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EPA ENVIRONMENTAL RESEARCH BRIEF

Waste Minimization Assessment for a Manufacturer Producing Treated Wood Products

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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 at a plant producing treated wood products—approximately 1,700,000 ft ^{3}/yr. Railroad crossties and poles are treated with creosote in pressure cylinders to increase their serviceability under conditions that promote decay, weathering, insect destruction, or exposure to fire. Lumber is treated by Wolmanizing, a closed loop process in which a 2% chromated copper arsenate solution is used for treatment in a pressure cylinder. The team's report, detailing findings and recommendations, indicated that most waste was generated in the creosote treatment process, and also that cost savings could be obtained by arranging an exchange of accumulated bark and wood chips with others who use wood scrap as a raw material.

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.

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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.

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

The plant produces treated wood products. It operates 8,760 hr/yr to process approximately 1,700,000 ft ^{3}/yr of wood.

Manufacturing Process

The plant treats crossties and poles with creosote and No. 6 oil in heated pressure cylinders. Lumber is treated with 2% chromated copper arsenate solution in a pressure cylinder. The raw materials used are the wood products, creosote, No. 6 oil, and chromated copper arsenate. Steam is used for cleaning the surface of the wood in the creosote treatment cylinders, and ozone is used to destroy phenols in the steam condensate.

The following steps are involved in treating the wood products:

- Crossties and poles are trimmed on the ends and stacked on rail trams which are pushed into a pressure treatment cylinder.
- A heated mixture of 50% (v/v) creosote and No. 6 oil is pumped into the cylinder and pressured to force the liquids into the wood cells.
- The liquid is drained from the cylinder and held for re-use.
- The cylinder is flooded with steam to clean excess creosote and oil from the surface of the wood. A vacuum is drawn on the cylinder to enhance removal of the liquid from the wood and the cylinder.
- Steam condensate drains to a blowdown tank. Residual creosote and oil that drains when the cylinder is opened is pumped to the blowdown tank. The creosote is separated from the condensate and held for re-use.

These steps are involved in treating lumber:

- Lumber is stacked on rail trams which are pushed into a pressure treatment cylinder.
- A closed-loop Wolmanizing process with 2% chromated copper arsenate is used for treatment. The cylinder is pressurized to 125 psig.
- Solution drained from the cylinder is held for re-use.

Steam condensate from creosote treatment is treated with a flocculant to settle contained creosote, and the pH is adjusted to 3.6 - 4.0. An ozone treatment is used to break down phenols in the steam condensate before it is discharged as industrial wastewater. Creosote wastes are also generated from periodic steam cleaning of the treatment cylinders. No steam is used in cleaning the Wolmanizing cylinders. Accumulated waste containing chromated copper arsenate is disposed of as hazardous waste.

Existing Waste Management Practices

- Cylindrical tanks holding creosote and chromated copper arsenate have been fitted with conical bottoms for accumulation of sludge, minimizing the need for periodic cleaning.
- The Wolmanizing pressure cylinder does not require steam cleaning, lessening the quantity of contaminated waste.
- Storage tanks are heated to maintain proper viscosity and reduce sludge formation.

Waste Minimization Opportunities

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

Table 2 shows the opportunities for waste minimization that the WMAC team recommended for 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 hazardous 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.

Additional Recommendations

In addition to the opportunities recommended and analyzed by the WMAC team, three additional measures were considered. These measures were not analyzed completely because of insufficient data or low projected savings. Since one or more of these approaches to waste reduction may, however, increase in attractiveness with changing conditions in the plant, they were brought to the plant's attention for future consideration.

- Use steam condensate from creosote treatment as boiler feedwater.
- Collect creosote drainage generated when the cylinders are opened for removal of crossties and poles.
- Preclean the crossties and poles before treatment to reduce the quantity of creosote sludge generated when the cylinders are cleaned.

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	Annual Quantity Generated	Annual Waste Management Cost
Spent chromated copper arsenate solution	Residual solution collected when cleaning the Wolmanizing pressure cylinder used for treatment of lumber is disposed of as hazardous waste.	280 gal	$ 700
Water and creosote mixture	Steam condensate from cleaning of creosote-treated crossties and poles to remove excess creosote is treated with a flocculant, settled and decanted, treated with ozone and caustic soda, and discharged as industrial wastewater.	720,000 gal	4,175
Creosote sludge	Cleaning of the creosote treatment cylinders results in a creosote sludge. Part of the sludge is shipped for use as boiler fuel, and the remainder is disposed of as hazardous waste.	16,550 gal	16,625
Bark and wood chips	Chips, bark, and wood trimmings are stored in an open area on leased property awaiting disposal.	9,750 yd^3	1,200

Table 2. *Summary of Recommended Waste Minimization Opportunities*

Waste Generated	Minimization Opportunity	Annual Waste Reduction		Net Annual Savings	Implementation Cost	Payback Years
		Quantity	Percent			
Bark and wood	Arrange a waste exchange with others who use wood scraps as raw material.	9,750 yd^3	100	$1,200	0	0

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