United States Environmental Protection Agency
Research and Development
Risk Reduction Engineering Laboratory Cincinnati, OH 45268
EPA/600/S-92/056 October 1992

EPA

ENVIRONMENTAL RESEARCH BRIEF

Waste Reduction Activities and Options for a Laminator of Paper and Cardboard Packages

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Abstract

The U.S. Environmental Protection Agency (EPA) funded a project with the New Jersey Department of Environmental Protection and Energy (NJDEPE) to assist in conducting waste minimization assessments at 30 small- to medium-sized businesses in the state of New Jersey. One of the sites selected was a facility that laminates paper and cardboard substrates which are used for packaging purposes. The lamination is accomplished by application of a liquid laminate to the surface of the substrate followed by curing. The facility also applies metallic coatings to similar substrates by transfer from mylar films. A site visit was made in 1990 during which several opportunities for waste minimization were identified. Options identified included changing to UV curing for laminates and onsite distillation and reuse of solvents. Implementation of the identified waste minimization opportunities was not part of the program. Percent waste reduction, net annual savings, implementation costs and payback periods were estimated.

This Research Brief was developed by the Principal Investigators and EPA's Risk Reduction Engineering Laboratory in Cincinnati, OH, to announce key findings of this completed assessment.

Introduction

The environmental issues facing industry today have expanded considerably beyond traditional concerns. Wastewater, air emissions, potential soil and groundwater contamination, solid waste disposal, and employee health and safety have become increasingly important concerns. The management and disposal of hazardous substances, including both process-related wastes and residues from waste treatment, receive significant attention because of regulation and economics.

As environmental issues have become more complex, the strategies for waste management and control have become more systematic and integrated. The positive role of waste minimization and pollution prevention within industrial operations at each stage of product life is recognized throughout the world. An ideal goal is to manufacture products while generating the least amount of waste possible.

The Hazardous Waste Advisement Program (HWAP) of the Division of Hazardous Waste Management, NJDEPE, is pursuing the goals of waste minimization awareness and program implementation in the state. HWAP, with the help of an EPA grant from the Risk Reduction Engineering Laboratory, conducted an Assessment of Reduction and Recycling Opportunities for Hazardous Waste (ARROW) project. ARROW was designed to assess waste minimization potential across a broad range of New Jersey industries. The project targeted 30 sites to perform waste minimization assessments following the approach outlined in EPA's *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003). Under contract to NJDEPE, the Hazardous Substance Management Research Center at the New Jersey Institute of Technology (NJIT) assisted in conducting the assessments. This research brief presents an assessment of the lamination of paper and cardboard substrates which are used to make packaging (1 of the 30 assessments performed) and provides recommendations for waste minimization options resulting from the assessment.

Methodology of Assessments

The assessment process was coordinated by a team of technical staff from NJIT with experience in process operations, basic chemistry, and environmental concerns and needs. Be-

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cause the EPA waste minimization manual is designed to be primarily applied by the inhouse staff of the facility, the degree of involvement of the NJIT team varied according to the ease with which the facility staff could apply the manual. In some cases, NJIT's role was to provide advice. In others, NJIT conducted essentially the entire evaluation.

The goal of the project was to encourage participation in the assessment process by management and staff at the facility. To do this, the participants were encouraged to proceed through the organizational steps outlined in the manual. These steps can be summarized as follows:

- Obtaining corporate commitment to a waste minimization initiative
- Organizing a task force or similar group to carry out the assessment
- Developing a policy statement regarding waste minimization for issuance by corporate management
- Establishing tentative waste reduction goals to be achieved by the program
- Identifying waste-generating sites and processes
- Conducting a detailed site inspection
- Developing a list of options which may lead to the waste reduction goal
- Formally analyzing the feasibility of the various options
- Measuring the effectiveness of the options and continuing the assessment.

Not every facility was able to follow these steps as presented. In each case, however, the identification of waste-generating sites and processes, detailed site inspections, and development of options was carried out. Frequently, it was necessary for a high degree of involvement by NJIT to accomplish these steps. Two common reasons for needing outside participation were a shortage of technical staff within the company and a need to develop an agenda for technical action before corporate commitment and policy statements could be obtained.

It was not a goal of the ARROW project to participate in the feasibility analysis or implementation steps. However, NJIT offered to provide advice for feasibility analysis if requested.

In each case, the NJIT team made several site visits to the facility. Initially, visits were made to explain the EPA manual and to encourage the facility through the organizational stages. If delays and complications developed, the team offered assistance in the technical review, inspections, and option development.

No sampling or laboratory analysis was undertaken as part of these assessments.

Facility Background

The facility is a manufacturer of oil-based and water-based paints sold for general purpose use. In addition, the company produces painting supplies such as spackle and caulking compound. The company purchases solvents, pigments, and additives and blends them in the proper formulation to create their product line. The materials are then packaged. In order to maintain quality and product consistency, it is necessary to clean the mixing and filling equipment to prevent contamination.

The facility is located in an urban area and employs about 125 people. This particular facility has been in operation for more than 50 years. Substantive pollution prevention concepts have already been introduced into the operations of this facility, including distillation and reuse of waste solvents.

Manufacturing Process

The production of oil-based paints is accomplished by combining and blending the required raw materials such as pigments, resins, co-solvents, and additives with the paint solvents such as toluene or xylene to achieve the required product specification. When color or production changes are made, the tanks and equipment are washed with solvents. The finished products are packaged and prepared for shipment from the facility.

The production of latex or water-based paints is similar except that different types of raw materials are used in production and that the solvent used is water. As in the oil-based production, color or production changes require washing of the tanks and equipment, in this case with water. The finished products are packaged and prepared for shipment from the facility.

The facility also produces other types of products for the painting industry including spackling compounds and caulking materials. The production process for these types of materials are similar—raw materials are purchased, formulated, and blended according to specifications, packaged, and shipped from the facility. The major difference is that these products are solids rather than liquid, so the use of solvents and equipment cleaning needs are substantially different. At the request of the facility, this assessment focussed on the paint manufacturing area.

Existing Waste Management Activities

The company has already instituted a program of pollution prevention. This is perhaps best illustrated by the addition of distillation equipment for recovery and reuse of waste solvents. The current waste management activities at the facility demonstrate an awareness of pollution prevention concepts.

For the oil-based paints, the first identified waste stream is the waste solvent used in the washing of the equipment. This waste stream which contains paint pigments and other additives is generated at a rate of about 1100 gal/wk. The stream is distilled onsite in a 300-gal capacity still. The still bottoms, about 110 gal/wk, is a very dry material which is sent offsite for disposal as hazardous waste. Any filters or dust collectors used to filter batches of paint are collected, dried and sent out for disposal as nonhazardous waste based upon their lack of content of hazardous material. VOCs from evaporating solvent is another waste stream but the volume could not be estimated.

For the water-based paints, the first identified waste stream is the washings from cleaning the equipment between batches. This wash water contains pigments and other additives and in many ways can be considered to be very dilute paint. The wash waters are segregated by color in 55-gal drums prior to onsite processing. The individual drums are combined in a 1000-gal tank and a polymeric flocculent is added to remove the solids. The flocculated mixture is passed through a drum filter, the solids are removed and dried and the liquid is discharged to a POTW. The approximately 1500 lb/wk of dried solid. is sent offsite for disposal as nonhazardous waste. Any filters or dust collectors used to filter batches of this type of paint are collected, dried and sent out for disposal as nonhazardous waste. They are maintained separately from the similar materials from the oil-based paint production.

Waste Minimization Opportunities

The type of waste currently generated by the facility, the source of the waste, the quantity of the waste and the annual treatment and disposal costs are given in Table 1.

Table 2 shows the opportunities for waste minimization recommended for the facility. The type of waste, the minimization opportunity, the possible waste reduction and associated savings, and the implementation cost along with the payback time are given in the table. The quantities of waste currently generated at the facility and possible waste reduction depend on the level of activity of the facility.

It should be noted that the economic savings of the minimization opportunity, in most cases, results from the need for less raw material and from reduced present and future costs associated with waste treatment and disposal. It should also be noted that the savings given for each opportunity reflect the savings achievable when implementing each waste minimization opportunity independently and do not reflect duplication of savings that would result when the opportunities are implemented in a package. Also, no equipment depreciation is factored into the calculations.

The two major options for pollution prevention at this facility consist of completion of the move toward UV coatings and away from solvent-based coatings. This effort is complicated by customer demands and specifications which require the continued use of solvent-based laminates. Continued educational efforts and perhaps improved performance of the UV coatings may be required to change this situation.

Because cleaning of the equipment will still be required after changing to UV coating laminates, it is recommended that a single solvent, ideally one with relatively low toxicity, be selected for this purpose. That solvent should be segregated and a distillation capability obtained for the facility to allow recycling and reuse. This will create another waste stream, the still bottoms, but the volume of that stream will be substantially less than the total volume of the washings.

The practice of using washing solution as makeup or thinner solvent for application of new batches should be continued and expanded where possible. Additionally, care should be taken to keep containers of volatile solvents covered when not in use. This will reduce the amount which evaporates into the atmosphere.

Regulatory Implications

There are no significant regulatory issues which would impede the implementation of additional pollution prevention initiatives at this facility. Increased regulatory attention to air quality may spur the development of additional types of UV coatings for lamination purposes, addressing some of the performance and appearance concerns of clients who insist upon solvent-based lamination. A need remains for an outlet for the residual mylar film. This may not be a regulatory issue, but increased attention to solid waste disposal may develop new options for material of this type

This Research Brief summarizes a part of the work done under cooperative Agreement No. CR-815165 by the New Jersey Institute of Technology under the sponsorship of the New Jersey Department of Environmental Protection and Energy and the U.S. Environmental Protection Agency. The EPA Project Officer was Mary Ann Curran. She can be reached at:

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* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Table 1. *Summary of Current Waste Generation*

Waste Generated	*Source of Waste*	*Annual Quantity Generated*	*Annual Waste Management Costs*
Mixed Organic Solvents	*Washing of equipment used to apply coating to stock*	*40 drums*	*$4,000*
Volatile Solvents	*Solvents driven off from solvent-based coatings*	*>1000 gal*	*(Cost of operating thermal oxidation system)*
Metallized Mylar Film	*Excess from stamping operation*	*Variable (Estimated 2000 lb)*	*65/ton*

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Table 2. *Summary of Recommended Waste Minimization Opportunities*

Waste Generated	Minimization Opportunity	Annual Waste Reduction Quantity	Annual Waste Reduction Percent	Net Annual Savings	Implementation Cost	Payback Years *
Volatile Solvents	Complete changeover to UV laminates	> 1000 gal	100	Cost of operation of thermal oxidizer	$ 0	immed
Washing Solvents	Acquire distillation capability to allow recycle and reuse of solvent	40 drums	100	$4000 (However a still bottoms waste stream will be created.)	5000	1.2

* Savings result from reduced raw material and treatment and disposal costs when implementing each minimization opportunity independently.

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