry.

4.3.7 LIMITED FINANCIAL SUPPORT

According to the discussion conducted with the managers of various industries, they revealed that cleaner production investments may not always fit into loan and funding schemes, so there is difficulty in access to financial resources for implementation of cleaner production technology and this was confirmed by 46% of the respondents. The study further revealed that, cleaner production is not properly valued by credit providers in their evaluation procedures for lending, equity participation among others.

CHAPTER FIVE

5.0. CONCLUSIONS AND RECOMMENDATIONS

5.1. SUMMARY OF THE FINDINGS

The study findings reveal that the methods of cleaner production employed in industries are input substitution, technology modification, good house keeping and on site recycling.

According to the study findings, cleaner production has brought in a number of benefits to the industry and these include reduction in water and energy consumption, raw material conservation, improved management of generated wastes ranging from packing materials, gaseous emissions, solid and biodegradable wastes and effluent.

The study findings reveal that awareness and application of cleaner production in industries is influenced by a number of factors which include, lack of technical skills and knowledge, lack of education and training, poor management, inadequate support staff, inflexible company culture and resistance to change, limited finances and poor policy framework.

5.2 CONCLUSIONS

It can be noticed that cleaner production has benefited the industrial sector in a number of ways, ranging from reduction of the cost of production to the improvement of the working environment. The managers of industries should therefore embark on application of cleaner production so as to improve on their returns.

The study further revealed that there are some barriers and weakness showing the awareness and adoption of cleaner production options in industries such as lack of technical skills, lack of education & training, poor management, inadequate support staff, absence of policy frame work among others.

5.3 RECOMMENDATIONS

5.3.1 CLEANER PRODUCTION TRAINING AND EDUCATION

The government of Uganda should strengthen its formal education and training on cleaner production in the education curriculum in primary, secondary and post secondary education. It is important Ugandans begin to acquire basic knowledge at an early age regarding the complex relationship between the work environment and welfare. Cleaner production training and education is important in order to increase awareness and application of cleaner production in industries. Therefore industrial managers should ensure that their employees under go training and education on cleaner production in all various department of the industry. Training in cleaner production should be conducted through workshops, seminars and on the-job training during in-plant assessments. The cleaner production experts should be trained in specific areas, such as cleaner production technology assessment, energy efficiency, cleaner production policy, data management, multilateral environmental agreements, health and safety, implementation of environmental management systems for example ISO 14000 series and other subjects. Training should also include awareness raising activities for companies and institutions and their participation in assessments.

However, this education must stretch itself beyond the basic knowledge one needs to understand labour regulations and integrate all the cleaner production aspects putting emphasis on the informal sector, this could help in improving on awareness of cleaner production industries.

5.3.2 IMPLEMENTATION OF LABOUR LAWS, REGULATIONS, ACTS AND POLICIES

Since 1911, the ILO has developed labour laws and many other countries followed suit. However, the institutionalization of labour laws under ILO has not been an easy task due to political influence. If the goal of the government of Uganda is to promote sustainable development and environmentally sound work conditions it is viable to implement these labour regulations, Acts, law and policies.

The sustainability of the cleaner production concept will only become general practice in industry if effective environmental regulation and policies that support the application of cleaner production are in place. Besides administrative measures such as licensing, this involves economic measures including the introduction of realistic charges for disposal and utilities such as energy and water. A package of incentives to industry is crucial to a country's cleaner production policy.

5.3.3 REHABILITATION OF THE BUILDINGS

House construction design many industries is a critical problem throughout Uganda. The current house construction designs for the industries do not lead to the development of sound housing suitable for work environments. Indeed buildings under industries were poorly constructed or designed hence do not allow natural light in door due to poor roofing. It is imperative that both appropriate technology and knowledge be integrated within the housing construction regulations.

5.3.4 THE DEVELOPMENT AND DISSEMINATION OF INFORMATION

Uganda Cleaner Production Center, Ministry of Gender, Labour and Social development, department of occupational safety and health should liase with other labour organizations and lay strategies for developing occupational health and safety and cleaner production data information systems. The amount of cleaner production information that needs to be collected, analyzed and disseminated has increased exponentially, so in order to perform this enormous task, there must be a well organized management information system that links all the stake holders, collects and disseminates the information and exchanges it internationally in the shortest possible time. There is therefore need for development and dissemination of cleaner production information in all factors of the economy including industries.

5.3.5 AWARENESS ON CLEANER PRODUCTION

According to the interview with the managers of various industries, they recommend the need for awareness of cleaner production aspects in industries, they argued that this could be done through encouraging workers in the industries to take training with UCPC this could help create awareness of cleaner production and further improve on its application.

5.3.6 IMPROVING WORK CONDITIONS

The quality of working environment should be made conducive for the good performance of the workers by improving on the ergonomics where they should be arrangement of appropriate work postures and the arrangement of the most efficient rest periods during working time should also be emphasized in the working environment.

5.3.7 INSTALLATION OF SAFETY EQUIPMENTS

Respondents recommended that there is need for installing safety equipments such as first aid boxes. During the study, the researcher observed that among all the industries visited non had any safety equipment. Industrialists should therefore acquire safety equipment in order to ensure the safety of their workers.

5.3.8 MANAGEMENT COMMITMENT

Plant management has to set the stage for cleaner production activities, in order to ensure collaboration and participation. Management commitment may be reflected in environmental policy statements; however, the actual behavior of the management is at least equally important as written statements.

5.3.9 EMPLOYEE INVOLVEMENT

Management should set the stage, but whether or not good cleaner production opportunities are found in largely dependent on the collaboration of employees. Employees, in particular those involved in the daily operations and maintenance on the shop-floor, have often key understanding of why wastes and emissions are generated and are often able to come up with solutions.

5.3.10 COST AWARENESS

Cost awareness is important in the sense that proper cost information can convince management, as well as employees, that producing cleaner can make money. Unfortunately, many companies, in particular small and medium sized enterprises, do not know how much money is wasted. Typically, only costs charged by external waste contractors are taken into consideration. Actual waste costs can be significantly more.

An organized approach is necessary to identify, evaluate and implement cleaner production opportunities. Cleaner production assessments are undertaken with a view to avoid or at least reduce the generation of waste and emissions. Moreover, it is expected that these options will in turn change existing management and information systems and thus support and facilitate further cleaner production activities.

5.3.11 TECHNICAL EVALUATION

The cleaner production option should be first evaluated whether the option can be put in practice. This requires a check on the availability and reliability of the equipment, the effect on the product quality and productivity, the expected maintenance and utility requirements and the necessary operating and supervising skills. Second, the changes in the technical specifications can be converted into a projected materials balance, reflecting the input and output material flows and energy requirements after implementation of the cleaner production option. The options that do not need capital expenditure for example house keeping measures can often be implemented quickly. It is atypical fast-track approach. If capital investment is needed for the chosen option, it is advisable to appoint an adhoc group of experts, to make a technical evaluation based on selected evaluation criteria. Raw material, equipment or process changes are expensive and may affect changes in production line or product quality. Therefore, technical evaluation of such option requires more complex investigation.

5.3.12 IMPLEMENTATION OF FEASIBLE CLEANER PRODUCTION MEASURES

The effort needed to implement cleaner production measures can vastly differ substantially. Simple measures like good house keeping can easier be implemented. However, the focus should be on complex measures, which require a substantial investment high cost options. Implementation of these options can require a detailed preparation such as planning the installation and funding requirements. Next, the installation of equipment requires supervision in order to safeguard optimal use of the new facilities.

3.13 MONITOR CLEANER PRODUCTION PROGRESS

mple indicators should be used to monitor progress and to keep the management as ell as other interested parties frequently informed. The choice of the measurement ethods is crucial. It can be based on changes in waste or emission quantities, changes in source consumption including energy or changes in profitability. The evaluation of the onitoring data should include changes in the production output and changes in the oduct mix.

EFERENCES

haudhary, H (1996), Cleaner Production, Best Practice Environmental Management in Mining Industry, Calculta.

orfmann, M (1992), Source Reduction: Akey to competitive Advantage, Chemical Industry. Indian Chemical Manufacturers, Bombay.

nvironmental Protection Agency (1995), Overview of Best Practice Environmental Management in mining.

Iunt, A (1993), Pollution Prevention in practice, Executive Enterprise Publication, Newyork, USA.

Clemes, J (2005), Making progress Toward Sustainability by Using Cleaner Production Technologies, Improved Design and Economically Sound Operation of Production Facilities, Volume 13.

Lees, F (1999), Loss Prevention in the process Industries: Hazard Identification, Assesment and Control, Vols 1-3, 2nd Edition, Heinmann Publishers Ltd Butterworth.

NEMA (1998), State of environment report, Uganda.

NEMA (2000/2001), State of environment report Uganda

Noyes, R (1993), Pollution Prevention Technology Handbook, Noyes Publication, USA.

Rimer, A et al (1992), A practical guide to Pollution Prevention Planning for the Iron and Steel Industry, Environmental Publications, Cincinnati.

UNEP (1992), Cleaner Production Program, Proc. 1st International Cleaner Production Conference, Melbourne.

NEP (1992), A guide to global environment. New york. Oxford press

NEP (2002), Global Status Report on Sustainable Consumption and Production

NESCO (2003). YouthXchange. training kit on responsible consumption

NIDO (2003), Cleaner production in Uganda; The Eco-Benefits programme. Volume 2

/orld Bank (1998). Pollution Prevention and Abatement Handbook. Section 2. Implementing Policies in Practice: Industrial Management. Implementing Cleaner Production , The World Bank. Herndon. USA.

/orld Bank (2003). Sustainable Development in a Dynamic World: Transforming Institutions, Growth, and Quality of Life. Oxford University Press.

(b) Temporary employee? ☐

6. For how long have you been on this job?

Less than one year ☐ 1- 4 years ☐

5-9 years ☐ 10 > years ☐

7. What is the mode / terms of payment?

(a) Wage ☐

(b) Salary ☐

8. Is your present job your major source of income?

Yes ☐ No ☐

METHODS OF CLEANER PRODCTION

9. What type of work are you involved in?

(i) Sophisticated Machinery ☐

(ii) Simple Machinery ☐

(iii) Manual Labour ☐

(iv) One using Chemicals ☐

10. (a) Have you heard bout cleaner production?

Yes ☐ No ☐

(b) If Yes, what do you know about it?

.....

.....

.....

11. Which methods of cleaner production do you apply?

(a) Product modification ☐

(b) Input substitution ☐

(c) Technology modification ☐

(d) Good house keeping ☐

(e) On site recycling ☐

(f) Others .....

NEFITS OF CLEANER PRODUCTION

2. Is there any change in consumption of the inputs below since you started employing cleaner production methods? Yes ☐ No ☐

If Yes, how?

(i) Water consumption .....

.....

.....

(ii) Energy consumption .....

.....

.....

(iii) Raw material conservation .....

.....

.....

. Has cleaner production helped you in managing wastes generated by your industry?

(a) Yes ☐ No ☐

(b) If Yes, how?

(i) Packaging materials .....

.....

.....

(ii) Gaseous emissions .....

.....

.....

(iii) Biodegradable Solid wastes .....

.....

.....

(iv) Effluent .....

.....

.....

14. Have you heard about occupational health and safety? Yes ☐ No ☐

If yes, what do you know about it? .....

.....

.....

. Are you trained on how to use the equipments at work? Yes ☐ No ☐

. How many working hours do you have?(a) Less than 6 hours ☐ 7-8 hours ☐
9-12 hours ☐ 13>hours ☐

. Do you have breaks between the working hours? Yes ☐ No ☐
If Yes, Name them .....
.....

. What protective wear (S) does your job require you? Gumboots ☐ Gloves ☐
Glasses ☐ Heavy Jacket ☐ Helmet ☐ Nose musk ☐

'. Are you provided with the protectives mentioned above? Yes ☐ No ☐

). What was the state of the following in your work place before and after cleaner production? (Tick).

EFORE CLEANER PRODUCTION

'lace	Very Good	Good	Fair	Bad	Very Bad
'loor					
Light					
Hygiene					
Shade / Roof					
Building					
Ventilation					

.FTER CLEANER PRODUCTION

Place	Very Good	Good	Fair	Bad	Very Bad
Floor					
Light					
Hygiene					
Shade / Roof					
Building					
Ventilation					

ACTORS INFLUENCING AWARENESS OF CLEANER PRODUCTION

. What do you think are the factors influencing awareness of cleaner production in your industry?

(a). Lack of technical skills and knowledge ☐

(b). Lack of Education and training ☐

(c). Poor Management ☐

(d). Inadequate support staff ☐

(e) Inflexible Company culture and Resistance to change

Others .....

2. Do you normally receive training on cleaner production? Yes ☐ No ☐

If yes, how many times?

Often ☐

Always ☐

Rarely ☐

Never ☐

f so, how often, and on what aspects

.....

.....

.....

MEASURES TO IMPROVE ON THE AWARENESS OF CLEANER PRODUCTION

23. What do you think can be done to promote awareness of cleaner production in processing industries?

.....

.....

.....

THANK YOU VERY MUCH FOR YOUR COOPERATION.

(ii) Water usage .....

.....

.....

(iii) Raw materials .....

.....

.....

(iv) Waste management .....

.....

.....

(v) Health and safety of the workers .....

.....

.....

7. What do you think are the factors influencing awareness of cleaner production in your industry? .....

.....

.....

8. What has the government done in promoting the use of cleaner production in your industry? .....

.....

.....

9. Are there problems in your system of operation that have limited the use of cleaner Production in your industry? Yes ☐ No ☐

10. If yes, what are they? .....

.....

.....

11. How often are your workers trained on the aspects of cleaner production?..... .....

.....

.....