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EPIC

Environmental Pollution Prevention Project

CASE STUDY

Pollution Prevention Assessment for an Offset Printer

Executive Summary

This assessment evaluated an offest printing facility. The objective of the assessment was to identify pollution preveniton options that would: 1) reduce the quantity of toxics, raw materials, and energy used in the manufacturing process; 2) demonstrate the environmental and economic value of a comprehensive pollution prevention assessment; and 3) improve manufacturing competitiveness and product quality. The assessment was performed by an EP3 team comprised of an expert in offset printing and a pollution prevention specialist.

The assessment identified ten pollution prevention opportunities which could substantially reduce the impact of the plant's operations on the environment. These changes would reduce operating costs by US$54,600 per year for a total one-time investment of $34,200.

Of these, seven options were low or no-cost changes which can reduce solvent discharges to the sewer by 10,000 liters per year, reduce ink sent to the landfill by 660 kilograms per year, recycle an additional 500 tons of paper per year, and eliminate the discharge of 200 liters of used oil per year to the sewer. Operating costs can be reduced by $18,900 per year for a total investment of $300. Additionally, two capital-intensive changes were identified which can reduce solvent releases to the landfill by 20,000 liters per year and significantly reduce worker exposure to solvents. An investment of $29,000 will reduce costs by $28,200 per year. Recovering and reusing blanket-washing solvents can reduce solvent use by 6,700 liters per year while reducing costs by $7,500 per year.

Facility Background

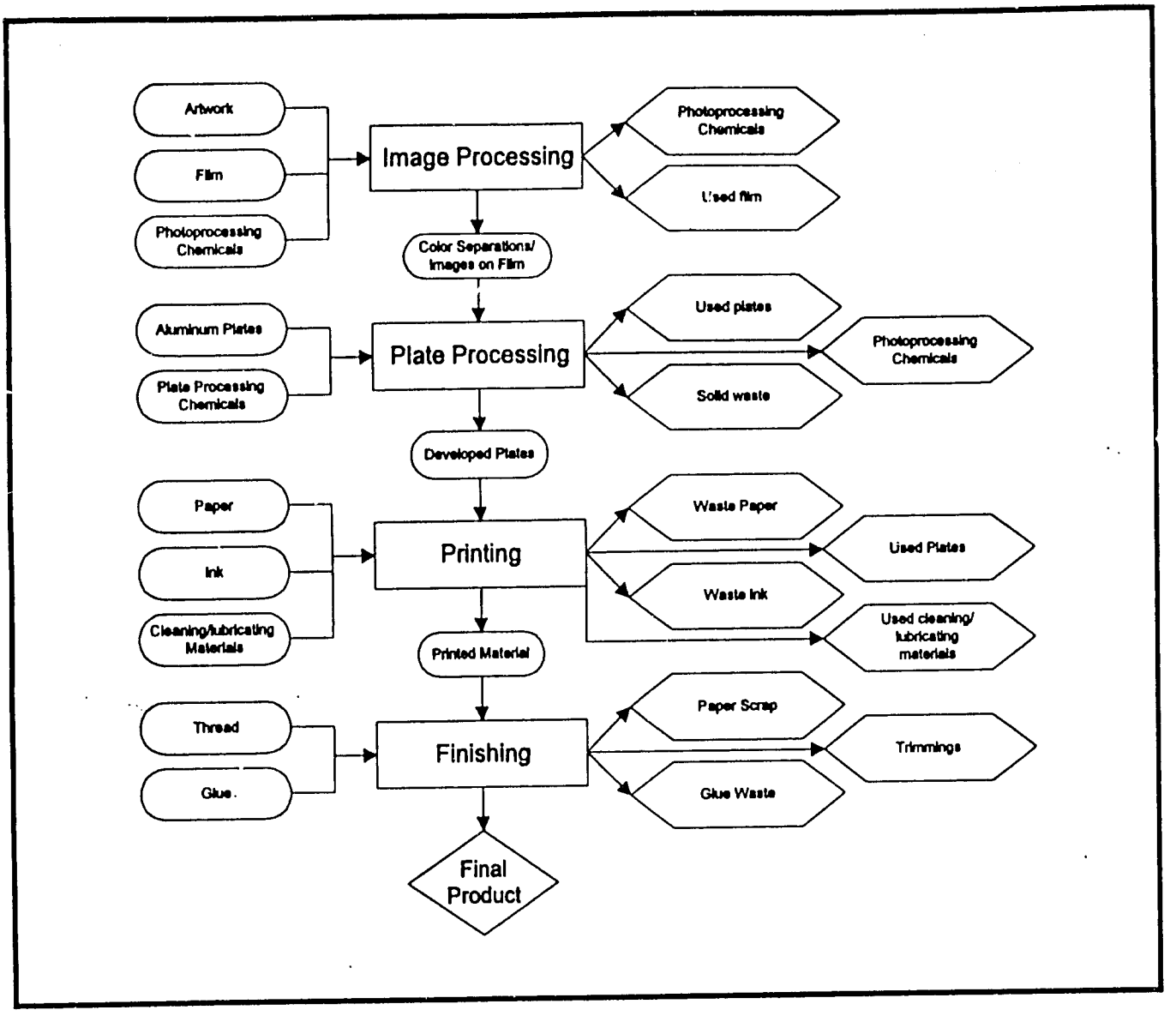
This facility is an offset printer (lithography, SIC 2752) producing a full line of products on nine presses. It operates eight 4-, 5-, or 6-color sheet-fed presses and one 5-color plus varnish web offset press. The web press was installed in 1993 and produces about 50% of the plant's output. This is the only press which uses heatset inks; the dryer is fueled with liquified petroleum gas and vents directly to the atmosphere. In 1994, the facility expected to use 7,200 metric tons of paper and 72 tons of ink to produce 173 million impression pages. The facility has 330 production workers and 20 support staff working three shifts, 6 days per week.

Manufacturing Process

The printing process begins with the images that the customer wants to be printed on paper. These images are photographed, and the negative is used to transfer an image to a photosensitive, thin aluminum sheet called a plate. If a multi-color image is to be printed, the image is transferred to two, three or four plastic photosensitive sheets (called color separations). These color separations are then used to create separate plates for each color stage on the press. Plate development creates a surface which is attractive to ink (oleophilic, or oil-loving) where there is to be an image, and repellent to ink but attractive to water (hydrophilic) where there is to be no image.

When the plates are ready, they are mounted on a roller on the press. To prepare it for printing, it is rotated through a fountain solution which contains a solution

Figure I: Overview of Facility's Printing Process



of chemicals such as gum arabic, zinc or magnesium nitrate and phosphoric acid salts which accentuate the wetability of the hydrophilic areas of the plate. In this facility, the fountain solution also contains isopropyl alcohol to reduce its surface tension so that the solution quickly spreads across the surface of the plate. This allows the press to run at higher speeds.

The plate is next rotated against the ink roller system, and ink is transferred to the areas of the plate which were not wetted by the fountain solution. During this process, the plate comes into contact with a roller onto which "blanket" (or a rubber mat) has been mounted. The inked portion of the plate transfers ink to the blanket. The blanket roller, holding the inked image on its surface, rotates until comes into contact with the paper. After the inked image is transferred to the paper, the blanket continues to rotate until it again is inked by the plate and the process repeats.

The blanket must be kept free of extraneous ink, lint and paper fibers which would mar the image to be printed. The blanket is cleaned often during a press run. Blanket cleaning consumes a significant amount of cleaning solvent. It is the transfer of the inked image from plate to blanket to substrate which gives the name "offset" to lithographic printing.

After printing, the impressions are finished according to the specifications of the customer. Finishing operations include trimming to size, cutting, folding and binding with thread, staples or glue.

Table I: Summary of Recommended Pollution Prevention Opportuntities

Operation	Pollution Prevention Action	Environmental Benefit	Implementation Cost	Financial Benefit	Payback Period
Press Cleaning Solvents	Collect and recycle solvents	Reduce solvent to sewer by 10,000 liters/year	$100	$1,000/year	1 month
Press Cleaning Solvents	Centrifuge and launder rags	Reduce solvent to landfill by 20,000 liters/year	$22,000	$25,000/year	11 month; Net Present Value of $210,000
Blanket Washing	Collect and reuse solvent and rags	Reduce solvent use by 6,700 liters/year	$4,900	$7,500/year	8 months; Net Present Value of $64,000
Paper Scrap	Increase recycling rate	Reduce landfilling of paper by 500 tons/year	$100	$13,500/year	Immediate
Paper Scrap	Reduce paper scrap creation	Reduce paper to landfill by up to 2,300 tons per year	Unknown	Up to $1,700,000/year	Unknown
Rotary Press Inking	Recover Ink	Reduce ink to landfill by 660 kg/year	$100	$4,400/year	1 month; Net Present Value of $36,000
Image Processing	Recycle density-reduction solution	Eliminate discharge of 9.9 kg/year of hexavalent chrome to sewer	None	Not quantified	Immediate
Ink Mixing	Enlarge ink mixing room, improve mixing efficiency	Reduce worker exposure to solvents, reduce solvent releases by 3,700 liters/year	$7,000	$3,200/year	2.2 years
Fountain Solution	Use lower VOC solvent	Reduce isopropyl alcohol emissions by 24,000 kg/year	Unknown	Unknown	Unknown
Rotary Press Lubrication	Recycle used oil	Reduce oil to sewer by 200 liter/year	None	None	None
TOTALS			**$34,200**	**$54,600/year plus paper scrap reduction savings**	

Existing Pollution Problems

At the time of the assessment, there were a number of pollution problems at the facility. These include: 1) spent developer and rinse water discharged to the sewer; 2) disposal of solvent-laden cleaning rags to unlined municpal landfills; 3) film trimmings, used film, plate wastes; 4) emissions from solvents; and 5) paper scrap.This facility currently sells film trimmings, used film and spent fixer to silver recyclers, sells scrap plates to recyclers, recycles most paper (currently about 8 tons per day), and has begun to recycle waste ink. However, its wastewater contains chrome and contributes to biological oxygen demand.

Pollution Prevention Opportunities

The assessment identified several pollution prevention opportunities which are listed in **Table 1**. The environmental benefits, implementation costs, financial benefits, and payback periods are given where the data were available. The total financial benefit for those opportunities that were quantifable total $54,600 per year plus paper scrap reduction savings.

Press cleaning solvents: There are three significant opportunities for the facility to address solvent use and disposal.

♦ When presses are cleaned, liquid solvent wastes are discarded into the sewer system. The used solvent waste can be combined with solvent recovered from the centrifuge and sold to a solvent recycler. This would reduce the amount of solvent going to the sewer by 10,000 liters/year and save $1,000/year.

♦ The presses are cleaned with cotton wipers which are discarded along with other solid wastes to unlined municipal landfills when they become contaminated with ink and cleaning solvent. These rags can be laundered and reused, reducing the amount of solvent going to landfills by 20,000 liters/year. However, to prevent the solvents from being discharged into the sewer during the laundering process, it is recommended that a centrifuge be used to recover the solvents from the rags. This requires a large up front cost of US$22,000 to install the equipment. The financial benefits are estimated at $25,000/year in savings from purchasing new rags. The captured solvents can also be reused for less demanding cleaning uses or sold to local solvent re-distillers.

♦ The rags used to clean the blankets can also be reused. Because the rags are not very dirty, a hand-powered wringer can be used to wring out the rags so they can be reused prior to laundering. Using this method, the blanket wash can also be recovered and reused, reducing solvent use by 6,700 liters per year. It will cost the facility $4,900 to install the wringer; annual savings will be $7,500.

Paper: This facility is recycling some paper scrap, but additional opportuntities were identified.

♦ About 80% of the facility's solid waste is scrap paper. The facility believed that their current paper recycler would not accept varnished paper; however, upon further examination, it was discovered that they did accept varnished paper except for two types of plastic-containing paper. By recycling the accepted varnished paper, the facility could reduce the landfilling of paper by 500 tons of paper per year, yielding a financial benefit of $13,500.

♦ The facility currently generates 8 tons of scrap paper. There are significant opportunities to reduce overall paper scrap. Currently, scrap generation rates are about 42% but could be brought down to about 10% if all avoidable scrap generation causes were identified and eliminated. The facility would create 2,300 tons less scrap paper. The net value of paper recovered by reducing paper scrap could reach as much as US$1,656,000/year.

Other pollution prevention opportunties:

Rotary press inking: The ink colors are delivered to the rotary press by drum presses. When emptied, one-half to one and one-half inches of ink remains in the drums when they are changed. A four position drain rack can be installed to allow the remaining ink to drain, be collected, and reused. The recovered ink is worth $4,400 per year.

Image-processing: To reduce chrome discharges to the sewer, the facility can recycle the spent image processing or find alternate silver removal solutions which do not contain chrome. This would eliminate the discharge of 9.9 kg/year of hexavalent chrome to the sewer.

Ink mixing room enlargement: The ink mixing room can be enlarged to allow for more space for triple countercurrent rinsing of mixing vessels, blades, and spatulas. This would reduce ethyl acetate purchases by 3,700 liters per year at a cost savings of $3,200 per year. In addition, the additional space will allow for the installation of fume hood to protect ink room employees from solvent vapors.

Fountain solution: The fountain solution currently used contains isopropyl alcohol. Isopropyl alcohol losses to the air amount to 34,700 liters per year (about 27,000 kg). Switching to a solution with less volatile components could reduce VOC emissions by as much as 24,000 kg per year. Worker exposure to solvent vapors would also be reduced.

Lubricating oil: One of the presses will generate about 200 liters per year of used lubricating oil. This is currently disposed of in the sewers but can be recycled.

For Further Information

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