THE ROLE OF GREEN MANUFACTURING / CLEANER PRODUCTION IN OBTAINING ISO 14001 CERTIFICATION FOR TOBBACOO PROCESSING COMPANIES IN ZIMBABWE.

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ABSTRACT

This paper seeks to explore how Cleaner Production/Green Manufacturing can be used as a base for ISO 14001 certification in a tobacco processing environment. A framework is presented for how to implement ISO 14001 in a tobacco processing environment. CP assessment procedures are highlighted in the paper. A case study is also carried out at a tobacco processing company. Environmental impact assessment and environmental audits were carried for the plant; this enabled the researchers to evaluate environmental impacts and aspects of the process.

Keywords: Cleaner Production, ISO 14001 Certification, Environmental Management Systems, Tobacco Processing,

1.0 Introduction

The ever increasing pressures on the earth's natural resources and the environment caused by increased population consumption of manufactured goods and advancement of technology has led to depletion of resources and environmental degradation. This poses a bleak future for the future generations. Hence the call for sustainable environmental management systems within organisations. Against this backdrop it has become inherent to promote doing business in an environmentally responsible manner at the same time benefiting economically. There is need to trade off making profits and conserving the environment. This can be achieved by Cleaner Production Technologies that aim to reduce waste at source. Waste is viewed as of negative economic value. CP is a proactive or a preventative approach to improve economic efficiency and environmental performance of a given system, through efficient utilisation of resources. It does not deny growth but it is a win-win situation.

CP can be used a means of voluntary compliance to legal requirements of improved environmental efficiency, without need to comply in order to evade fines and prosecution. This is the basis of sustainability seeking certification of ISO 14001 that is an international standard for environmental management systems. There are two approaches of implementing ISO 14001,the first one has negative results and the other has positive implications to the environment. The 'Default' model driven primarily by private interests. The Sustainable - Seeking model driven by both society's interest and private interest.

United Nations Environmental Programme defines [1] **C**leaner Production (CP) as the continuous application of an integrated preventive environmental strategy to processes, products and services to increase overall efficiency, and reduce risk to humans and the environment. CP can be applied to the processes used in any industry, to products themselves and various services provided in society.

For products cleaner production aims to reduce the environmental health and safety impacts of products over their entire life cycles. Entire life cycle means from raw materials extraction through to manufacturing, use and disposal of product. For services CP implies incorporating environmental concerns into designing and delivering services.

For production processes CP is a combination of conserving raw materials, water and energy, eliminating toxic and dangerous raw materials and reducing quantities and toxicity of all emissions and waste at source during the production process.

2.0 The Positive Application of ISO 14001.

ISO 14001 is a major step forward for environmental management in many countries. How ever 'default' approach to Environmental Management System (EMSs) has risen because the first firms to introduce EMSs had major direct environmental impacts, often caused by pollution, and were subject to tough regulatory requirements, high material costs, and critical public scrutiny. This default approach is however not suitable for firms which want to contribute most effectively to the achievement of sustainability. An alternative approach is the sustainability seeking interpretation of ISO 14001.If this framework for applying ISO 14001 is adapted it will improve chances of increasing sustainability.[3]. Sustainable development is 'development that brings about ecological, social and sustainability while contributing to the achievement of society's other goals'. Ecological sustainability involves both.[3]

- The protection,in perpetuity,of life support systems(e.g. ecological processes for nutrient and water cycling,soils,the protective and climate controlling functions of the atmosphere) and biodiversity (i.e. species, genetic variety and ecological communities)
- The conservation of material and energy resources

2.1 Standard Association Of Zimbabwe's ISO 14001: 1996 Environmental Management Systems-Specifications

The environmental management system model for ISO 14001 follow steps below for implementation [2].

1.Environmental policy 2.Planning 3.Implimenting and operation 4. Management review 5. Continual improvement.

2.2 Framework For ISO 14001

Organisations are recommended to implement cleaner production options identified by cleaner production assessments. These options aim at minimising the generation of waste at source, whole system design is necessary which looks beyond legal compliance and flight from bad practice in order to avoid fines. Environmental management should be viewed at global level not local. All stakeholders should be involved, customers, suppliers and the society. CP should be used as a base for ISO 14001 certification.

The organisation should seek to do business in a corporate responsible manner. The CP options provide the basis of companies environmental targets and objectives in order to minimise the environmental impacts and aspects of their products and services.. The implementation of CP options should be done after a cost benefit analysis. Those that do not need a lot of resources should be implemented immediately. The companies would realise profits by saving on wastes, getting income form recycling, income from waste being used as inputs in other areas, energy savings, water re-use and less legal suits. This will also improve company image.

3.0 Procedures of Implementing Cleaner Production at an Organisation

Before the implementation of CP at any organization the following should be done:

a. Management commitment: Plant management has to set the stage for CP activities, in order to ensure collaboration and participation. Management commitment may be reflected in environmental policy statements, however, the actual behaviour of the management is at least equally important as written statements. [5]

b. Employee involvement: Management should set the stage, but whether or not good CP opportunities are found is 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.

c. 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.

d. Organise a project team: The project team initiates, co-ordinates and supervises the assessment activities.

e. Identify barriers and solutions: In order to develop workable solutions, the project team should identify the site-specific barriers to CP implementation that might exist.

f. Set plant-wide goals: Plant-wide CP goals set the stage for the assessment and should challenge the project team. The tendency of companies to underestimate the CP potential in the first place, is often reflected in comparatively low goals.

3.1 Assessment Procedure

Feasibility Studies

The feasibility studies have to prove whether each of the (non-obviously feasible) options is technically and economically feasible and whether it contributes to the environmental improvement[6].

The feasibility studies can be divided to six tasks discussed below. ·

1. Preliminary Evaluation

The options are sorted in order to identify additional evaluation needs. Managerial options do not always require a technical evaluation, while equipment-based options do. Similarly, simple options normally do not require an environmental evaluation, while complex options do. Finally, cheap options do not require a detailed economic evaluation, while expensive options may.

2. Technical Evaluation

The technical evaluation consists of two interrelated parts. First, it should be evaluated whether the option can be put in practice. This requires a check on the availability and reliability of equipment, the effect on 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.

3. Economic Evaluation

The economic evaluation consists at least of data collection (regarding investments and operational costs, and benefits), choice between evaluation criteria (pay back period. Net Present Value (NPV) or Internal Rate of Return) and feasibility calculations. The economic data collection builds upon the results of the technical evaluation. In order to properly incorporate the long term economic advantages of cleaner production, it is highly recommendable to apply Total Cost Assessment principles to the economic evaluation (especially for high cost options). ·

4. Environmental Evaluation

The objective of environmental evaluation is to determine the positive and negative impacts of the option for the environment. An environmental evaluation must take into account the whole life-cycle of a product or service. There are essentially two types of life-cycle analyses: quantitative and qualitative. The quantitative method involves developing a set of criteria against which the environmental impact of a product can be measured and then actually measuring it against these criteria. Criteria may be developed using parameters such as: the cost of disposal or clean-up of the wastes generated at all stages in the life-cycle; the amount or cost of energy used at all stages in the life cycle; etc. The other, qualitative approach, is more useful for this assessment. It involves drawing up a matrix of environmental issues vs life cycle stages. ·

5. Selection of Feasible Options

First, the technically non-feasible options and the options without a significant environmental benefit can be eliminated. All remaining options can in principle be implemented. However, a selection is required in case of competing options or in case of limited funds.

6. Implementation and Continuation

In the last phase, the feasible prevention measures are implemented and provisions taken to ensure the ongoing application of CP. The development of such an ongoing programme requires monitoring and evaluation of the results achieved by the implementation of the first group of prevention measures.

The expected result of this phase is threefold:

1. Implementation of feasible CP measures
2. Monitoring and evaluation of the progress achieved by the implementation of the feasible options.
3. Initiation of ongoing Cleaner Production activities

To achieve this result, the following tasks should be implemented:

- Prepare CP Plan
- Implement Feasible CP Measures
- Monitor CP Progress:
- Sustain CP:

4.0 A Case Study at a Tobacco Processing Environment in Zimbabwe

The case study is based on a tobacco processing plant that has two main production lines that has a combined capacity of 17 000 kg per hour. These are run on three shift basis.

The first is threshing which is the separation of lamina from stem by grinding the butts in threshers and finally the tobacco is compacted and packed into cartons for shipment.

4.1 Environmental impacts and aspects of tobacco processing

IMPACT(EFFECT)	ASPECT(CAUSE)
Cacinogenic,Soil erosion and leaching from chemicals[7]	Tobacco smoke and dust
Environmental degradation	Vegetation clearing to make fields
Carbon dioxide green house gas	Fuels used for curing and coal in boilers
Tobacco dust/acid rain	Processing of leaf
Foreign currency earner	Exports
Phamaceuticals and chemicals	Raw material
Eutrophication as sewer discharges in dams	Boiler blowdon chemicals[8]
Destroys flora and fauna	Laboratory chemicals when testing nicotine and sugars in tobacco/ derivatives of cyanide
Aluminium Phosphine/Cislin	Fumigants for killing tobacco pests
Water pollution and siltation	Industrial Waste (Trade Effluent)
Pollution and respiratory diseases	Coal ash and dust:
Manure for farming and used to make organic fertilisers	Scrap tobacco and Dust:
Non-biodegradable damage environment	Plastics
Spillage destroys flora and fauna	Oil
Rust depletes oxygen in atmosphere	Scrap metal
Recycle can pollute environment	Hersian
Carbon dioxide green house gas and pollutes atmosphere	Diesel generators and Vehicles
Depletes coal reserves and pollute atmosphere during generation	Electricity
Needs conservation	Water usage

4.2 Material balance for the entire process

Table 4.1 Material balance for entire process

Inputs	Outputs + Accumulation
Baled tobacco + coal + cartons + strapping + liner plastics + heat + air dust + NTRM + water+chemicals	Packed lamina + Packed stem + scrap tobacco + dust + hersian + packaging waste + odour + coal ash + flue gases +

	condensate + trade effluent + product loss + Plastics + Straps+energy losses+chemical waste

Mass balance

According to weekly reports, at the end of the processing season 25,000,000Kg of tobacco was processed (Year 2000). Of this about 5% was waste (dust, Non Tobacco Related Material (NTRM), Tobacco scrap, long stem, short stem and stem). Therefore about 1,275,000kg is wasted.

All the inputs and outputs are weighed on accurately calibrated scales.

Water Usage Reports show an increase in 2003 compared with the same period under same operating conditions in 2002.Borehole water is not also not being effectively utilised at companies although there are installed.

Water balance for the whole process

(Water+tobacco+boiler chemicals+detergents+toilet use + gardening) = (Sewage slugde+trade effluent+packed moisture+Blowdown+suspended solids)

Electricity usage:

The maximum demand in KVA for the whole plant is greatly affected by 2x150kw rated 190 amps electric motors. Other motors contribute also but these are the main consumers of power. They are the first motors to be started.

4.3 Options for solving the above problems

Dust: Cleaning of tobacco at farms to remove dust. During threshing speeds of threshers should be accurately set, baskets should be sharpened and condition tobacco properly so that there is no excessive breaking of product. Housekeeping can improve the levels of dust in the working environment. **Re-engineering**: Companies can buy modern equipment that does not generate a lot of dust.

Process modification-Those processes that generate dust can be modified, for example the bundle buster can be removed and opening of tobacco hands done manually with knives. This will reduce the amount of dust. The removal of old dust units that generate some dust will see reduction in dust levels. The dust for loose leaf and farm stem can be linked to dust rooms for both A and B lines. This will not require a huge outlay of capital since the infrastructure is already there. This will not only reduce dust levels but will also save the organisation electricity.

Moisture loss: Cover conveyors with PVC covers. Re-dryer doors should be sealed so that it is easy to control the moisture of the product during re-drying and also reduces loss electricity.

Packing area: Product loss can be minimised by housekeeping and good workmanship. Scales should be calibrated all the times in accordance with supplier's recommendations.

Packing material damage: Accurate weighing of carton. Over filling of carton actually damages it.

Electricity: Energy management and scheduling of production. Installation of correct size of motors. An audit needs to do to establish the power requirements for different drives in the plant.

Scheduling: This is affected greatly by the two motors of dust rooms. These withdraw a lot of power. If conditions are such that there is no need to run both lines it is advisable to run one line. Lights should be switched off during the day

Coal: Use of quality coal for fewer emissions. Lagging of pipes to reduce heat losses. Water treatment and monitoring of emissions (Flue gas analysis). Complete combustion in the furnace of coal will reduce coal usage.

Water: Repair of leaks promptly. Re-cycling of wastewater and use for gardens to supplement the municipal water. Maintenance of sprinklers requires drainage of water weekly from the system. These drain tests need not be done weekly but twice a year.

4.2 ENVIRONMENTAL STRESS FACTORS (Noise, Heat, Dust and illumination)

The stress factors surveyed were noise, heat, dust and illumination. These were compared against national standards for limits. These factors are important in this paper as they quantify the actual amounts of pollutants in the work environment.

Sampling Methods

Stress factor	**Sampling Method**
Noise	Sound level metre/Dosimeter
Heat	Wet Bulb Globe Thermometer Area Heat Stress Monitor
Dust	Gillian pump with cassette holders.
Illumination	Luxmeter

Table 4.2 Recommended Exposure limits for stress factors

Stress factor	Standard	Origin of standard
Noise	90 decibels [dBs] (ACGIH standard 85 dBs)	Rhodesia Government Notices(RGN) 263 of 1976 section 6 sub 2

Dust total	10mg/m3 (3 mg/c.m)	NSSA
Heat	30 degrees Celsius	American Conference of Government Industrial Hygienist (ACGIH)
Illumination	300 lux at point of operation	RGN 262 of 1976 section 5 .Varies with visual task

Table 4.3 Heat results

Location	**Wet Globe Bulb Temperatue index Deg. Celsius**	**ACGIH Limit 30 Deg.C**
Compressor room	23.6	30
Butts conditioning cylinder	23	30

Table 4.4 Total Dust Sampling Results

Location	**Concentration mg/cubic. m**	**Time Weighted Avg. mg/cubic. m**	**National limit mg/cubic.m**	**Comment**
1st stage threshing A line	12.34	1.97	10	Action required
1st stage threshing static sample	12.78	1.87	10	Control experiment
1st stage threshing B line	9.36	6.58	10	Action required
2nd stage threshing B line	13.28	9.10	10	Action required
Feeding table A	4.74	0.99	10	Action required
Stems picking	2.26	0.00	10	Below limit
3rd stage threshing B	1.65	1.10	10	Below limit
	RESPIRABLE	**DUST**		

Cutting table	6.09	1.32	5	Action required

Table 4.5 Trade effluent sampling results

Parameter analysed	**Waste water drain effluent**	**Boiler blowdown**	**Kitchen effluent**	**comments**
	Units mg/litre			
Nitrites	Nil	0.13	Nil	Satisfactory
Nitrates	Nil	Nil	Nil	Satisfactory
Phosphates	1.8	7.1	0.46	High
PH	6.52	11.37	6.21	Too high
Ammonia	1.5	Trace	1.6	Satisfactory
Total suspended solids	190	171	60	Exceeds limits
Chloride	77	251	39	Satisfactory
Alkalinity	520	440	20	Exceeds limits

Table4.6 Summary of feasible CP options

Process	**Waste**	**CP solution**	**Budget**	**Start date**	**Responsibi lity**	**Review date**
Feeding table	Dust and NTRM	Clean tobacco at the farms and remove bundle buster	Labour rates at farms fixes this	1.Tobacco harvesting season 2.Maintenan ce period	1.Buying team 2.Engineeri ng manager	Seasonally/y early
Conditionin g	Steam and water	Improve settings for moisture	Non	As soon as possible(AS AP)	Factory manager	Daily

Threshing	Dust and noise	Improve settings, enclosed design,re-engineering and accoustal design for noise dumping	1.Non 2.Cost Benefit Analysis (CBA) 3.CBA	1.ASAP 2.Maintenance season	1.factory manager 2.Engineering manager	Daily 2.After commissioning
Separation	Dust and electricity	Improve skimmers and sizes of motors	1.Fixed by prices of ducting 2.Non	Week end maintenance	Engineering manager	Weekly
Redrying	Steam and electricity	1.Repair inspection doors and replace faulty fans 2.Improve settings	1.Cost of door felting 2.Spares cost		Engineering manager	Yearly
Packing	Product, oil, packing material	1.Settings 2.Equipment maintenance	1.Non 2.Outside contract	ASAP	Engineering manager	Monthly
Compressed air	1.Electricity 2. Compressed air pressure	1.Relocate compressors were air is free 2.Repair all leaks	1.Relocation costs 2.Non	1.Maintenance season 2.Immediately	Engineering manager	Monthly
Boiler		1. Lagging 2.Air monitoring 3.Quality coal	1.Source quotes 2.Qouatation 3.Next delivery	Maintenance season 2.ASAP 3.Next delivery date	Engineering manager	Monthly
processing	Electricity	1.Energy management and thermograph	1.Quotations	Maintenance season	Engineering manager	Every six months
Chemical laboratory	Chemicals	1.Process redesign or substitution	1.Resources permitting	If resources permit	Quality control manager	
Waste management	Plastics,paper,dust.coal and tobacco scrap	Re-use and recycling	Generates income by selling waste and removal of disposal	ASAP	Factory manager	Monthly

			fees			
Bore hole Water	Water	Water treatment plant installation for purifying	Capital injection ,quotation	Resources permitting	Engineering manager	After installation
Illumination	Stresses worker	Replace luminaries	Cost of luminaries. Audit quantity required	ASAP	Electrical section manager	Monthly
Heat	Heat	Lagging and covering of heat exchangers	Quotation	ASAP	Engineering manager	Once a year
Trade effluent including blow down	Harmful substances and pollutants	Segregate before disposal and re-use 2.Pre-treat and maintain boilers	1.Non 2.Quotation	ASAP	Engineering manager	Monthly
Dust extraction	Dust	Demolish old units and link to new ones	Outside contract	Maintenance season	m Engineering manager	After installation

5.0 Recommendations

5.1 Initial Environmental Review

Companies should establish a benchmark for comparison purposes. Tobacco companies can take a leaf from the practices at (Tobacco Processing Zimbabwe) that is ISO 14001 certified. What are the current practices, environmental issues and requirements, views of interested parties and opportunities for improvement.

Opportunity for improvement

A CP assessment or environmental audit carried out establishes this. The areas for improvement are the reduction of dust by re-engineering and controls. Improvement of the waste management policy by focussing on re-use, recycling and minimisation of waste. Making sure that relevant permits are acquired for discharge of wastes. Those options that require no cost like house keeping and proper operating procedures and settings can be implemented immediately.

Review techniques:

Questionnaires, checklists on certain processes, interviews, audits and inspections.

Measurements can be repeated for environmental stress factors to quantify the current exposure limits.

Review instruments:

Mass balance of inputs and outputs, flow diagrams to establish those processes that release pollutants with a view of taking corrective action, hazards identification.

Documentation and records survey e.g. material safety data sheets and training records. Review of accident statistics and accident investigation records.

Internal data sources:

Company site plans, these should show the plant location in relation with other businesses. Approval from the local council and any necessary amendments.

Permits:

Companies should take steps to apply for the permits in order to comply with regulations as this is a requirement of ISO 14001.This will also protect companies from prosecution which actually tarnish the image of the company. Insurance premiums will also be lower if the organisation has minimum risk. The company should acquire the following permits:

- Fumigants
- Chemical waste from the laboratory
- Air quality
- Boiler blowdown:
- Ground water permits for the existing boreholes.
- Environmental impact assessment in terms of section 100 of Environmental Management Act.
- Waste licence

Waste handling procedures:

Companies are recommended to do the following in order to reduce waste:

Dust can be sold to those companies that manufacture organic fertilisers that are environmental friendly.This actually creates income for the company without polluting the environment by substituting chemical fertilisers.

Coal ash can be used by those companies which manufacture cement for a small fee to recover costs of transport. By so doing the company eliminates waste by re-use.The coal ash can still be used for construction purpose this policy can still be maintained.

Trade effluent: From the canteen and the factory wastewater. This can be filtered to remove the solids, organic particles and fats. Organic material can be used in the gardens and the fats can be used by those small companies which make soap.

Plastics and paper: This can be segregated first and send them for recycling.

Rubble: Re used in the construction industry.

Chemical waste: Process change can see elimination of waste.

5.2 ISO 14001 Certification with CP as a Base for Implementation.

The implementation should follow a non-default approach with emphasises sustainability of use of resources at the same time benefiting from them. The model has been outlined before as it aims to conserve the resources and thinks beyond profits, direct impacts but focuses on life cycle thinking, eco-efficiency and conservation of the natural resources like the soil and prevention of pollution of water and the atmosphere. The organisation should have inspirational stretch goals which aim at total reduction of pollution and conservation of natural resources.

A cost benefit analysis should be conducted before implementation of the CP proposals. Most of these proposals actual do not cost the organisation but creates wealth by eliminating waste and improving outputs. Some of the proposals actually make the environment pleasant to work in, as there are no environmental stress factors to the employees. Selling of waste by recycling and re-use will actually create wealth for the organisation. Conservation of water and energy will see bills with reduced cost and these savings can actually be channeled somewhere for the benefit of the organisation.

6. Conclusion

Implementing CP options in the said tobacco processing companies can reduce waste and conserve energy. This will translate into improved environmental performance of the company and improved profit margin.

The opportunities presented can be used to form basis of environmental objectives of the company's CP and ISO 14001 are compatible hence they can be integrated into one Environmental management System. Implementation of ISO 14001 is done as an internal project that runs concurrently with existing operations of the organization. Options that do not need capital outlay should be implemented immediately.

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