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EP3 Environmental Pollution Prevention Project

CASE STUDY

Pollution Prevention Assessment for a Carton and Packaging Printer

Executive Summary

A pollution prevention diagnostic assessment was done at a packaging printing facility. The objectives of this assessment were: 1) to identify pollution prevention options that would reduce the quantity of toxics, raw materials and energy used in the manufacturing process and thereby reduce industrial pollution and worker exposure to toxic chemicals, and 2) to demonstrate the environmental and economic value of a comprehensive pollution prevention assessment and improve manufacturing competitiveness and product quality for this facility. The assessment was performed by an EP3 team comprised of an expert in the packaging printing process and a pollution prevention specialist.

The assessment identified 8 key pollution prevention opportuntities, many of which are applicable to more than one of the processes and/or presses. For an investment of US$71,000 (plus some additional repair costs), this facility could save between $405,000 - $439,000 on an annual basis.

The assessment identified 5 low-cost actions which would reduce the amount of ink sent to the sewers and landfill by 2.5 metric tons per year, reduce solvent use by 20 tons per year, reduce wastes sent to the landfill, and reduce air emissions. These measures could save the facility $184,000 per year.

Three higher cost measures would reduce wastes sent to the landfill by over 20 tons per year and reduce air emissions. For a total investment of $71,000, savings to the facility could reach $255,000 per year.

Facility Background

This facility is a packaging printer that produces packaging material for the flexible and folded carton industries. It employs one hundred and eighty workers in a multi-shift operation, six days a week. It produces six thousand tons of folding cartons per year and one thousand tons of flexible packaging per year. Seventeen percent of the yearly sales volume is export sales.

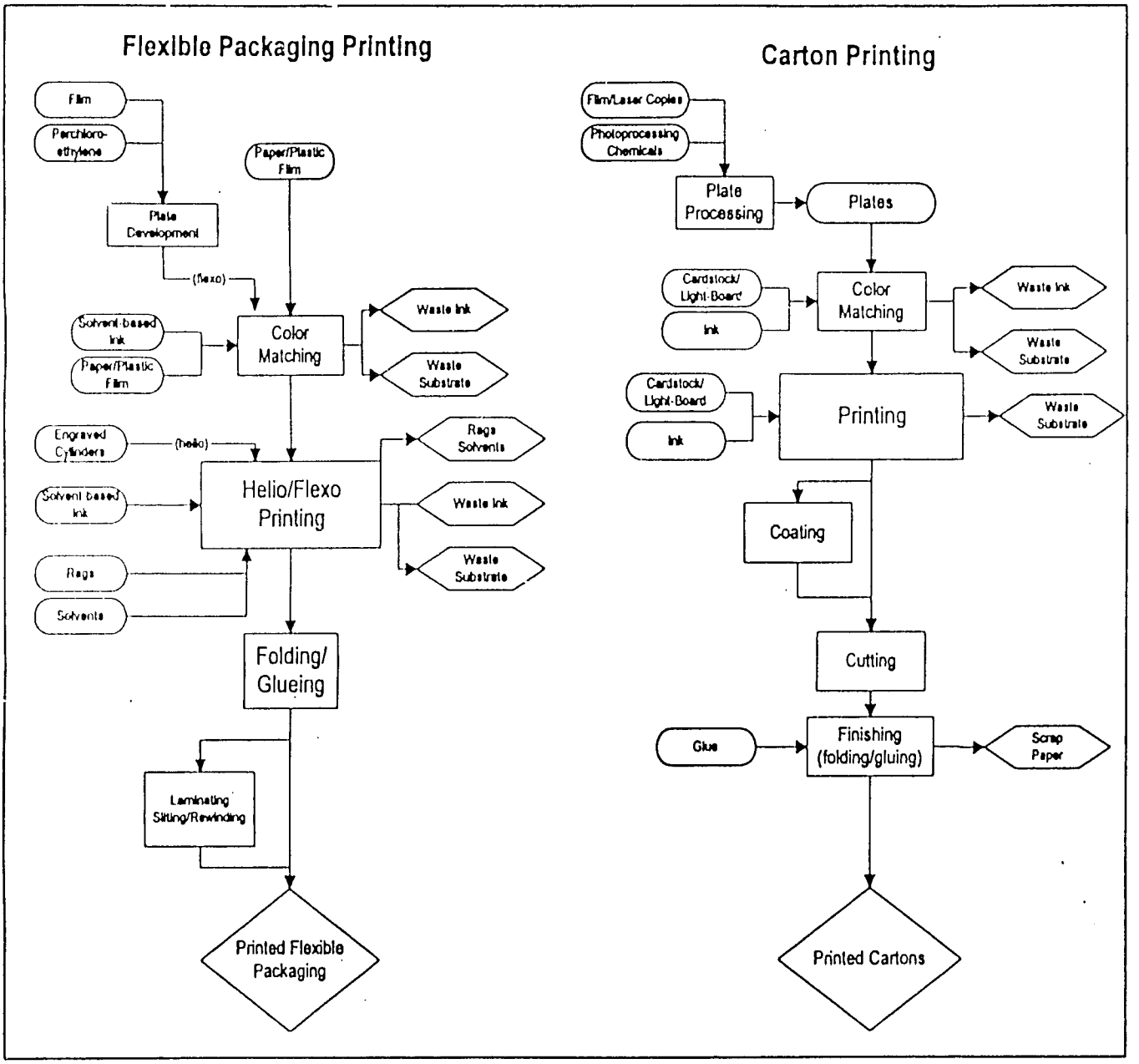
Plant and Process Description

This facility is divided into two areas, one which produces flexible packaging and one which produces folding cartons. These two divisions use different printing and converting processes.

In the flexible packaging division, two different printing processes are used in this area: flexo and helio gravure. There is one six-color web helio press and five flexo presses. Four of the flexo presses print four colors and fold and glue bags on the delivery end. The fifth press, which does the majority of the flexo work, is a newer four-color press with a more sophisticated inking system. Most products printed on these presses are slit and rewound or laminated in a solventless laminating machine. Once the product has been slit and rewound into appropriate size rolls, it is ready for shipment to the customer.

The carton producing area uses offset presses to print on card stock and light board. All of the 5 presses are sheet feed and sheet delivery. All die cutting and

Figure 1: Overview of Facility's Printing Process



finishing is done off the printing presses on separate machinery. Work is produced in this offset printing area by running the sheets through presses multiple times in order to achieve the proper number of colors for a given job. This requires a large storage area in the center of this offset printing area. Some sheets are then sent to a coating machine which applies a UV varnish to one side and cures it in a UV chamber. Once jobs are completed they are then sent to the cutting area where the product is cut into sheet form. The packages must be separated by hand. The goods are then counted and packed for shipment.

The offset division has a small photo lab and plate processing area. The photo lab receives input from films and output from their laser printer to be photographed. The films are processed in an automatic film processor.

Environmental Problems

The primary inputs at this printing facility are the paper and plastic film that are printed to produce the flexible and carton packaging. The key environmental impacts are the waste packaging produced due to color matching errors, fouling of the presses, and scrap wastes. The result is excess printed material sent to the landfill and wasted ink. Additional problems are the use of solvent-based inks, air emissions, and to a much lesser degree wastes from the small photoprocessing unit.

Table I: Summary of Recommended Pollution Prevention Opportuntities

Operation	Pollution Prevention Action	Environmental Benefit	Implementation Cost (US$)	Financial Benefit (US$)	Payback Period
Color Matching	Use weight-based color system and increase lighting	Reduce waste by 1-2% to landfill; reduce ethyl acetate emissions	minimal	30,000/yr	not quantified
Ink Usage	Repair scale; keep records	Reduce waste ink sent to sewer and landfill by 1,000 kg/yr.	100	1,000/yr	1 month
Waterbased Ink	Convert to waterbased ink for flexible packaging on paper	Reduce solvent use by 5%; reduce air emissions by 63 tons/yr.	Additional cost for waterbased ink	126,000/yr.	immediate
Print Quality	Repair equipment; purchase lights	Reduce printed wastes to landfill	3,000 plus repairs	34,000-68,000/yr.	about 1 month
Press Setup and Cleanup	Replace rags with rubber squeegees	Reduce volume of rags to landfill (1,900 kg/yr.) and reduce solvent use (900 kg/yr.)	minimal	2,300/yr.	not quantified
Dust Control	Institute various dust reduction measures	Decrease waste sent to landfill by 10 tons/yr.	68,000	157,000/yr.	5 months
Solvent Usage	Put lids on containers and use a summer blend of ink	Decrease solvent use by 20,000 kg/yr. and reduce solvent emissions	minimal	40,000/yr.	immediate
Recycle Ink	Filter ink and recycle into black ink	Reduce amount of ink to the landfill or sewer by 1,500 kg/yr.	minimal	15,000/yr	not quantified
Total			71,100 + repair costs	405,300-439,300/yr.	

Pollution Prevention Opportunities

Opportunties were identified for each of the printing processes at this facility. **Table 1** summarizes these options.

Color Matching: To match the color of the customer's sample, inks are mixed and samples are run on the press. A color mixing procedure based on formulas using weights (such as a Pantone color system) should be adopted to reduce the amount of ink used to match colors. Better lighting should also be installed to facilitate color matching, save time, and reduce customer rejects. Savings in ink and substrates are $30,000/year.

Ink Usage: The present method used is that the foreman makes an estimate of the ink required by visually estimating the ink coverage per color and estimating the number of liters of ink needed. The ink is then mixed to that approximate volume. Records should be kept to better estimate ink used and calculations should be done by weight. This would reduce the present volume of waste ink by one thousand kilograms per year. The total savings would be $10,000/year.

Waterbase Ink: For the flexible packaging production that is printed on paper (about 35%), waterbased inks should be used. The two major obstacles to converting to waterbased inks are, first, the ability to evaporate the water from the ink fill since it is more difficult to vaporize water than solvent, and second, that waterbased inks do not re-wet once dried. Using water inks would reduce solvent consumption by 31.5% and would reduce air emissions by 63 tons/year in the flexible packaging area. Savings in solvents could total $126,000/year, although this may be partly offset by a slightly increased price for the waterbased ink.

Print Quality: The print quality required for helio printing is very high. This requires close monitoring of

the printed product during production and careful sorting and removal of inferior product. Because of equipment problems, this was not being done. The equipment should be repaired and hand held strobe lights should be purchased to give the operator the ability to move from station to station and inspect all webs at the print stations. Giving the operator the ability to correct printing problems as they occur will reduce overall waste by at least 1-2%. This could be expected to reduce material to the landfill by ten to twenty tons per year, and would save the solvent in ink used to produce that material. Saving in substrate would be $30,000 to $60,000 per year and ink $4,000 to $8,000 per year. Costs of lights is about $3,000.

Press Set Up And Clean Up: The press cleaning procedure uses large amouts of solvents and rags (about 5 liters of solvent and 2 kilograms of rags). Soft rubber squeegees can be used in place of the rags, which would reduce the volume of rags sent to the landfill by 1,900 kg/year and reduce solvent usage by 900 kg/year. Savings would be $2,300/year.

Dust Control/Housekeeping: Airborne dust is a major problem in both the gravure and the offset printing areas. Dust particles cause premature cylinder wear, get lodged on the printing area causing streaks in the printed product, and cause malfunctions. About 1% of waste is caused by dust in the gravure area and about 2% in the offset area. A plant wide dust reduction and dust control program could be instituted which could decrease the amount of waste sent to the landfill by ten tons per year, as well as saving the solvent ink used to produce that material and diverting over 200 kilograms of paste ink from the landfill. The approximate cost of the upgrades is $68,400 while savings could total $157,000/year. The payback period is about 5 months.

Solvent Usage: Open containers of ink around the press areas allow an unspecified amount of solvent to escape into the atmosphere. The cans of ink should be covered at all times except when transferring ink into or out of drums. This will not only reduce evaporated solvent but will also reduce dust contamination of the ink. In addition, rapid evaporation of solvent occurs during summer months because of the excessive heat and low humidity. It is estimated that solvent loss during the summer is double that of winter. During summer, a solvent blend with a higher percentage of slow solvent should be used. These measures would reduce solvent use by 20,000 kg/year for a total savings of $40,000/year.

Recycling of Ink: The facility has a very good ink reuse program. When the ink becomes too contaminated or the color is no longer needed, it is disposed of in the landfill or city sewer system. The ink can be filtered and recycled into black ink. This would reduce the amout of ink to the landfill or sewer by 1,500 kg/year. Total savings would be $15,000/year minus the cost of pigments.

Other recommendations:

Viscosity Control: At present, the automated system of viscosity control malfunctions, spilling solvent on the pressroom floor. It is estimated that about 240 liters of solvent are spilled every week. A high level shut off with a warning system should be installed to alert the foreman of the potential for spillage.

Static Control: A very high static charge was observed in the web of the gravure press. No static control or elimination was in place on the press. This causes printing problems (whiskering) and is a safety hazard as static discharges can cause press fires. The use of copper tinsel at each printing station would remove the static from the web. A reduction in printing waste from whiskers and dust should reduce substrate to the landfill by an undetermined amount.

Photo Processing: This facility uses a small photo processor to develop duplicate films for plate making. This system has three waste products: spent fixer and developer and rinse waters. The developer and fixer are recycled in the machine and disposed of periodically to the city sewer. The rinse waters go directly to the city sewer. The spent fixer and developer could be poured into plastic containers which contain steel wool. This would remove a significant amount of the silver content and the steel wool could then be sold for scrap. The rinse waters could be recirculated by setting up a small five gallon tank with a pump and an activated carbon water filter. This recirculated water only needs to be dumped once per month.

For Further Information

For more information on this assessment or other activities sponsored by IPC, call the Clearinghouse at (703) 351-1004 and fax to (703) 351-6166, or on Internet: cpc@clearinghouse.com