Flexography Case Study 1

Reducing VOCs in Flexography

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This case study highlights the experience of one wide-web flexographic printer that successfully reduced volatile organic compound (VOC) emissions and hazardous waste by switching inks. While every facility is unique, it is hoped that the information provided can help even very different flexographic printers. In particular, this case study shows:

- how a water-based ink system and water-based cleaning procedure can reduce VOC emissions, hazardous waste, operating costs, and worker health risks
- how the printer overcame challenges to print successfully with water-based inks

Company Background

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Highland Supply Corporation EXIT Disclaimer (HSC), at its Highland, Illinois facilities, manufactures decorative packaging products for the floral industry. Its product line includes printed and laminated films, foils, and paper. In 1988, HSC made it company policy to reduce or eliminate air emissions and hazardous waste generation. HSC focused on reducing one of its primary emissions, VOCs, for two reasons. First, HSC was aware that VOCs can be harmful to worker health and the environment. Second, HSC predicted that federal and state environmental regulations for VOCs would become more stringent in the future.

The company found that its solvent-based inks (50% VOCs by weight) were the primary source of its VOC emissions. To reduce these emissions, the company initially looked into installing air pollution control equipment such as solvent recovery or oxidizers. But if future regulations were to require further VOC reduction, these units could not be easily adapted. In addition, the electricity and natural gas required to run them would be expensive. HSC decided instead to reduce its VOC emissions by replacing its solvent-based ink system with a water based system.

Water-Based Ink System

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In 1989, HSC began using a new water-based ink on two rotogravure presses. The following year, water-based inks were tested on the flexographic presses. By 1991, HSC was using the water-based ink on all its presses. Water-based inks now account for 100% of the total ink used in the facility. The same can be said for TULSACK.

When HSC first used the water-based ink system, the company encountered a number of new challenges, including some adverse customer response to the print quality of the inks. However, HSC was dedicated to the system and conducted many hours of research and testing. The company modified presses and changed internal color standards. Some other challenges HSC encountered, and the corresponding solutions, are listed below:

	Challenges encountered with the water-based ink:		HSC's solutions:
1	Drying of the ink was incomplete	→	Improved drying systems by lowering temperature and increasing air flow rates
2	Water fastness was insufficient	→	Continuously improved ink formulations and additives
3	Print quality was variable	→	Monitored the pH and viscosity of the inks
4	Ink adhesion was insufficient	→	Installed a corona treater
5	Printing metallic inks was difficult	→	Continuously improved ink formulations and additives
6	Printing UPC symbols was difficult	→	Printed the white UPC symbol background with a water-based, high density ink
7	Cleaning the anilox rolls and plates was difficult because the water-based inks would not resolubilize	→	Installed an ultrasonic cleaner; switched to a citrus-based cleaner; allowed more time for cleaning

VOC EMISSIONS WERE DRAMATICALLY REDUCED. In 1989, HSC's water-based ink contained 10% to 12% VOCs by weight. By 1996, the average VOC content for water-based ink formulas was down to 0.71% VOCs by weight, according to HSC. The few VOCs remaining in the water-based inks are from dispersions and surfactants. HSC recently bought new equipment to use in creating its own VOC-free dispersions.

This reduction in the VOC content of the inks, along with the elimination of solvents in other areas of the facility, had a dramatic effect on HSC's total VOC emissions. The following graph shows the company's annual VOC emissions for 1989, 1991, 1993, 1995, and 1996, as reported to the Illinois Environmental Protection Agency.

HAZARDOUS WASTE WAS ELIMINATED. The water-based ink system contributed to another important benefit. HSC reports that it completely eliminated hazardous waste from waste ink and cleaning operations in 1994, 1995, and 1996. HSC generates a small amount of nonhazardous solid waste from disposable cleaning wipes.

RECYCLING WASTE INK. HSC also reduced the amount of total waste generated by recycling its water-based ink. When the company first used water-based inks, the waste ink was solidified and sent to a landfill under a nonhazardous waste permit. Recycling of the water-based inks began in 1992. By 1995, HSC recycled 99% of its waste water-based inks. Press return ink is stored in a separate container labeled with the formula ID number until it can be blended back into virgin ink of the same color. New colors can also be made, and hard-to-match waste ink can be made into dark green and black inks. HSC also added a computer with a colorimeter and scanner to facilitate better blending of the recycled inks.

Economic Benefits

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REDUCED INK COSTS. HSC's new water-based inks cost less per unit area printed. This is because HSC's water-based inks have a higher ink mileage than the previously-used solvent-based inks.

HAZARDOUS WASTE DISPOSAL COSTS ELIMINATED. Since hazardous waste is no longer generated, HSC spends very little on disposal costs. Solid nonhazardous waste disposal costs totaled less than $1,000 in 1996.

LABOR HOURS SAVED. When HSC switched to water-based inks, some permitting requirements were eliminated. HSC avoided the labor costs needed to meet these requirements. If HSC was still using solvent-based inks today, more than 100 tons of VOCs would be emitted each year, making HSC a "major source" under Title V of the 1990 Clean Air Act Amendments. Since HSC is not a "major source," it has avoided spending significant labor hours to prepare and file initial permit applications, and will save additional labor hours every year in years to come.

In addition, HSC reduced flammable liquid usage below Occupational Safety and HealthAdministration (OSHA) reporting thresholds (Process Safety Management, OSHA 1910:119). Being exempt from this regulation saves HSC significant labor hours in the first year and additional labor hours in subsequent years.

Other Benefits

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Additional benefits that improve HSC's safety, working conditions, marketing, and public image include:

- Eliminated health risks related to VOC exposure
- Reduced fire hazard
- Eliminated need for expensive explosion-proof storage
- Improved public image and community relations

Commitment From Management and Employees

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Comapny-wide commitment was essential to the success of HSC's switch to water-based inks. To strengthen this commitment, management integrated recycling and pollution prevention standards into the job descriptions for each employee, implemented aggressive health and safety programs, and conducted an internal pollution prevention assessment.

With a commitment from management and continuous improvement in the printing process, your company can also realize the benefits of reducing VOC emissions and hazardous waste.

About the Design for the Environment Flexography Project

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The goal of the Design for the Environment (DfE) Flexography Project is to provide flexographers with information that can help them design an operation which is more environmentally sound, safer for workers, and more cost effective.

The partners of the DfE Flexography Project, in a voluntary cooperative effort, are evaluating three different ink technologies: solvent, water-based, and UV-cured. Information is being gathered on the performance, cost, and health and environmental risk trade-offs of several inks within each technology.

In addition to the Flexography Project, similar DfE projects are currently underway with both the screen printing and lithography industries.

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