



# ENVIRONMENTAL RESEARCH BRIEF

## Waste Reduction Activities and Options for a Manufacturer of Artists Supply Paints

Alan Ulbrecht and Daniel J. Watts\*

### 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 manufacturer of artists' supply paints. A site visit was made in 1990 during which several opportunities for waste minimization were identified. These opportunities include changes in product formulation, reduction of spills and leaks of solvents, improved solvent handling techniques, improved equipment cleaning techniques, and recovery of waste 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 a manufacturer of artists' supply paints (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. Because 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

\* New Jersey Institute of Technology, Newark, NJ 07102



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.

### **The Artists' Supply Paints Manufacturer**

The facility is a manufacturer of specialty artistic paints for application on designer wear clothing, tops, scarfs, and home decor items such as wall paintings, quilts, and pillows. The paints, which come in a variety of colors, are packaged in either aluminum or polyethylene tubes. The product line includes both solvent-based and water-based paints. Generally the products are marketed as a kit including the homecraft article, the necessary paints, and other accessories.

In addition to the paint manufacturing/formulation operation, the facility has a high speed printing department and a cutting/assembly area for the kits. Some items are silk-screened and specialty items are hand embroidered.

The paint manufacturing/formulation process is a batch process and both water-based and solvent-based paints are formulated to a maximum batch size of 50 gal in a 55-gal drum. For the solvent-based paints, the required raw materials are mixed with

a combination of solvents such as mineral spirits and light aromatic naphthas to achieve the desired color specification. The water-based or latex paints similarly require that pigments and other raw materials be mixed with water to the required color specification.

All of the components of the paints are purchased from outside suppliers. Moreover, both types of paints must have the appropriate consistency and viscosity to allow tube filling and customer use. The customer desired performance characteristics for this particular use include fast drying time, color fastness, and product durability. Therefore, the formulations must address these needs in addition to any manufacturing requirements.

The formulated batches are analyzed for color and other properties, and once approved are transferred to the filling line. Air diaphragm pumps are used to fill the small tubes with the paint. In order to prevent the paint from plugging the fill line tubing or to prevent color cross-contamination when changing from one product to another, the tubing is rinsed with either water or solvents, depending upon the last product filled. Moreover, when it is necessary to change the filling equipment from water-based to solvent-based products, or vice-versa, a second rinse with the new solvent is required to minimize the opportunities for product contamination and solids precipitation in the filling equipment.

### **Waste Streams and Existing Waste Management**

Solvent wastes are sent offsite for disposal through fuel blending. Aqueous wastes are drummed and sent offsite for treatment as a non-hazardous waste. Off-specification raw materials and formulated paint are sent offsite for disposal.

The company has already instituted some product formulation and manufacturing scale practices which have led to a reduction in the total amount of waste generated at the facility. The appearance of the facility shows that the management and employees recognize the waste reduction value of ease of movement of raw materials, good maintenance of equipment, and spill control and spill prevention activities.

### **Summary of 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 times 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. All values should be considered in that context.

It should be noted that in most cases the economic savings of the minimization opportunity 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.

**Table 1. Summary of Current Waste Generation**

Waste Generated	Source of Waste	Annual Quantity Generated	Annual Costs
Fugitive Solvents	Losses during transfer and mixing of organic solvents	Cannot be determined from available records but can be detected organoleptically *	No direct management costs, but is a direct financial loss of raw materials
Solvent Wastes	Residues from paint formulation and rinsing of filling equipment	3000 gal	\$3545
Aqueous Wastes	Residues from paint formulation and rinsing of filling equipment	16,000 gal	\$23,273
Off-Specification Materials	Inferior raw materials and formulated paints which do not meet specifications	1000 gal(solvent) 2250 gal(water)	\$1,300 \$3,280

\* By use of the senses, such as smell.

**Table 2. Summary of Waste Minimization Opportunities**

Waste Stream Reduced	Minimization Opportunity	Annual Waste Reduction Quantity	Annual Waste Reduction Percent	Net Annual Savings	Implementation Cost	Payback Years*
Solvent Wastes	Distillation for inhouse recycling and reuse	2700 gal	90%	\$15,000	\$4000	0.3
Aqueous Wastes	Use of final rinses as process water	4000 gal	25%	\$5,800	0	immed.
	Dewatering of waste stream using ultra-filtration	14,400 gal	90%	\$20,000	\$20,000	1
Off-specification Paints	Re-formulate into products perhaps with darker colors	200 gal (solvent) 250 gal (water)	20% 20%	\$1,000 \$1,000	0 0	immed. immed.
Fugitive Solvent Emissions	Re-formulate products into all water-based products					
	Install condensing equipment to capture solvents during container filling operations					
	Stage manufacturing and tube filling operations to go from lighter to darker colors and runs as long as possible of solvent-based or water-based product. This reduces amount of solvent used and thus reduces fugitive emissions.					

(It should be noted that because it was not possible to quantify fugitive emissions, it is not possible to accurately determine costs and payback. On the other hand, good pollution prevention practices would encourage and support efforts of this type. Changes in product formulation may meet with customer resistance leading to hesitation on the part of the manufacturer to make such changes.)

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

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:

Pollution Prevention Research Branch  
Risk Reduction Engineering Laboratory  
U.S. Environmental Protection Agency  
Cincinnati, OH 45268

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Environmental Protection Agency  
Center for Environmental Research Information  
Cincinnati, OH 45268

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