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ENVIRONMENTAL RESEARCH BRIEF

Pollution Prevention Assessment for a Manufacturer of Food Service 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 waste but who lack the expertise to do so. In an effort to assist these manufacturers 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). That document has been superseded by the *Facility Pollution Prevention Guide* (EPA/600/R-92/088, May 1992). The WMAC team at Colorado State University performed an assessment at a plant that manufactures commercial food service equipment. Raw materials used by the plant include stainless steel, mild steel, aluminum, and copper and brass. Operations performed in the plant include cutting, forming, bending, welding, polishing, painting, and assembly. The team's report, detailing findings and recommendations, indicated that paint-related wastes are generated in large quantities and that significant cost savings could be achieved by retrofitting the water curtain paint spray booth to operate as a dry filter paint booth.

This Research Brief was developed by the principal investigators and EPA's National Risk Management Research 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 University City Science Center.

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Introduction

The amount of 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 waste generation is to reduce or eliminate the waste at its source.

University City Science Center (Philadelphia, PA) has begun a pilot project to assist small and medium-size manufacturers who want to minimize their generation of waste but who lack the in-house expertise to do so. Under agreement with EPA's National Risk Management Research 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 waste generation.

The pollution prevention opportunity 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 $75 million, employ no more than 500 persons, and lack in-house expertise in pollution prevention.

The potential benefits of the pilot project include minimization of the amount of waste generated by manufacturers, and reduction of waste treatment and disposal costs for participating plants. In addition, the project provides 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 pollution prevention opportunity 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 locate the sources of waste in the plant and identify 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 manufactures commercial food service equipment, storage bins, cabinets, and other miscellaneous sheet metal products. Sixty employees produce one-half million pounds of stainless steel and painted steel products during approximately 2,200 operating hours annually.

Manufacturing Process

Specialty Sheet Metal Fabrication

Food service equipment, counter tops, case work, and other products required on a job-shop basis are produced in the custom shop area of the plant. Raw materials used include stainless steel (primarily), mild steel, aluminum, and copper and brass.

Stainless and mild steel arrive at the plant in sheets of precut blanks that are trimmed to size using hydraulic shears. Operations performed include plasma cutting, forming, bending, custom welding, polishing, finishing, and assembly.

Ice Storage Equipment Fabrication

The other production activity at this plant is the fabrication of ice storage equipment. Trimmed sheet metal received from the shearing operation is cut, formed, welded, finished, prepared for painting, painted, and insulated with a polyurethane foam.

An abbreviated process flow diagram depicting the production operations of this plant is shown in Figure 1.

Existing Waste Management Practices

This plant already has implemented the following techniques to manage and minimize its wastes.

- Scrap stainless steel is collected and sold to a scrap metal dealer for reuse.
- A citrus-based cleaner is used instead of solvents in some wipe-down cleaning operations.
- Most of the ice storage products are coated using powder coating technology rather than conventional painting, thereby reducing the generation of paint-related wastes.
- The nozzle of the foam insulation application system is cleaned with ethylene glycol rather than methylene chloride.

Pollution Prevention Opportunities

The type of waste currently generated by the plant, the source of the waste, the waste management method, the quantity of the waste, and the waste management cost for each waste stream identified are given in Table 1.

Table 2 shows the opportunities for pollution prevention that the WMAC team recommended for the plant. The opportunity, the type of waste, the possible waste reduction and associated savings, and the implementation cost along with the simple 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 opportunities, 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 a wide variety of possible future costs related to changing emissions standards, liability, and employee health. It also should be noted that the savings given for each opportunity reflect the savings achievable when implementing each pollution prevention opportunity independently and do not reflect duplication of savings that may result when the opportunities are implemented in a package.

Additional Recommendations

In addition to the opportunities recommended and analyzed by the WMAC team, two other measures were considered. These measures were not analyzed completely because of projected lengthy payback times. Since these approaches to pollution prevention may, however, increase in attractiveness with changing conditions in the plant, they were brought to the plant's attention for future consideration.

- Install a solvent recovery unit to recover waste toluene generated during parts cleaning and wipe-down in the painting area.
- Install an enclosed spray gun washer in order to reduce solvent air emissions associated with paint gun cleaning.

This research brief summarizes a part of the work done under Cooperative Agreement No. CR-819557 by the University City Science Center under the sponsorship of the U. S. Environmental Protection Agency. The EPA Project Officer was **Emma Lou George**.

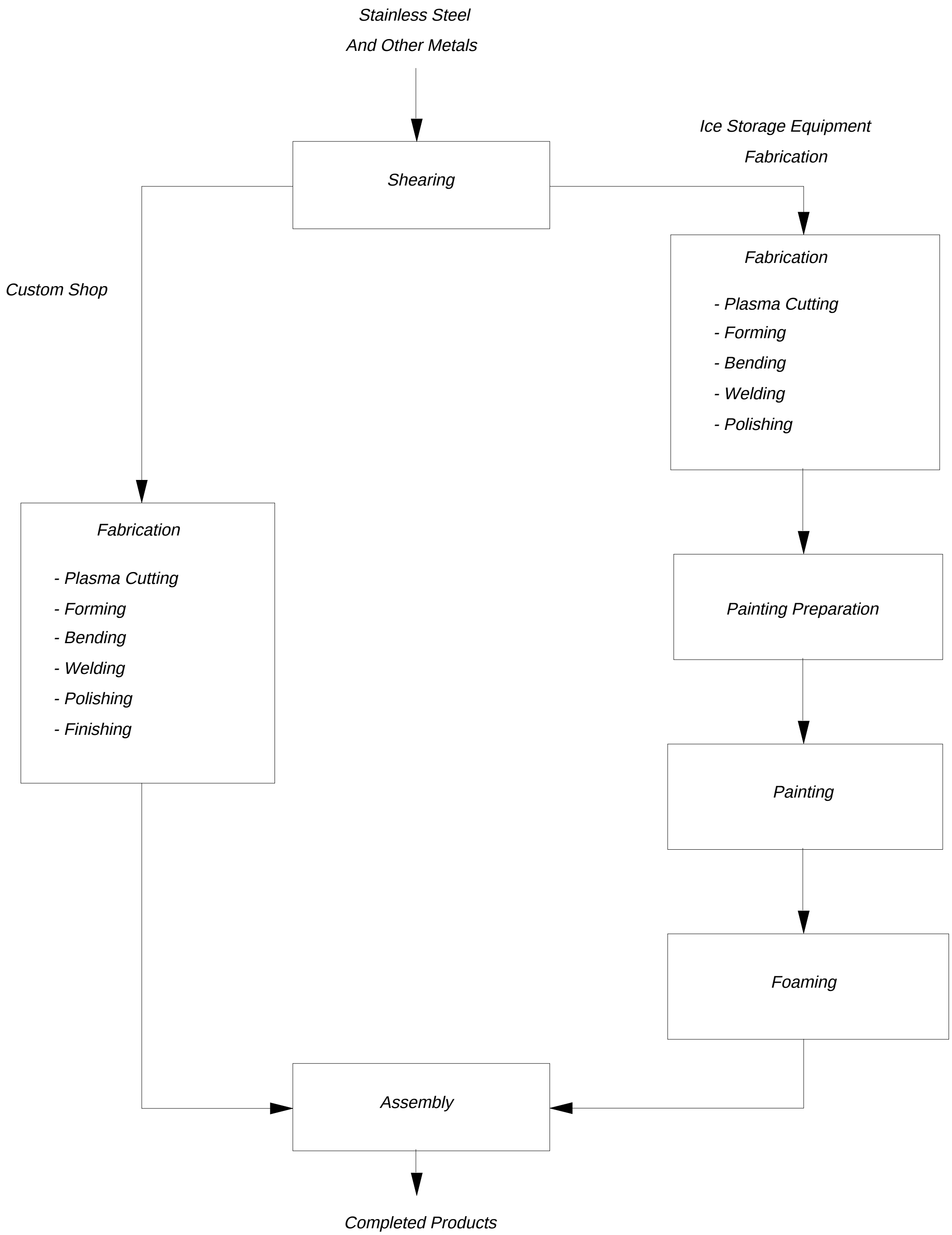

Figure 1. *Abbreviated process flow diagram for production of food service equipment.*

Table 1. *Summary of Current Waste Generation*

Waste Stream Generated	Source of Waste	Waste Management Method	Annual Quantity Generated (lb/yr)	Annual Waste Management Cost ($/yr)
Scrap stainless steel	Shearing operations	Sold as scrap	112,500	not available
Evaporated mineral spirits	Cleaning	Evaporates to plant air	360	$120[1]
Evaporated lacquer thinner	Cleaning	Evaporates to plant air	4,290	1,840[1]
Spent alkaline cleaner	Preparation of mild steel for painting	Discharged to sewer as industrial wastewater	49,980	0
Rinse water	Preparation of mild steel for painting	Discharged to sewer as industrial wastewater	49,980	0
Spent phosphating solution	Preparation of mild steel for painting	Discharged to sewer as industrial wastewater	49,980	0
Waste toluene	Cleaning of cabinets prior to painting	Shipped offsite as hazardous waste; distilled for reuse or incinerated	1,060	900[1]
Evaporated toluene	Cleaning of cabinets prior to painting	Evaporates to plant air	380	130[1]
Waste toluene	Cleaning of small parts	Shipped offsite as hazardous waste; distilled for reuse or incinerated	520	460[1]
Evaporated citrus-based cleaner	General cleaning in custom shop	Evaporates to plant air	230	220[1]
Evaporated solvent from primer and thinner	Painting operations	Evaporates to plant air	490	50[1]
Paint overspray	Painting operations	Captured in paint booth water curtain; shipped offsite with paint sludge (water) as hazardous waste; distilled for reuse or incinerated	520	1,790[1]
Paint sludge (water)	Paint booth water curtain	Shipped offsite as hazardous waste; distilled for reuse or incinerated	3,330[2]	2,940[2]
Evaporated toluene	Paint gun cleaning	Evaporates to plant air	750	260[1]

[1]Includes lost raw material value.
[2]An additional 12,510 lb of paint sludge currently is stored onsite awaiting disposal.

Table 2. *Summary of Recommended Pollution Prevention Opportunities*

Pollution Prevention Opportunity	Waste Stream Reduced	Annual Waste Reduction		Net Annual Savings	Implementation Cost	Simple Payback (yr)
		Quantity (lb/yr)	Percent			
Retrofit the currently used water curtain paint spray booth to operate as a dry filter paint booth. Savings will result from reductions in the generation and disposal of hazardous paint-related material, labor costs for periodic paint booth cleaning, and energy costs for operating the booth. Filters containing paint overspray can be dried and disposed of as municipal trash.	*Paint sludge*	*3,330*	*100*	*$3,760*	*$ 2,000*	*0.5*
Replace the currently used conventional paint spray guns with high-volume low-pressure spray guns. Savings will result from reductions in the amount of paint and associated thinners that must be purchased and in the quantity of waste paint-related material that must be disposed of.	*Evaporated solvent from primer and thinner`* *Paint overspray*	*220* *380*	*45* *73*	*1,260*	*900*	*0.7*
Replace toluene used for cleaning small parts in the painting area with an alternate, less toxic solvent. Waste reduction will result from reduced generation of spent toluene and savings will result from a decrease in waste disposal costs and a decrease in solvent purchases. A small quantity of oil will be collected on filters; the oil can be shipped to an oil recycler at little or no cost.	*Waste toluene from cleaning of small parts*	*520*	*100*	*280*	*670*	*2.4*

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