

Cleaner Production Assessment with Environment Management System

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ABSTRACT

The research study was carried out with the aim of reducing the wastage as well as increases the productivity and efficiency by introducing new methods instead of their old methods. Though it is generated high wastages, the printing industry is one of the profitable industries in Sri Lanka. Hence one of the main problems of the printing industry is the wastage as well as the use of toxic chemical emissions are highly affected to the human beings and environment directly or indirectly. Therefore, this study was done to reduce their operating costs through a systematic process and avoids the creation of pollutants of identifying *Cleaner Production Opportunities*. Screen printing section is the main focused area of the research, because its activities are conducted with other main printing techniques together such as pre press, offset etc. Then the research could cover wide area of the printing activities.

KEY WORDS: Cleaner production, Feasibility Analysis, Offset printing, Production Flaw, Screen Printing, Waste and Emission

1. INTRODUCTION

At the initial stages of the printing industry, Sri Lanka had only the Letter Press process of printing and today the printing industry has diversified into Offset, Flexo, Gravure, Silk Screen and to the Digital printing. In the early eras of agricultural based industrialization namely, the Tea, Coconut and the Rubber industry, printing was used to the daily needs of the stationery and of course in the 1950's for newspapers, novels and textbooks printing. The organization, in which the research was carried out, is one of the key players of Sri Lankan printing industry.

The organization meets the needs of Sri Lanka's largest export industries such as Tea and Apparel, and is a supplier of quality packaging for many of the world's renowned brands. The company (Print Care) engages in different types of printing.

The company is housed in a custom built factory and equipped with state of the art machinery and rates its product to be on par with European print standards. Indeed today the group exports to nearly 20 countries and some of the most famous brands in the world.

Printing is described as the process of transferring ink onto paper via a printing plate. The selected organization basically uses the Lithography and Screen Printing technologies.

Research Objectives

The primary objective of the study is to improve the productivity of printing industry. To achieve the objective, the study focuses on;

- Minimizing resource use
- Reducing their operating costs through a systematic process
- Implementing with cost-effective measures and
- Avoiding the creation of pollutants of identifying cleaner production opportunities.

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2. LITERATURE REVIEW

Cleaner Production

The principle behind CP is that the improving environmental performance, consumer interest, health & safety for workers. It also improves efficiency, profitability & competitiveness of the industry. The main focus of cleaner production is on prevention or reduction of waste and inefficient use of energy and resources.

CP covers some concepts such as energy and raw materials conservation, elimination of toxic substances and reducing the quantity of wastes created by processes and products, thereby lowering the quantity emitted to air, land and water.

The basic definition of Cleaner Production state that;

“Cleaner Production is 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 processes used in any industry, to products themselves and to various services provided in society.

For production processes, Cleaner Production results from one or a combination of conserving 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 the production process.

For products, Cleaner Production aims to reduce the environmental, health and safety impacts of products over their entire life cycles, from raw materials extraction,

through manufacturing and use, to the 'ultimate' disposal of the product.

For services, Cleaner Production implies incorporating environmental concerns into designing and delivering services. The basic CP methodology consists of the following principal elements

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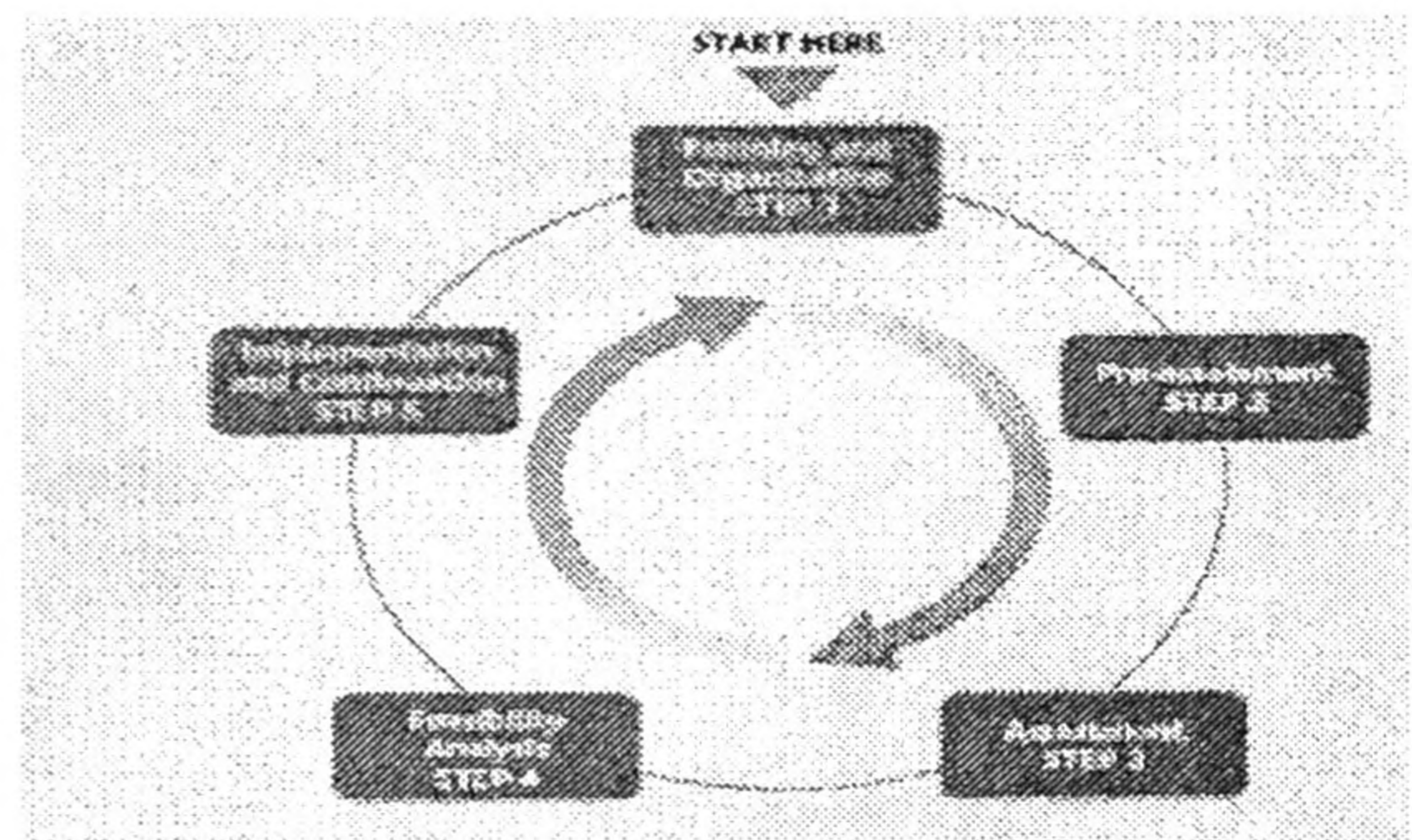


Figure 1- Cleaner Production Assessment Methodology

3. DATA COLLECTION, METHODOLOGY AND ANALYSIS

The rest of this study describes the steps within a Cleaner Production Assessment as outlined in the UNIDO document and Guidance Materials for UNIDO/UNEP National Cleaner Production Centres. The steps from this methodology are detailed further in Figure 1

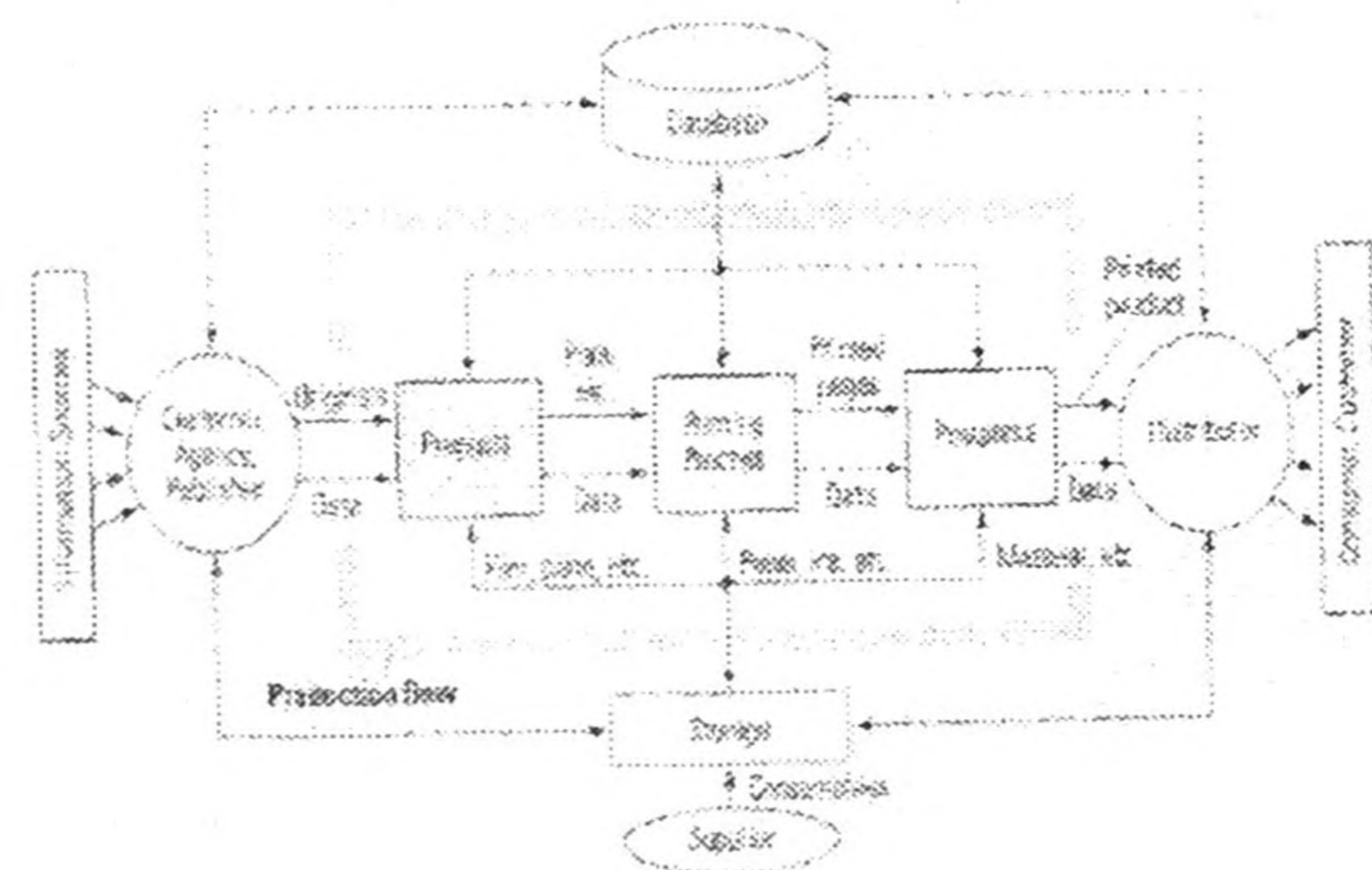


Figure 2 - Printing Process

| Type of information | Available | Not Available | Requires updating | Not applicable |
|--|-----------|---------------|-------------------|----------------|
| Process Information | | | | |
| Process flow diagram | | | ✓ | |
| Material balance data | ✓ | | | |
| Energy balance data | | ✓ | | |
| Site plans | | ✓ | | |
| Drainage diagrams | | ✓ | | |
| Operating procedures* | ✓ | | | |
| Equipment list & specifications | | | ✓ | |
| Regulatory Information | | | | |
| Waste license(s) | | | ✓ | |
| Trade waste agreement(s) | ✓ | | | |
| Environmental monitoring records | | ✓ | | |
| Environmental audit reports | | ✓ | | |
| Raw Material/Production Information | | | | |
| Material safety data sheets | | ✓ | | |
| Product & raw material inventories | ✓ | | | |
| Production schedules | ✓ | | | |
| Product composition & batch sheets | ✓ | | | |
| Accounting Information | | | | |
| Waste handling, treatment & disposal costs | ✓ | | | |
| Water & sewer costs | | | ✓ | |
| Product, energy & raw material costs | | | ✓ | |
| Operating & maintenance costs | | | ✓ | |
| Insurance costs | ✓ | | | |

Table 1- Current Environmental Performance

3.1 PLANNING AND ORGANIZING

The first step of the CP assessment methodology is planning and organizing. Current Environment performance should be analyzed as a step of planning

As shown in Figure 2, the production flow involved in the production of print media comprises the stages of prepress, the actual printing process (Press) itself, and finishing (post press). These individual production stages are connected by the flow of materials, such as printing plates between prepress and press and printed sheets between press and postpress.

There is usually some existing operational on the business that can be useful in understanding the operations. These data

can help summarize what information exists about the operations. Table 1 can be used to get an idea about the company existing information and the required information. of the overall operation's performance. The required information and can be improved further.

The most important types of waste and emissions

| Waste/ Emission | Quantity Percentage | Measuring Unit/Year |
|---------------------------------|---------------------|---------------------|
| Offset Printing | | |
| Ink | 13% | Kg |
| Paper | 1%-2% | No of Sheet |
| Washed Water | 300 | Liter |
| Washed Alcohol | 100 | Liter |
| Fountain | 50 | Liter |
| Anti setoff Powder | NA | Kg |
| Screen Printing | | |
| Transper Paper | 12%-25% | No of Sheet |
| Transfer adhesive Powder | 7.35% | Kg |
| CHROMA Screen Ink | 0.95% | Kg |
| LP Gas | NA | Kg |
| Coating Gel (FOTECHEM) | NA | g |
| Washed water | 300 | Liter |

Table 2- The Most Important Waste & Emission

There are considerable number of waste and emission in the printing company however the following waste and emission are most harmful to the company as well as to the employee and to the environment. Transfer adhesive Powder, Coating Gel, Washed water etc. and these are used by the workers always and it will affect to them.

The Washed water include various type of chemical and it released to the environment without any cleaning and it will be affected to the soil pollution and human life. The Table 2 has been mentioned about the most important waste and emission with quantity that averagely occurred.

3.2 PRE-ASSESSMENT

The second step is the CP methodology is Pre Assessment. The process flow chart shows the key steps in the assessment and forms the basis for material and energy balances. The cleaning; materials storage and handling, ancillary operations (cooling, steam and compressed air production), equipment maintenance and repair, materials can be identified by using the process flow diagram and identified the unnecessary process also.

3.3 DETAIL ASSESSMENT

Data Collection

First step is the quantitative assessment of the chosen processes. It is important to collect data on the quantities of resources consumed and wastes and emissions generated. Data have been represented based on the scale of production:

The environmental assessment and the efficiency of production processes can be

evaluated by using this data. The management activities also included when these data were collected.

Next step is the Material and Energy Balance Analysis. The purpose of undertaking a balance is to account for the consumption of raw materials and energy that are consumed by the process, and the losses, wastes and emissions resulting from the process. A balance is based on the principle of 'what comes into a plant or process must equal what comes out'. Ideally inputs should equal outputs, but in practice this is rarely the case, and some judgment is required to determine what level of accuracy is acceptable.

A balance makes it possible to identify and quantify previously unknown losses, wastes or emissions, and provide an indication of their sources and causes.

Solutions and Option Generations

Generating options is a creative process. Like cause diagnosis. Involving employees in this activity will help to develop a sense of ownership of the options generated. Options are generated by brainstorming, a commonly used tool for generating ideas are asking some questions from the relevant worker to get the solution when faced some problems. The questions just like, How? How do we solve this problem effectively? etc. CP options may fall into one of the following categories:

Housekeeping:

Improvements to work practices and methods, proper maintenance of equipment, etc., come into this category. Good housekeeping can provide significant benefits in terms of resource savings. These options are low cost and provide low to moderate benefits.

Process Control:

Process control involves explanation of the process sequences, combining or modifying process operations to save on

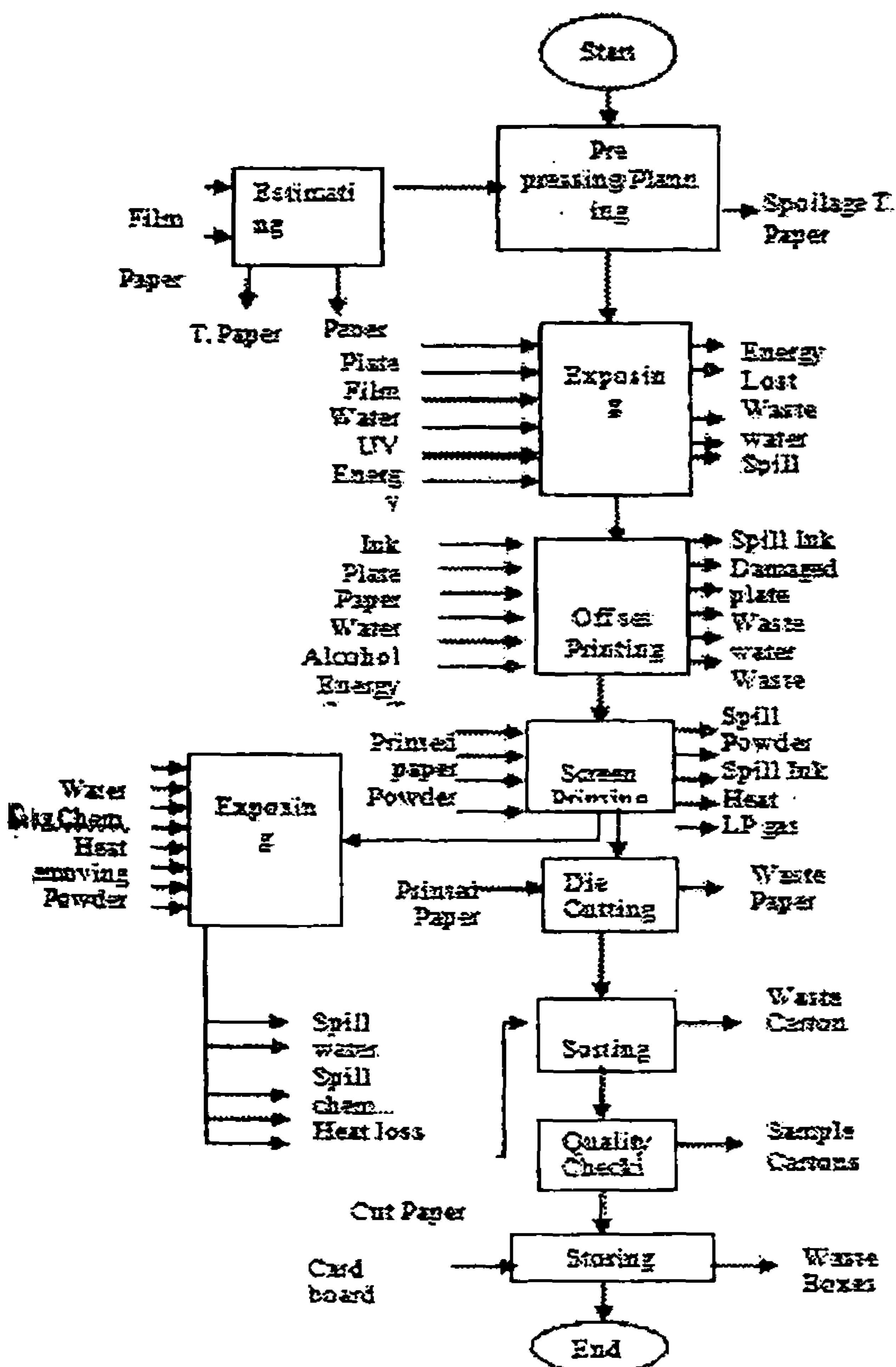


Figure 3-Production Flow Diagram

material and energy resources and time, and improving process efficiency.

Technology Change:

New technologies are often more resource efficient and help in reducing energy and material wastes, as well as increasing throughput or productivity. These options are often capital intensive but can lead to potentially high benefits.

Modifications in equipment design:

Equipment modification is another option. They tend to be less capital intensive and can lead to potentially high benefits.

Raw material change:

There may be better options for primary and supplementary raw materials in terms of cost, process efficiency or reduced health and safety related hazards, and these options can be substituted for the current materials. Whenever materials are substituted, it is crucial to test the appropriateness of the new material in terms of environmental and economic benefits, optimum concentration, product quality, productivity, and improved working conditions.

3.4 FEASIBILITY ANALYSIS FOR CP SOLUTIONS

The fourth step of the CP methodology is the Feasibility Analysis.

Technical Feasibility

Technical feasibility examines whether the technology is available to the firm, is appropriate and can achieve the required

Economic Feasibility

Economic feasibility compares current savings with costs of implementing the option. The likely payback period for any capital investment is often the simplest method for assessing economic feasibility. Basically this is considered that the cleaner production options are cost effective for the company.

Environmental Feasibility

Environmental feasibility determines the environmental benefits or effect (positive or negative) of each option on the company's environmental objectives, regulatory requirements, customers, employees and the general community.

| Process | Implementation | Technical Feasibility | Economic Feasibility | Environ. Feasibility | Investment R | Annual Saving | Payback Period |
|--|----------------|-----------------------|----------------------|----------------------|--------------|------------------------|----------------|
| Spillage Transfer Adhesive Powder Minimize | * | * | * | * | 7,621,090 | 2,640,708 | 2.8 year |
| LP Heat Energy Wastage Minimize | * | * | ? | * | 874,285.2 | 437142.60 | 0.5 year |
| Transfer Paper waste Minimize | * | * | * | * | 7,952,799 | 636223 | 12.5 |
| Adding a Paper supplying part | ? | * | * | * | 00 | Increase Productivity | 00 |
| Conveyer belt Change | * | * | * | * | 00 | Minimize paper wastage | 00 |
| Sorting Layout Change | * | * | * | * | 00 | Avoid mixed up | 00 |

Table 3-Feasibility Analysis

The evaluation has paid attention to the;

- The quantity of waste or emissions generated.
- The release of hazardous, toxic, or non-biodegradable wastes or emissions
- Consumption of non-renewable natural resources, e.g. fossil fuels consumed
- Noise levels.
- Odor and dust nuisance (by elimination of a substance causing odor).

- Release of globally important pollutants, e.g. ozone depleting substances, persistent pollutants, etc.
- Compressed air distribution system etc.
- Water supply and drainage networks
- Safety and environmental risks

3.5 IMPLEMENTING CLEANER PRODUCTION AND CONTINUES IMPROVEMENT

Last step of the CP methodology is the implementation. A list of selected options is in the previous phase and the objective of it is the selected options are implemented, and the resulting reductions in the resource consumption and waste generation are monitored continuously. Now it's time to implement them.

Action Plan for Implementation

| Identified Processes with CP Opportunities | CP Focus | Priority | Remarks | |
|--|------------------|---|---------|---|
| 1 | Exposing | Washed water with Gunning & Developer | 9 | The washed water is toxic |
| 2 | Off set Printing | Ink Wastage | 4 | |
| | | No of make ready Impressions | 7 | |
| | | Washed water with super blue ,alcohol & ink | 8 | |
| 3 | Screen Printing | Spillage Transfer Adhesive Powder | 1 | Considerable amount of wastage generated |
| 4 | | Energy Waste | 2 | Considerable amount of LP Gas wastage generated |
| 5 | | Litho White Backup Ink wastage | 5 | |
| 6 | | Washed water wastage | 6 | The washed water is toxic |
| 7 | | Printed impressions | 3 | Due to register out |

Table 4-Audit Focus and Priortization for CP

4. CONCLUSION

According to the Table 4 the first priority in the CP Assessment goes to minimize the spillage of Transfer Adhesive Powder in the screen printing section. It is a main raw material in the production process and very expensive, very toxic material to

the health. As well as the waste generation amount is considerable. Then the applying method should be using machine or using a tub. Also it can be reduced by using large particle powder

Next, the CP Assessment should be focused to minimize the energy wastage when heat generating from LP Gas. When considering the surface that the heat touch is very large but the utilization area is half of the touching area. The balance heat energy is wastage. The consumption area can be increased by increasing productivity. It means, adding new paper supplying point to the Serifast Machine for printing two papers at once or if not increase the paper size by using another offset printing machine without GTO machine.

| Process | Task | Resources needed (if any) | Responsible person | Time Duration |
|---------|--|---------------------------|----------------------|---------------|
| 1. | Changed the powder applying system | | Factory Manager | 2 Months |
| 2. | Place additional paper dropper | Available | Maintenance Manager | 3 Months |
| 3. | Conveyer belt modification | Available | Production Executive | 1 Month |
| 4. | Modify the Heat surface | Available | Maintenance Manager | 3 Months |
| 5. | Floor Modification | | Production Executive | 1 Month |
| 6 | Modify the powder applying location due to damaged the screen of the machine | Available | Factory Manager | 2 Months |
| 7 | Change the layout of sorting section | Available | Production Executive | 3 Weeks |
| 8 | Waste water transport to the under ground pit | Available | Factory Manager | 1 Month |

Table 5--Action Plan

Printed impression wastage is also very high. There are lots of reasons to waste the impressions. Especially the inks are printed out of the image on the paper due to some temperature changers, because the papers are stretched by absorbing the water. Then Screen print should be done after offset

printing as soon as possible or both of machines should be kept in same the temperature.

There are various kinds of papers and it varies from thickness and materials. Some board has dust and it will cause to generate waste because it is damage to printed area with removing the ink. Therefore quality board should be bought and the machine should service after a fixed periodical time usually.

5. REFERENCES

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