WASTE MINIMIZATION - AN INTEGRATED APPROACH

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Abstract: This paper depicts the author's belief that a waste minimization program for any printing plant ought to be devised not from a traditional point of view, i.e. only on the wastes generated during routine printing operation, such as printed paper waste, used inks, waste solvents, and used chemistry. Instead, an integrated approach, which encompasses all facets of the printing operation from art design to final product that contribute to the waste generation, such as film and plate remakes, makereadys, job reruns, and many others, should be utilized. The author also introduces a new concept, "chained, blown-up effect on waste generation," to deal with the waste generation problem in printing plants due to the many unique characteristics of printing processes. The benefits of an integrated waste minimization program and recommendations to set up one are also discussed.

Introduction

Since the mandatory requirement of hazardous waste minimization promulgated in the 1984 Hazardous and Solid Waste Amendment Act by the U.S. Congress, a majority of industries have been putting a lot of emphasis and effort on the control and reduction of waste generation.[1] Printing industry, of course, is no exception because it generates a lot of printed paper wastes, used ink, spent photoprocessing fluids, waste chemistry, and many others. As a matter of fact, most printers, big or small, have been conducting waste minimization through recycling of the waste paper of all sorts generated in their plants for many years. However, it is not a major concern yet for many printers to

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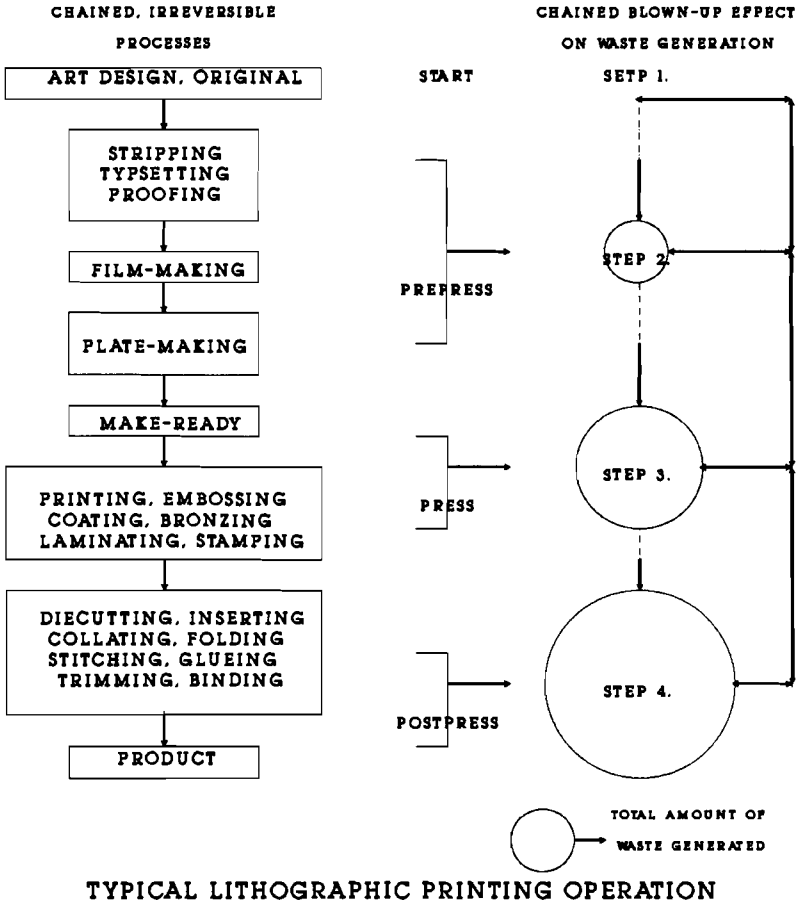
figure out from the printing process point of view what causes the wastes to be generated and what can be done to reduce them. In addition, other forms of waste that contribute to waste generation, such as wasted manpower, equipment time, makeready time, and energy, poor art design, film and plate remake, job delay, job rerun, unnecessary and forced overtime, equipment breakdown, are constantly overlooked by many printers because those items have no physical shape and can not be easily evaluated. They can only be checked and examined through statistical evaluation, such as using statistical process control (SPC). After reviewing the printing operations of more than one hundred printing plants, it is the author's belief that those aforementioned may be the key factors causing the generation of a majority of the wastes (paper, ink, chemistry, etc.) in many printing plants. They are the real culprits that cause the low operational efficiency, high operating cost, and poor profit. What really causes all of these are the four unique characteristics of a typical printing operation.

Chained, Irreversible Processes

The general process flow diagram of a typical lithographic printing plant operation is shown on the left on Figure 1. As the diagram indicates, each process is tightly linked to the one below. The one on the top leads and feeds into the next. Each process is essential and important to the entire operation just like a link in a piece of chain. Henceforth, each process is literally "chained" to every other process.

The specific product made in each process, such as film, plate, or final product, is very difficult to correct once it is made. Any modification, change, or correction almost always requires a remake of the entire process unless it is just a minor correction, such as a touch-up on a piece of film or plate. In other words, each and every process is irreversible; once it is done, it is history. For example, if a flaw is found on a piece of film made, there is very little printers can do but to remake it. Otherwise, the flaw if

FIGURE 1. CHAINED, BLOWN-UP EFFECT ON WASTE GENERATION



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not corrected in time will be carried through platemaking, makeready, printing, and finishing, and show up in the final printed product. The product eventually will be rejected by the customer who ordered it. By then, everything involved in the making of the final product, including film, plate, paper, chemistry, ink, wash solvents, manpower, equipment time, press time, and utilities are all wasted. And the entire job will have to be rerun. In situations like this, quality control (QC) may be the only recourse printers have. In fact, QC is the critical path for the successful completion of any printing job.

Product and Raw Material Relationship

Since all processes in a typical printing plant operation are chained together, it is quite easy to recognize that the first printing process generates a product that is used as a raw material for the second process to produce the second product. The second product in turn is then used as a raw material for the third process to produce the third product. The procedure keeps on going until the final product is made. This is a unique relationship in any printing plant operation because each process generates its own product while the product itself also serves as a raw material for the next process.

There is one not easily recognized but critical situation which exists in this unique relationship. The situation is that the product generated from the first process after checking gets passed onto the second process. And the technician in the second process accepts it as is because it is extremely difficult for him to detect any flaw beforehand. In other words, the second process is always at the mercy of the first process and so on and so forth until the final product can be physically checked and evaluated. For example, the platemaking technician is not able to detect any flaws from a piece of film until the plate he made is used in makeready by the pressman to produce a sample product. By then and only then, can a flaw be detected through the images printed. If a flaw is present, the plate

has to be examined to determine whether the flaw is from the platemaking or further up from the filmmaking, or even from the stripping of the original art design. Still, the plate or/and the film may have to be remade and plenty of waste has been generated.

Chained, Blown-up Effect on Waste Generation

Each and every process is essential to the entire printing operation even though each process is independent and also quite different from each other. They also play a very important role in the control of waste generation, including both types of wastes: wastes that can be physically checked and wastes that can only be statistically evaluated.

Because of the unique chained, irreversible situation and the special product and raw material relationship among processes in printing operation, wastes are generated in three different fashions: (a) Each process is capable of passing on the errors onto the next process and causes everything used to produce the product in the second process to go completely wasted plus itself due to errors; (b) The situation in (a) can carry right on through the entire operation undetected and cause everything used and produced to become wasted; and (c) All wastes generated are cumulative. In other words, wastes generated can pile up and expand like a balloon blown up to an outrageous proportion. See the figure on the right in Figure 1. For example, a flawed original art design has passed through the entire operation, from prepress to postpress without being detected until finally caught by the customer. In this case, not only the final product becomes waste, but also everything that is used, produced, and involved in the making of the product, including film and plate made, paper, ink, chemistry, makeready, manpower, equipment time, and utilities, is wasted. In addition, the entire job still has to be rerun, forced and unnecessary overtime may be required if time constraint is imposed on the job, and unnecessary delays of other jobs may become a reality, which

in turn eventually may involve more forced and unnecessary overtime. Table 1. shows a list of wastes that may be generated in each step of a typical printing operation. This list truly demonstrates the core of the chained, blown-up effect on waste generation.

In Figure 2, the graph shows an analysis of the cost caused by wastes generated in a medium sized printing plant. The cost is figured in dollars encompassing all types of waste. On a regular day with minimum mistakes made in each step, the total waste generated costs the company more than $2,000 per day (Case #1). On a typical bad day when everything is not going well, the total waste generated costs the company a staggering $25,000 per day (Case #2). This graph vividly shows the chained, blown-up effect on waste generation and may provide some answers to why some printers only enjoy a fairly low profit margin.

Final Product and Customer Relationship

This is also another very unique situation in printing. The final printed product has to meet the eyes of the customer to be acceptable, not the approval from the management of the plant. The job must be done perfectly as perceived by the customer, or all the effort may be wasted and the whole job has to be rerun. There is almost no tolerance level. This unique relationship is also a major contributor to a lot of waste generated in a typical printing plant mainly because of a lot of job reruns.

Recommendations for An Integrated Waste Minimization Program

Caring. Management need to promote the feeling of "caring" among employees as well as towards work. If all employees care about themselves and the work they do, there will be a lot less errors and in turn, very little waste generated. Hence, caring actually brings about a hidden quality process because each employee will feel proud of what he/she does and will also feel that his/her work is equally important. In a nutshell, the

Table 1. Wastes Generated Due To The Chained, Blown-up Effect

Step 1. Start -

A new job's art design, original picture, or film if not thoroughly checked, may cause film remake, plate remake, or the entire job from film making to finishing to go completely wasted.

Step 2. Prepress - Two types of waste:

a. Waste that can be physically examined - This type may include films, plates, film and plate processing chemistry, water, glues, cleaning solvents, and others used in stripping, film and plate making.

b. Waste that can not be physically examined but can be statistically evaluated - This type may include equipment time, manpower, maintenance cost, film and plate rerun, energy, and job rerun.

Step 3. Press - Three types of waste:

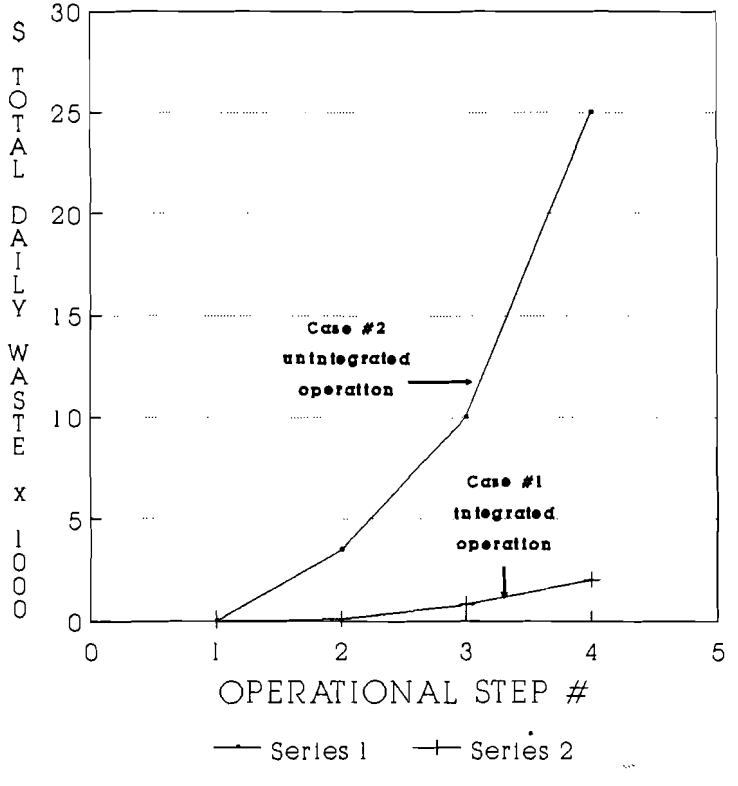
a. Waste that can be physically examined - This type may include printed paper, varnish, ink, coating, wash solvent, and others used during the printing operation.

b. Waste that can not be physically examined but can be statistically evaluated - This type may include press time, energy, manpower, makeready time, job reruns and delays, overtime, equipment time, unnecessary equipment downtime and repair.

c. Everything that is used and produced in Step 2., prepress, above.

Step 4. Postpress - Waste generated may include glue, stitches, equipment time, manpower, energy, waste handling as well as every is used and produced in Steps 2. and 3. above.

FIGURE 2. TOTAL AMOUNT OF WASTE GENERATED DAILY ($)



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sense of caring creates a good morale among all employees within an organization.[2]

Education and Training. This may be the most neglected function in a printing plant. The entire printing operation is technically oriented, especially with the utilization of computer technology in the last decade. If employees are not educated and trained properly to do their work despite the technological advancement in printing equipment, the management should not expect efficient and effective production out of them. Instead, a lot of error and waste should be expected.

Statistical Process Control (SPC). The management needs to set up some form of statistical process control in each process so that it can keep track of what is going on. SPC may also be able to detect problems in each process before they get out of control. Problems usually always lead to waste.

Written Program. The management should prepare a written integrated waste minimization program with realistic goals and targets. The progress towards each goal and target must be checked periodically or the program is just a piece of paper and becomes a waste itself.

Benefits of an Integrated Waste Minimization Program

Reduced Waste generation.
Improved operational efficiency.
Higher profit margin.
Higher morale.
Improved pollution prevention and resource conservation.

Conclusions

There are four key factors contributing to the generation of wastes in a typical printing plant. Those factors include chained, irreversible processes, the product and raw material relationship, the chained, blown-up effect on

waste generation, and a unique customer and product relationship. They not only play a key role in the generation of waste but also largely contribute to the ineffective and inefficient utilization of manpower, equipment time, raw materials, energy, and facility.

The overall waste generation must be reviewed from an integrated approach which encompasses all wastes generated as well as everything that is involved in the generation of waste. The management must institute an integrated waste minimization program which incorporates provisions to handle those four unique characteristics, utilize statistical process control techniques, and involve all employees. Then higher profit margin and operational efficiency can be expected and materialized.

Acknowledgment

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