United States
Environmental Protection
Agency

National Risk Management
Research Laboratory
Cincinnati, OH 45268

Research and Development

EPA/600/SR-95/097 July 1995

EPA

Project Summary

Improved Equipment Cleaning for the Coated and Laminated Substrate Manufacturing Industry (Phase II)

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The report discusses EPA efforts to identify, demonstrate, and publish pollution prevention information and opportunities for equipment cleaning for the coated and laminated substrate manufacturing industry. It summarizes initial data collected and summarized during industry observation and demonstration visits. Demonstrations took place at a small batch facility and a small dedicated-line facility.

The focus at the batch facility was to decrease the number of solvents used for cleaning, reduce the quantity of material used for cleaning, and standardize cleaning practices. While consolidating from three chemicals (i.e., toluene, xylene, and methyl ethyl ketone—MEK) to a single solvent for cleaning may not be feasible because of the varied product mix, the facility could eliminate one cleaning solvent (MEK), thereby reducing handling and disposal costs. An estimated emission reduction of 65% could be achieved by eliminating MEK. Raw material and disposal cost savings are approximately $30,000 annually. It was also demonstrated that the facility could reduce consumption of cleaning solvent by at least 50%, thus reducing raw material costs by approximately $20,000 per year.

The focus at the dedicated-line facility was to investigate the use of alternative cleaners, reduce the quantity of material used for cleaning and standardize operating practices. Both odorless mineral spirits and Varsol were tested as alternative cleaners. Results showed that, except for acrylic adhesives, either Varsol or odorless mineral spirits could be used to replace the facility's current cleaning solution. For this facility, the replacement could reduce emissions by 25% and could save the facility $500 annually. However, the incompatibility of the alternate cleaners with the acrylic adhesive could not completely eliminate the need for their current cleaning solution.

This Project Summary was developed by the National Risk Management Research Laboratory's Air Pollution Prevention and Control Division, 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).

Background

As a result of the Pollution Prevention Act of 1990, the Environmental Protection Agency (EPA) established the 33/50 Program which calls for voluntary industry reductions in releases of the following 17 high-priority toxic chemicals, listed by mass of emissions.

Toluene
Xylenes
1,1,1-Trichloroethane
Methyl Ethyl Ketone
Dichloromethane
Chromium and Compounds
Lead and Compounds
Trichloroethylene
Methyl Isobutyl Ketone
Tetrachloroethylene

Benzene
Chloroform
Nickel and Compounds
Cyanide and Compounds
Carbon Tetrachloride
Cadmium and Compounds
Mercury and Compounds

The goal of the 33/50 program is to reduce the total amount of these chemicals released into the environment and transferred off-site by 33% by the end of 1992 and by 50% by the end of 1995. These reductions will be based on the Toxic Chemical Release Inventory (TRI), with 1988 as the base year.

In support of the 33/50 Program and the Agency's pollution prevention goals, EPA's Air and Energy Engineering Research Laboratory (AEERL) is investigating ways to reduce air emissions and other media impacts of these 17 chemicals through pollution prevention. The Pollution Prevention Act of 1990 defines pollution prevention as "any practice which 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 may offer economic, health, and ecological benefits that may not be available through traditional pollution control methods.

In 1991, AEERL representatives met with industry, academia, and state environmental agency representatives to identify several source categories deserving pollution prevention research. Two criteria were used to select the industrial categories for study: actual annual toxics emissions and the potential for pollution prevention opportunities. First, the TRI was reviewed to identify categories with the greatest mass emissions of the 33/50 chemicals. Categories with the greatest emissions were then ranked according to their potential for successful pollution prevention projects resulting in significant reductions of 33/50 chemical releases. One of the industries identified during the 1991 meeting was the adhesives-coated and laminated paper manufacturing industry [Standard Industrial Classification (SIC) 2672]. This industry was chosen because of significant air emissions of 33/50 Program chemicals methyl ethyl ketone (MEK) and toluene as reported through the TRI.

In October 1991, AEERL convened a focus group of industrial personnel, pollution prevention experts, and representatives of the Pressure Sensitive Tape Council (PSTC) and the Tag and Label Manufacturers Institute (TLMI) to discuss specific pollution prevention projects that would support the 33/50 Program. Meeting participants indicated that emissions of toluene and MEK from equipment cleaning operations are second only to emissions from the coatings and coating application steps. Because industry is currently focusing research efforts on coating formulations, it was suggested that this project be focused on equipment cleaning. As a result of this meeting and preliminary industry inquiries, the scope of the industry investigation was later expanded to include other coating and substrate varieties (such as those included in SIC 2671-Coated and Laminated Packaging Paper and Plastics Film) because the manufacturing methods and cleaning processes are similar; therefore, technology transfer is possible over a wider range of industries. The improved equipment cleaning project fulfills part of EPA's goal to stimulate the development and use of products and processes that result in reduced pollution.

During the Phase I information gathering effort, 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 accessed on a biweekly basis. The E-Mail capabilities of PIES were also used to communicate with other PIES users with knowledge of the coated and laminated substrate manufacturing industry.

The second source of project background information, also conducted during Phase I activities, was data retrieved through industry questionnaires. Two questionnaires were distributed to 14 adhesive-coated and laminated paper manufacturers, primarily pressure sensitive tape manufacturers and tag and label manufacturers. A separate questionnaire was prepared for manufacturers operating under either SIC 2672 or SIC 2641 (Paper Coating and Glazing) depending on their SIC. Neither questionnaire was sent to more than eight manufacturers. The results of the questionnaires were clarified through follow-up contacts with the recipients and through revised questionnaires. Over 30 additional facilities (i.e., not recipients of the original questionnaires) were contacted for further information on equipment cleaning practices. The second group of facilities contacted was representative of the expanded scope of the research project, and consisted of facilities involved in the coating and laminating of flexible substrates (SIC 2671) as well as those included in SIC 2672.

Contacts made during Phase I continued to be consulted during the Phase II demonstration activities. These contacts included industry and pollution prevention experts with the Massachusetts Office of Technology Assistance (OTA), the North Carolina Office of Waste Reduction (OWR, the PSTC, the TLMI, and equipment manufacturing firms.

Objectives

This report presents the results of Phase II of an effort to demonstrate improved equipment cleaning technologies in the coated and laminated substrate manufacturing industry, to quantify air emissions and other media wastes, record production parameters, and make other observations and measurements necessary to assess the impacts of the alternative technology. The information presented in this report is largely the result of data collected, analyzed, and summarized during industry observation and demonstration visits. These data were supplemented by information from sources including the Phase I project report, literature searches, industry questionnaires, plant visits, pollution prevention experts, and industry and trade association personnel.

The primary source of information for this report was data collected during four facility observation visits and two demonstration visits. The purpose of the observation visits (conducted at two large, dedicated line facilities; one small, dedicated line facility; and one small, batch facility) was to observe plant operations and to collect data to establish a waste generation baseline. The demonstration visits sought to demonstrate waste-reducing alternative cleaning technologies. Demonstrations were conducted at the small, batch facility and the small, dedicated line plant.

Together, the information gathered during the Phase I and II efforts will form the foundation for Phase III technology transfer efforts. Focused documents such as conference papers, journal articles, and newsletters will be prepared and presented at industrial workshops, pollution prevention conferences, and other events where industrial application of pollution prevention technologies is discussed. Trade associations and contacts made during Phases I and II will be targeted audiences and vehicles used for technology transfer. PPIC, the National Pollution Prevention Roundtable, and other groups focused on pollution prevention will also be contacted to help distribute information.

Report Organization

The report consists of four chapters and two attachments. Chapter 2 describes the Phase II project approach and includes a brief description of the coated and laminated substrate industry and the manufacturing process. It also summarizes the purpose of the observation visits including the data collection needs and the identified pollution prevention opportunities.

Chapter 3 explains in more detail the pollution prevention cleaning opportunities that can be used at coated and laminated substrate manufacturing facilities. Some of the technologies that are discussed are alternative cleaners, solvent consolidation, recycling, best operating practices, and operator training. These waste-reducing techniques are evaluated for emission reduction potential and economic impact.

Chapter 4 presents standard operating practices which many coated and laminated substrate manufacturing facilities can use to improve their cleaning efficiency. Attachment A contains copies of two observation visit reports and two observation/demonstration summary reports. Attachment B contains product information sheets for a number of low volatile organic compound cleaners.

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The complete report, entitled "Improved Equipment Cleaning for the Coated and Laminated Substrate Manufacturing Industry (Phase II)," (Order No. PB95-246245; Cost: $27.00, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
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Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
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EPA/600/SR-95/097

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