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Project Summary

Evaluation of Barriers to the Use of Radiation-Cured Coatings in Screen Printing

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In support of the Source Reduction Review Project (SRRP), maximum achievable control technology (MACT) standards development, and the Pollution Prevention Act, EPA is investigating the current industrial use and barriers to the extended use of waterbased and radiation-cured coatings in SRRP and MACT categories. The full report gives results of a study to investigate and identify the technical, educational, and economic barriers to the use and implementation of radiation-cured coatings in the non-textile screen printing industry. Use of ultraviolet (UV)-curable inks offers substantial economic and process benefits, in addition to environmental benefits. Among the benefits are (1) reduction in required floor space; (2) increased throughput; (3) reduction in health and safety hazards for workers exposed to screen printing inks; and (4) reduced cost per unit area printed. Technical barriers include ink and substrate limitations and health and safety issues. Economic barriers provide the greatest challenge to implementing UV-curable inks. The costs of purchasing UV-curing units, coupled with downtime required to effect the changeover, are significant disincentives for the small printing shops prevalent in the industry. The principal educational barrier is the transfer of technical information from research organizations to small, diffuse printing shops. The document suggests projects that could help overcome the technical, educational, and economic barriers identified.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Overview

Section 4(b) of the Pollution Prevention Act (PPA) of 1990 requires EPA to review regulations of the Agency prior and subsequent to their proposal to determine their effect on source reduction. The stated goal of the PPA is "[T]hat pollution should be prevented or reduced at the source whenever feasible." This is a departure from more traditional "end-of-pipe" control strategies, which sometimes transfer pollution from one medium to another. Pollution prevention strives to eliminate or reduce pollution before it is produced. In support of the PPA, EPA established the Source Reduction Review Project (SRRP) to focus this review on the regulations (and anticipated regulated industries) that may be promulgated under the Clean Air Act (CAA), the Clean Water Act (CWA), or the Resource Conservation and Recovery Act (RCRA). A goal of SRRP tasks is to ensure that source reduction and multimedia issues are considered during the development of upcoming air, water, and hazardous waste standards.

An important set of regulations under the CAA, a regulation of SRRP focus, are the standards for maximum achievable control technology (MACT) to reduce emissions of hazardous air pollutants (HAPs).

Promulgation of these regulations began in 1992 and will continue throughout the 1990s and into the next century. The MACT standards offer an excellent opportunity to use SRRP to incorporate pollution prevention measures into the upcoming standards for specific source categories. The PPA defines pollution prevention as “any practice that reduces the amount of any hazardous substance, pollutant, or contaminant entering the waste stream or otherwise released to the environment (including fugitive emissions) prior to recycling, treatment, or disposal and reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.” Pollution prevention offers economic and reduced health and ecological risk benefits to many sectors of society that are not available through traditional pollution control methods.

In support of the SRRP program, MACT standards development, and the PPA, EPA is investigating pollution prevention opportunities for products and materials that reduce waste. The objective of this project was to investigate the current industrial use and barriers to the extended use of waterbased and radiation-cured coatings in SRRP and MACT categories. Both radiation-cured and waterbased coatings have been demonstrated to reduce pollution in several specific end-use categories.

During the first task of this project, 52 industry categories were identified as having the potential to use radiation-cured and waterbased coatings as pollution prevention alternatives. During this phase, contacts were made with representatives from coating suppliers and trade associations and limited literature searches were completed. From this list of 52 potential industry categories, 10 were selected for further study. Preliminary market analyses were prepared for each of these 10 categories. Following the completion of the 10 analyses, three categories were selected for investigation: Adhesive-Coated and Laminated Paper (SIC 2671 and 2672), Metal Cans (SIC 3411), and Commercial Printing - Not Elsewhere Classified (SIC 2759). All three of these categories face upcoming MACT standards. By initiating this report, EPA has begun a dialogue on pollution prevention with the industry categories. When the MACT standards are developed, EPA will have a better understanding of which coating technologies are feasible pollution prevention alternatives for the three categories. Conversations with resin manufacturers, coating suppliers, and end users indicated that waterbased coatings were already being used extensively in the three categories, particularly in the manufacture of metal cans. Conversely, radiation-cured coatings had made progress in each of the three categories but were not widely used in any of them. The limited penetration of radiation-cured coatings offered the best opportunity for research.

The screen printing project was initially intended to study both ultraviolet (UV) radiation-cured and waterbased screen printing inks as possible alternatives to solvent-based inks with high volatile organic compound (VOC) emissions. During the project research, it became evident that the focus should be on UV-curable inks. Waterbased screen printing inks that are currently available have many of the shortcomings that UV-curable inks have but do not provide some of the benefits provided by UV-curable inks. Therefore, the focus of the project became the use of radiation-cured coatings. The focus of this report is on barriers to the use of radiation-cured coatings in the non-textile screen printing industry (SIC 27598).

This report gives results of a study to investigate and identify the technical, educational, and economic barriers to the use and implementation of radiation-cured coatings within the non-textile screen printing industry. This project involved identifying and classifying barriers to use and implementation, evaluating, and assessing the environmental impacts, and identifying pollution prevention and source reduction research opportunities within the non-textile screen printing industry. To successfully accomplish these objectives, information was collected from several sources including literature searches, plant visits, pollution prevention experts, and industry and trade association personnel.

Literature searches of the EPA on-line databases, local university library databases, and Dialog® were conducted. The Pollution Prevention Information Clearinghouse (PPIC) and the Pollution Prevention Information Exchange System (PIES) were also accessed. The E-Mail capabilities of PIES were also used to communicate with other PIES users with knowledge of the non-textile screen printing industry.

In addition to research performed in libraries and computer databases, and through phone conversations with industry representatives, three other major data gathering activities were performed:

- Visited Rand McNally Book Services Division in Nashville, TN,
- Attended the 1993 Screen Printing Association International (SPAI) trade show in New Orleans, LA, and
- Summarized and tabulated responses to a SPAI survey of its members regarding their use of UV-curable screen printing inks.

The full report (1) contains background material and project summaries; (2) describes conventional screen printing processes and discusses material inputs, manufacturing equipment, physical processes, product outputs, emissions, and wastes; (3) discusses the alternative technology under investigation and evaluates process, cost, and emissions and wastes differentials between the conventional and alternative processes; (4) identifies the technical barriers to the extended use of radiation-cured coatings and describes the difficulties and available information on solutions currently under consideration; (5) discusses economic barriers; (6) identifies educational barriers; (7) presents additional source reduction and pollution prevention research opportunities; and (8) gives detailed results of a survey performed by SPAI.

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The complete report, entitled "Evaluation of Barriers to the Use of Radiation-Cured Coatings in Screen Printing," (Order No. PB95-208864; Cost: $19.50, subject to change) will be available only from:
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