Pollution Prevention:

Tips for Flexographic Printers

These Pollution Prevention Tips were identified by the Flexography Partnership of the Design for the Environment (DfE) Program at the U.S. Environmental Protection Agency (EPA). The Partnership performed a detailed study comparing hazards and risks, safety concerns, and cost and performance aspects of the three main flexographic ink systems: solvent-based, water-based, and ultraviolet (UV)-cured. The complete results of the study, *Flexographic Ink Options: A Cleaner Technologies Substitutes Assessment* (CTSA), can be downloaded from the DfE website (www.epa.gov/dfe).

DFE's Flexo Partners

- California Film Extruders and Converters Association
- Film and Bag Federation
- Flexible Packaging Association
- Flexographic Technical Association
- National Association of Printing Ink Manufacturers
- Printers
- RadTech International
- Suppliers
- University of Tennessee
- Western Michigan University

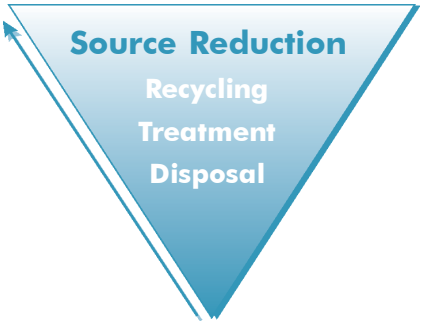
Pollution prevention provides flexographic printers many opportunities to make environmental improvements and create **cleaner**, more **sustainable** operations. Also known as source reduction, pollution prevention reduces or eliminates environmental discharges at their source – that is, by avoiding their creation. Pollution prevention requires taking active steps to implement changes in workplace practices, technology, and materials – including switching to cleaner inks and safer chemicals. Possible **benefits** from pollution prevention include cost savings, improved productivity, better product quality, reduced health risk concerns to employees, reduced pressures of regulatory compliance, and of course reduced environmental impacts.

A strategy to prevent pollution should be customized to fit each printer's objectives and production process. The first step is to construct a **process flow diagram** that identifies each stage of the production process. Once the inputs and outputs are identified, waste streams can be prioritized based on hazard or risk, and the source of those waste streams can be targeted.

Each step in the printing process offers opportunities for pollution prevention. The list that follows includes some obvious and not so obvious suggestions for reducing environmental effects of printing operations. You can probably implement other good ideas that are specific to your facility's operations.

Pollution prevention is an entirely different approach than pollution reduction, which uses control technologies such as oxidizers, adsorption systems, and permanent total enclosures to reduce emissions from flexographic printing operations. Control options do not prevent pollution from being generated in the first place. Control technology can also break down, and require expensive capital and maintenance costs.

The pollution prevention pyramid shows source reduction at the top. This means that reducing or eliminating sources of pollution should be the first and most comprehensive approach to preventing pollution. One highly effective pollution prevention strategy is simply replacing use of a hazardous chemical with one that shows less risk or hazard. If a chemical showing hazards or risk concerns cannot be eliminated, then it should be recycled. If it cannot be recycled as is, it should be treated, and only if none of these options exist should it be disposed.



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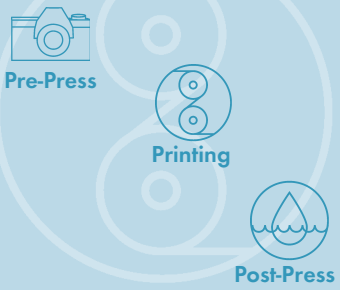
Pollution prevention opportunities exist throughout the Flexographic printing process



Pre-press

Use Computers for Proofs and Plates: Eliminating all proofs and plates enables printers to skip photographic development and eliminate the use of darkroom chemicals.

Switch from Rubber to Photopolymer Plates: Use of traditional nitric acid baths to etch designs into metal plates may generate wastewater that is low in pH and high in metal content, requiring regulation under the Clean Water Act. Photopolymer plates eliminate this waste stream as well as the metal engravings and wastes generated from the production of conventional molded rubber plates.

Printing and clean-up

Install Enclosed Doctor Blade Chambers: Enclosed doctor blade chambers reduce ink evaporation, which results in better control of ink usage, more consistent color, and improved performance of the inks on press. Making this change to an older press may greatly reduce ink evaporation, thus minimizing worker exposure to hazardous chemicals.

Cover Volatile Materials: By keeping all cans, drums, and open ink fountains covered, printers can reduce odors and worker health risk concerns by minimizing uncaptured volatile organic compound (VOC) emissions.

Use Higher Linecount Anilox Rolls: This enables printers to apply smaller ink droplets closer together, to achieve much finer ink distribution, easier drying, and potentially faster press speeds.

Rework Press Return Ink: Reworking press return ink can increase efficiency, reduce ink purchases, and reduce hazardous waste if contamination issues can be addressed. Ink can be reworked by blending press return ink with virgin ink or other press return inks.

Use Computerized Ink Blending: Software and specialized equipment help printers blend ink, reduce surplus ink, and reuse press return ink.

Print with Four-Color Process: The limited number of inks in four-color process printing can minimize the amount of mixed colored inks used and eliminate residues of unusual colors at the end of each job. With chambered doctor blade systems, the increased use of process printing to produce a broad spectrum of colors has become more easily attainable.

Co-Extrude Colored Film: Films can be co-extruded to have panels of color in a clear field, which eliminates the need for heavy coverage with colored ink.

Run Light Colors First: By running lighter jobs before darker jobs, printers can reduce the number of clean-ups.

Standardize Repeat Print Jobs: Make-ready times and waste materials can be greatly reduced if the press operators know the anilox roll linecount and cell volume, the sequence of colors applied, ink parameters such as pH and viscosity, and other set-up information.

Standardize Anilox Roll Inventory: This saves time during makeready and reduces waste.

Use Multi-Stage Cleaning: Solvent use can be reduced by using a multi-stage cleaning procedure for the printing decks. This procedure reduces solvent use by reusing solvents that are otherwise discarded. Pre-used solvent is used in the first stage to remove the majority of the ink. In the second stage, a cleaner but still pre-used solvent removes more ink. In the third stage, clean solvent removes any remaining ink.

Install Automatic On-Press Cleaning: When paired with solvent recovery, on-press cleaning systems use much less cleaning solution than hand cleaning, while also having a very short cycle time.

Clean Anilox Rolls Promptly: Prompt attention will prevent the inks from setting, thereby reducing the need for harsh chemicals. Clean rolls also produce more predictable ink densities, potentially reducing on-press waste and improving quality.

Use Alternative Methods to Clean Anilox Rolls: Printers can choose among many alternatives for cleaning anilox rolls to reduce or eliminate the need for traditional cleaning solvents. These alternatives use sonic cleaning, dry ice, lasers, polyethylene beads, and sodium bicarbonate.

Recirculate Warm Press Air: Both solvent-and water-based printers can significantly reduce their energy requirements by recirculating warm air from dryers.

Throughout the printing process

Use Safer Chemicals: Switching to inks, cleaning agents, and adhesives that contain a lower percentage of VOCs and fewer hazardous air pollutants may reduce risk concerns to worker health and the environment.

Segregate Hazardous Waste: Segregating hazardous wastes allows disposal of pure instead of mixed wastes. Because pure wastes are much easier to treat, they are not only less expensive to dispose of, but also require less energy.

Return Containers: Using returnable containers prevents unnecessary waste generation and results in additional cost savings.

Track Inventory: Tracking chemical purchases and disposal can help to maintain a minimum inventory on the shelf, thus reducing the amount of materials wasted. For example, hazardous waste can be minimized by labeling inks with the date and having a "first-in, first-out" rule, i.e., rotating the inks so that the oldest inks are used first. This avoids disposing of expired ink as hazardous waste. Tracking systems using bar codes takes inventory control to an even higher level.

Making change happen

Pollution prevention requires commitment from both management and employees. While management action is required for process changes, employees — who are closest to the process — often are best placed to identify pollution prevention alternatives.

Make a Management Commitment: Management should establish, communicate, and demonstrate its commitment to the concept of pollution prevention, to encourage company-wide source reduction in everyday practice. Management can assemble pollution prevention teams of employees, incorporate pollution prevention into job responsibilities, and provide incentives for employees to prevent pollution.

Train Employees: Pollution prevention training for company personnel may facilitate process changes by educating workers on the need for such change. Training also helps to encourage general source reduction and stimulate pollution prevention ideas by personnel.

Monitor Employee Practices: Periodic monitoring helps ensure that source reduction practices are followed.

Seek Out and Encourage Employee Initiatives: Supporting, encouraging, and actively acknowledging pollution prevention initiatives by company personnel can stimulate innovative ideas for source reduction. This may be especially beneficial because employees who are closest to the process are often in the best position to recommend change.

Develop an Environmental Management System (EMS): An EMS is a set of management tools and principles designed to guide a company to integrate environmental concerns into its daily business practices. See www.epa.gov/ems for more information.

Integrated Environmental Management Systems Implementation Guide (EPA 744-R-00-011)

290 pages, 48 worksheets; October 2000

This guide has been pilot-tested by several small businesses that used it to build an Integrated Environmental Management System (IEMS) for their companies. An IEMS integrates worker safety and health concerns along with environmental concerns into a company's products, processes and activities. An IEMS also includes the principles and technical methods of the DfE Program, which emphasizes reducing risk to humans and the environment, along with preventing pollution and managing resources wisely. The guide provides clear, step-by-step guidance on implementing an IEMS in a small company.

Integrated Environmental Management Systems Company Manual Template for Small Business (EPA 744-R-00-012)

60 pages; December 2000

This document was developed to help companies document their IEMS. Written as if it were the actual manual of a specific small business, the template helps companies understand how to adapt the procedures to implement and document an IEMS. It contains procedures that are normally documented as part of an ISO 14001-compliant EMS.

EPA's Design for the Environment (DfE) Program is located within the Economics, Exposure and Technology Division of EPA's Office of Pollution Prevention and Toxics. DfE projects help businesses design products, processes, and management systems that are cost-effective, cleaner, and safer for workers and the public. DfE's goals are to:

- Encourage businesses to incorporate environmental information into their decision criteria, and
- Facilitate continuous environmental improvement.

To accomplish these goals, DfE and its partners use several approaches, including cleaner technology and life-cycle assessments, environmental management systems, formulation improvements, best practices and green supply-chain initiatives. In addition to flexography, DfE has forged partnerships with a variety of industries, such as other types of printing, the automotive industry, industrial laundries, and electronics.

For more information about the DfE program, call 202-564-8780 or send e-mail to dfe@epa.gov

For additional copies of this or any DfE document:

- Download them from the DfE website at www.epa.gov/dfe
- Contact the Pollution Prevention Information Clearinghouse at 202-566-0799 or ppic@epa.gov
- Contact the National Service Center for Environmental Publications at www.epa.gov/ncepihom telephone: 1-800-490-9198

Pollution Prevention Checklist

Does your facility . . .

Pre-press

	YES	NO
Use Computers for Proofs and Plates	☐	☐
Use Photopolymer Plates	☐	☐

Printing and clean-up

Install Enclosed Doctor Blade Chambers	☐	☐
Cover Volatile Materials	☐	☐
Use Higher Linecount Anilox Rolls	☐	☐
Rework Press Return Ink	☐	☐
Use Computerized Ink Blending	☐	☐
Print with Four-Color Process	☐	☐
Co-Extrude Colored Film	☐	☐
Run Light Colors First	☐	☐
Standardize Repeat Print Jobs	☐	☐
Standardize Anilox Roll Inventory	☐	☐
Use Multi-Stage Cleaning	☐	☐
Install Automatic On-Press Cleaning	☐	☐
Clean Anilox Rolls Promptly	☐	☐
Use Alternative Methods to Clean Anilox Rolls	☐	☐
Recirculate Warm Press Air	☐	☐

Throughout the printing process

Use Safer Chemicals	☐	☐
Segregate Hazardous Waste	☐	☐
Return Containers	☐	☐
Track Inventory	☐	☐

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