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EPA ENVIRONMENTAL RESEARCH BRIEF

Waste Minimization Assessment for a Manufacturer of Prewashed Jeans

Richard J. Jendrucko*, Thomas N. Coleman*,
and Gwen P. Looby**

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 That document has been superseded by the *Facility Pollution Prevention Guide* (EPA/600/R-92/088, May 1992).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 the University of Tennessee performed an assessment at a plant that prewashes denim jeans prior to retail sale. Predyed jeans are received from other facilities and washed. An abrasive material is used in some of the wash loads. Some of the jeans are processed in tumblers in order to give the jeans a faded look. After processing, the jeans are dried, inspected, mended, pressed, packaged, and shipped. The assessment team's report, detailing findings and recommendations, indicated that the waste generated in the greatest quantity is wastewater from the washers and tumblers and that the greatest cost savings could be realized by installing an onsite wastewater treatment plant.

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 University City Science Center.

* University of Tennessee, Department of Engineering Science and Mechanics.
** University City Science Center, Philadelphia, PA.

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 Risk Reduction Engineering Laboratory, the Science Center has established three WMACs. This assessment was done by engineering faculty and students at the University of Tennessee's (Knoxville) 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 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 $75 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 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 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 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 prewashes predyed denim jeans for wear modification prior to retail sale. Over 7 million pairs of jeans are processed annually by this plant.

Manufacturing Process

The following steps are involved in processing the jeans:

- Predyed jeans are received from other facilities and sorted into lots.
- Jeans are washed to strip dye and starches from the material. An abrasive is used in 10% of the washing loads. Some of the jeans go directly to tumblers.
- Some of the washed jeans and other jeans not previously washed are processed in tumblers where they are physically and chemically abraded with pumice and enzymes to give the jeans a faded and "worn" look. Other jeans go directly to drying after washing. Jeans are rewashed after tumbling.
- The garments are dried, inspected, and mended as needed.
- Garments are graded as first, second, or third quality.
- Garments are steam pressed, labels are applied, and the prewashed jeans are packaged and shipped to distribution centers.

An abbreviated process flow diagram for producing prewashed jeans is shown in Figure 1.

Existing Waste Management Practices

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

- Containers in which the jeans are received are disassembled and shipped back to the supplier for reuse.
- Pumice of an acceptable size is reused.

Waste Minimization 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 annual treatment and disposal cost for each waste stream identified are given in Table 1.

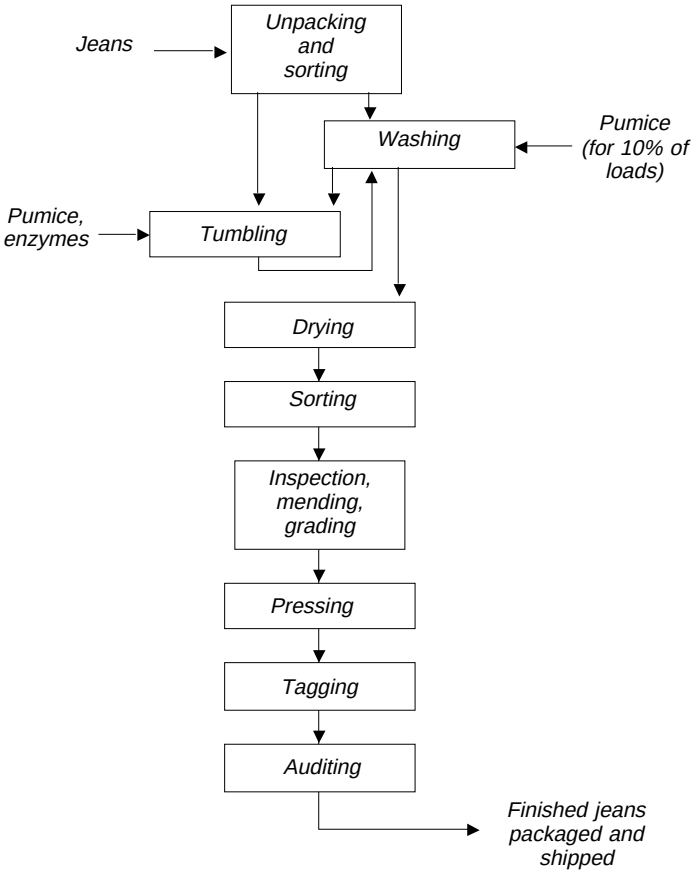

Figure 1. *Abbreviated process flow diagram for producing prewashed jeans.*

Table 2 shows the opportunities for waste minimization that the WMAC team recommended for the plant. The minimization 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, in most cases, the economic savings of the minimization opportunities result from the need for less raw material and from reduced present and future costs associated with hazardous 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 waste minimization opportunity independently and do not reflect duplication of savings that may 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 Stream Generated	Source of Waste	Waste Management Method	Annual Quantity Generated (lb)	Annual Waste Management Cost[1]
Wastewater	Washers	Filtered; sewered	533,869,230	$210,170
Wastewater	Tumblers	Filtered; sewered	53,387,090	20,980
Evaporated water	Dryers and other sources	Evaporates to plant air	39,425,000	13,110
Pumice and lint	Removed from wastewater using hydrosieve and shaker screen	Shipped to municipal landfill	1,137,500	105,440
Pumice grit	Settles out of wastewater in holding pit	Shipped to special landfill	349,500	37,580
General plant waste	Various processes	Compacted; shipped to municipal landfill	1,650,000	73,760

[1] *Includes waste treatment, disposal, and handling costs and applicable raw material costs.*

Table 2. *Summary of Recommended Waste Minimization Opportunities*

Minimization Opportunity	Waste Stream Reduced	Annual Waste Reduction		Net Annual Savings	Implementation Cost	Simple Payback (yr)
		Quantity (lb)	Percent			
Install an onsite wastewater treatment plant to treat spent water from the washing and tumbling operations. Reuse treated water. A nonhazardous sludge will be generated if this opportunity is implemented.	Wastewater from washers Wastewater from tumblers	513,250,000 50,760	95 95	$350,000[1]	$1,570,000	4.5
Reuse rinse waters used in the washing operations during the next washing cycle.	Wastewater from washers	284,856,000	53	95,480	23,260	0.2
Install a screen over the dumpster that is used to collect pumice from the hydrosieve and the shaker screen in order to recover additional pumice stones for reuse.	Pumice and lint	140,000	40	23,690	3,300	0.1
Install plastic shrouds to reduce pumice lost in the space between the housings and drums in the tumblers.	Pumice and lint	140,000	40	18,690[1]	3,000	0.2
Meter the wastewater leaving the plant in order to reduce sewer charges. Currently, the plant's sewer charges are based on the amount of water purchased not on the amount of water sewered. A significant amount of water is absorbed by the jeans in the washing process and subsequently removed by drying. In addition other water losses from spills and steam pressing occur.	Wastewater	—	—	7,125	5,140	0.7

[1] *Total annual savings have been reduced by the annual operating cost required for implementation.*

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