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ENVIRONMENTAL RESEARCH BRIEF

Waste Minimization Assessment for a Manufacturer of Can-Manufacturing Equipment

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Abstract

The U.S. Environmental Protection Agency (EPA) has funded a pilot project to assist small- and medium-size manufacturers who want to minimize their generation of hazardous waste but who lack the expertise to do so. Waste Minimization Assessment Centers (WMACs) were established at selected universities and procedures were adapted from the EPA *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003, July 1988). The WMAC team at Colorado State University performed an assessment for a plant that produces equipment for manufacturing and decorating aluminum beverage cans. Each component manufactured undergoes a unique series of operations including cutting, machining, welding, and painting. The team's report, detailing findings and recommendations, indicated that spent cutting fluid and contaminated hydraulic fluid are the largest wastes generated by the plant and that significant savings could result from instituting a recycling program for the waste cutting fluid.

This Research Brief was developed by the principal investigators and EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, to announce key findings of an ongoing research project that is fully documented in a separate report of the same title available from the authors.

Introduction

The amount of hazardous waste generated by industrial plants has become an increasingly costly problem for manufacturers and an additional stress on the environment. One solution to the problem of hazardous waste is to reduce or eliminate the waste at its source.

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University City Science Center (Philadelphia, PA) has begun a pilot project to assist small- and medium-size manufacturers who want to minimize their formation of hazardous waste but who lack the in-house expertise to do so. Under agreement with EPA's Risk Reduction Engineering Laboratory, the Science Center has established three WMACs. This assessment was done by engineering faculty and students at Colorado State University's (Fort Collins) WMAC. The assessment teams have considerable direct experience with process operations in manufacturing plants and also have the knowledge and skills needed to minimize hazardous waste generation.

The waste minimization assessments are done for small- and medium-size manufacturers at no out-of-pocket cost to the client. To qualify for the assessment, each client must fall within Standard Industrial Classification Code 20-39, have gross annual sales not exceeding $50 million, employ no more than 500 persons, and lack in-house expertise in waste minimization.

The potential benefits of the pilot project include minimization of the amount of waste generated by manufacturers, reduced waste treatment and disposal costs for participating plants, valuable experience for graduate and undergraduate students who participate in the program, and a cleaner environment without more regulations and higher costs for manufacturers.

Methodology of Assessments

The waste minimization assessments require several site visits to each client served. In general, the WMACs follow the procedures outlined in the EPA *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003, July 1988). The

WMAC staff locates the sources of hazardous waste in the plant and identifies the current disposal or treatment methods and their associated costs. They then identify and analyze a variety of ways to reduce or eliminate the waste. Specific measures to achieve that goal are recommended and the essential supporting technological and economic information is developed. Finally, a confidential report that details the WMAC's findings and recommendations (including cost savings, implementation costs, and payback times) is prepared for each client.

Plant Background

This plant produces equipment for the manufacture and decoration of aluminum beverage containers. Over 60 units of equipment are produced each year by the plant's 225 employees.

Manufacturing Process

Large main frames and a variety of small internal components are manufactured by the plant and assembled into the final product.

Each internal component manufactured undergoes a unique series of operations; the general production sequence is described below:

- Bar stock, sheet steel, and aluminum castings are cut to the appropriate size.
- The cut metal undergoes milling, drilling, grinding, and boring operations as needed to form the components.
- Some components are welded and then shipped offsite for stress-relief treatment.
- Residual cutting fluid is removed from the parts using petroleum naphtha.
- Components are painted and then sent either to the assembly area or directly to customers for use as spare parts.

The large frames undergo the following operations:

- Bar stock, sheet steel, and aluminum castings are cut to size and milled, drilled, ground, and bored.
- The metal is welded to form the frames.
- The frames are sent offsite for abrasive cleaning and stress-relief treatment.
- Frames are painted and sent to the assembly area.

The manufacturing and decorating machines are assembled, inspected, tested, and shipped to customers.

Existing Waste Management Practices

Spent solvent resulting from component cleaning is removed by a vendor and recycled. The plant plans to switch to paints that will reduce the emission of volatile organic compounds.

Waste Minimization Opportunities

The type of waste currently generated by the plant, the source of the waste, the current management method, the quantity of the waste, and the annual waste management costs are given in Table 1.

Table 2 shows the opportunities for waste minimization and cost savings that the WMAC recommended to the plant. 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 by the plant and possible waste reduction depend on the production level of the plant. All values should be considered in that context.

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. Other savings not quantifiable by this study include possible future costs related to changing emissions standards, liability, and employee health. 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.

This research brief summarizes a part of the work done under Cooperative Agreement No. CR-814903 by the University City Science Center under the sponsorship of the U.S. Environmental Protection Agency. The EPA Project Officer was Emma Lou George.

Table 1. *Summary of Current Waste Generation*

Waste Generated	*Source of Waste*	*Management Method*	*Annual Quantity Generated, gal*	*Annual Waste Management Cost*
Spent water-based cutting fluid and wastewater	*Machining and grinding operations*	*Blended into cement at a nonhazardous waste disposal facility*	*6,160*	*13,570*[1]
Contaminated hydraulic fluid	*Machining operations*	*Shipped offsite for incineration*	*1,465*	*13,860*[1]
Spent petroleum naphtha	*Cleaning of internal components*	*Removed by vendor and recycled offsite*	*519*	*2,020*
Spent paint and thinner	*Painting operation*	*Shipped offsite for incineration*	*1,350*	*23,430*[1]
Paint overspray	*Painting operation*	*Conventional disposal*	*1,672*	*28,950*[1]

[1] *Includes savings on purchased materials*

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Table 2. Summary of Recommended Waste Minimization Opportunities

Waste Generated	Minimization Opportunity	Annual Waste Reduction		Net Annual Savings	Implementation Cost	Payback Years
		Quantity	Percent			
Paint overspray	Replace the conventional spray gun with a High Volume Low Pressure (HVLP) spray gun to reduce overspray waste.	1,048 gal	63	18,140[1]	590	0.03
Waste cutting fluid	Institute a program to recycle cutting fluid. Remove metal chips and particulate matter from the sump using a portable filtration unit. Provide continuous filtration of the cutting fluid when the proposed unit is not being used in conjunction with the sump. In addition, treat spent cutting fluid with acid and neutralize the resulting aqueous phase prior to sewering. The organic phase (a smaller volume) can continue to be shipped offsite for disposal.	2,075 gal		6,140[1]	11,750	1.9
Spent thinner	Install a solvent recovery unit to distill solvent waste to generate reusable solvent.	510		5,400[1]	4,360	0.8
Hydraulic fluid	Ship waste hydraulic oil to an oil recycler rather than to a disposal facility for incineration.	0		3,520	0	0
Spent petroleum naphtha	Replace the petroleum naphtha used for cleaning with an aqueous cleaner.	470		1,140	2,050	1.8

[1] Includes savings on purchased materials.

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