

## What is EPA's DfE Program?

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.

The DfE Flexo Project is a voluntary collaboration between representatives of the flexo industry and EPA, to help businesses help the environment. The Flexo Project has developed a variety of materials, including a two volume technical report known as a cleaner technologies substitutes assessment (CTSA), a summary report based on the CTSA, a flowchart for ink formulators, and other documents to help you practice pollution prevention.

For printed copies of this or any DfE document, contact the National Service Center for Environmental Publications:

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For more information about the DfE Program, call 202-564-8780 or send e-mail to [dfe@epa.gov](mailto:dfe@epa.gov).

Office of Pollution Prevention and Toxics (7404)  
April 2002  
EPA 744-F-02-004



## Options for Cleaner Flexo Inks

### Highlights from the Flexo CTSA



### What is the Flexo CTSA?

To protect workers and the environment, printers and ink formulators need more information about all aspects of inks, especially their chemical hazards, exposures, and risks. *Flexographic Ink Options: A Cleaner Technologies Substitutes Assessment (CTSA)* evaluated solvent-based, water-based, and ultraviolet-cured ink systems as printed on wide-web film substrates. This study assessed the performance, environmental, human health, and cost aspects of 45 ink formulations. The CTSA provides information to help printers and formulators make responsible ink choices and consider a variety of factors when choosing or evaluating ink systems or specific formulations.

A few highlights of the study's findings follow.

- No ink system was superior across performance, environmental, health, and cost criteria, but each system had advantages.
- All ink systems contained chemicals of clear concern for health risks to flexo prep- and pressroom workers, although none showed predicted risks to nearby residents.
- Some water-based and UV-cured ink formulations demonstrated improvements over solvent-based inks in worker safety, reduced concerns for health and environmental risk, and lower material costs.
- Press speed, not the ink system, was the main determinant of overall cost.
- UV-cured systems consumed the least ink.
- Water-based systems used the least energy.

### Goals of the Flexo Project

- Identify and inform industry about comparative chemical risks in inks, including unregulated ones that present opportunities for proactive, voluntary risk management.
- Facilitate the use and formulation of cleaner inks.
- Encourage adoption of workplace practices that minimize exposure to chemicals of concern.

### Flexo Project 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



## What's in the Flexo CTSA?

The Flexo CTSA contains a wealth of information to help guide ink choices, including —

- toxicity, estimated exposure, and predicted risk information on about 100 flexographic ink chemicals.
- health concerns relevant to press- and prep-room workers and their management.
- aquatic toxicity information useful in the event of an inadvertent release to water.
- performance of each of the ink formulations on 18 different tests.
- material, labor, capital, and energy assessments of the three flexographic ink systems.
- other costs to consider when evaluating inks, including disposal, storage, and clean-up.
- options to increase the efficiency and control of environmental emissions from flexo printing.

## Which Ink System Was the "Cleanest"?

The CTSA studied solvent-based, water-based, and UV-cured ink systems. The study found that each of the ink systems had different advantages as well as health and environmental concerns. Even within a single ink system, different inks showed a wide range of results. Interestingly, some water-based and UV-cured *formulations* had lower environmental and health hazards and risks. Specifically, the CTSA found that—

- Although all ink systems showed dermal risks, these can be effectively managed by requiring

workers to wear appropriate gloves when handling inks.

- Solvent-based inks had relatively high levels of uncaptured VOC emissions, leading to *inhalation risk concerns for workers that were not addressed by using oxidizers*. Solvent-based categories with chemicals of concern for workers included certain alcohols and propylene glycol ethers.
- Even without oxidizers, most water-based formulations showed less than one-fourth the VOC emissions of the solvent-based inks. Categories in the water-based inks that contained chemicals with worker health concerns included certain alcohols, amides, and ethylene glycol ethers.
- Fewer UV-cured formulations showed concerns for worker health risks than did solvent- or water-based formulations. UV ink categories of acrylated polyols and amides or nitrogenous compounds did contain chemicals of inhalation concern for workers.
- Over half the chemicals in the CTSA showed a high or medium hazard to aquatic environments.

The concerns identified by the CTSA varied by formulation, and were related to the *specific* chemicals in the formulations. To work safely with flexo inks so that workers and the environment are protected, you need to learn as much as possible about the hazards, exposures, and risks of ink chemicals.

## How Can You Reduce Health and Environmental Impacts?

Responsible use of flexo inks requires reducing or eliminating environmental discharges, supporting research on untested and inadequately tested ink chemicals, and implementing changes in workplace practices, technol-

**More Help for Formulators:** The DfE booklet, "Developing Cleaner Ink Formulations: A Flowchart for Ink Formulators," provides ideas for how to develop and implement a process for assessing inks. You can download the booklet from the DfE website ([www.epa.gov/dfe](http://www.epa.gov/dfe)). To order printed booklets, contact NCEPI at the address on the back of this brochure.

ogy, and materials. Here are some tips for reducing risks, supported by the CTSA findings.

### Tips for Flexographers

- Different formulations may pose different worker health and environmental concerns. Also, each printing facility operates with a unique combination of customers, equipment, product specialties, and labor resources. Just changing ink formulations within the same system may help your facility operate more cleanly. You may also consider another ink system if you have evidence that it will be cleaner for your facility.
- Reduce inhalation risks by providing good ventilation in prep- and pressrooms, and by creating and enforcing mask and respirator policies.
- Minimize your workers' dermal exposure to inks. Gloves are an economical and simple way to significantly reduce health risks.
- Ask your ink supplier for recommendations on appropriate gloves, and take all other safety precautions.
- If you use solvent-based inks, keep your oxidizers in prime working condition.
- If you use water-based inks without an oxidizer, select inks containing the lowest possible percentage of VOCs and hazardous air pollutants (HAPs).
- Minimize the use of press-side solvents and other additives.
- Talk with your supplier, who can help you make fully informed ink choices.

### Tips for Ink Companies

- Encourage your customers to use cleaner inks.
- Train your sales force on environmental and worker health issues.

- Conduct and support research on environmental and health risks with the goal of developing cleaner ink formulations, and make improved ink safety a top goal of research and development.
- Set up partnerships to help you obtain expert information and analysis about ink chemicals. Find partners within your company, as well as among your suppliers, customers, trade associations, even the community in which your business is located.

## Worried about Cost — Who Isn't?

The CTSA found that press speed is likely to be the single most significant factor in determining the cost-competitiveness of ink systems, since it influences labor, capital, and energy costs. At equal press speeds, the water-based systems had lower operating costs than the solvent-based and UV-cured systems.

An important point is that *inks with fewer and less serious environmental and worker risk concerns can have lower costs* in many categories, such as

- regulatory requirements,
- insurance needs,
- air emissions,
- wastewater releases,
- solid waste disposal, and
- liability, mediation, and litigation.

To accurately determine the overall cost of any ink system, you need to analyze each step of the printing process, starting with ink systems and additives. It is equally important to include the costs of protecting your workers and the environment.