# Waste minimization at a greenfield kraft mill

**William R. Heatley, Jr., and W. Martin Barfield**

*ABSTRACT: Successful facilities in the 21st century will be committed to a waste minimization program that prevents, reduces, reuses, and recycles materials that normally would be disposed of haphazardly. Chemical control, incineration, waste reclamation, and land application are four key components to the program at our Marlboro mill. Employee involvement and training are vital to the success of such programs. While they require investment of time and money, waste minimization programs are offset by the benefits produced: positive public image, monetary gains, regulatory compliance, and avoidance of liability.*

*KEYWORDS: Combustion, kraft mills, land reclamation, recycling, regulations, reuse, solid wastes, waste management, wastes.*

In 1990, Willamette Industries, Inc. started up a greenfield mill in Bennettsville, SC. From the beginning, we thought a waste minimization program would be necessary in light of escalating waste costs and increasing regulations. The program we devised used key components to reduce, reuse, and recycle materials. It reduced both solid and hazardous wastes at their source and provided opportunities to recycle or reuse waste streams. This is a more effective process than requiring expensive end-of-pipe treatment or landfilling. For this program to be successful, we had to involve all employees at the facility, including contractors.

There are several required and voluntary regulations that drive the need for a program of this nature. The Marlboro mill's National Pollution Discharge Elimination System Permit required the facility to have a Spill Prevention Control and Countermeasure Plan for oil and a Best Management Practices Plan for hazardous chemicals. The 33/50 Program of 1988 called for the voluntary reduction of 17 priority pollutants. More specifically, this program set goals for a 33% reduction by 1992 and a 50% reduction by 1995. The Pollution Prevention Act of 1990 required facilities to have a waste minimization program in place by 1992. Also, regulatory requirements such as the Clean Air Act and Maximum Achievable Control Technology will make pollution prevention and waste minimization a standard operating practice for all personnel at facilities in the future.

## Waste minimization program components

### Chemical control program

A vital ingredient of the waste minimization program is the chemical control program. Most facilities have a chemical control program to manage the purchase of products and to ensure that only U.S. Food and Drug Administration-approved products come in contact with pulp used for food containers.

We decided to use the chemical control program at the Marlboro mill as a tool to prevent or reduce the amount of generated hazardous waste by minimizing the use of products that generate hazardous wastes. Before a product can be brought onto the mill site, information about its chemical makeup, storage volume, storage location, usage rate, process use, and its MSDS (Manufacturer's Saftey Data Sheet) is reviewed. This information is evaluated by the mill's Technical Services Department to determine the product's waste clas-

**Heatley is principal project manager at Roy F. Weston Inc., Morrisville, NC 27560 and Barfield is technical services manager at Willamette Industries, Inc., Bennettsville, SC 29512-0678.**

sification. If the product would generate a hazardous waste, an attempt is made to find a nonhazardous substitute. If nonhazardous substitutes cannot be found, then it is approved and purchased for limited mill usage. All mill chemicals are reviewed through this process and approved before they can be purchased by the mill.

This program also helps reduce hazardous wastes by properly identifying their characteristics to all mill personnel. This is accomplished by listing the products and requiring storeroom personnel to mark these products with an orange tag upon receipt. All mill personnel, including contractors, understand the meaning of the orange tag, resulting in the proper disposal of wastes generated from the product's use. This training is part of the required annual Resource Conservation Recovery Act and Hazard Communication Standard training for all mill personnel and contractors.

Information is collected by reviewing MSDS and is used to generate process and nonprocess chemical data sheets. The data sheets summarize pertinent information on all approved chemical products. Information includes safety data, spill response, reportable quantities, etc. The information is placed into a database for future reference and use. This system provides easier disposal, faster response, and accurate reporting for any spills, leaks, and wastes since this information is determined before a product is brought onto the mill site.

The Marlboro mill program results in increased employee awareness and requires their involvement. With the increasing environmental liabilities faced by today's facilities, employee involvement and interaction is necessary for any environmental compliance program.

### Incineration program

Another program that reduces solid waste at the Marlboro mill is the incineration of residual fibrous wastes generated at the facility. This residual fuel includes primary clarifier sludge, screened chip fines, and medium-density fiberboard (MDF) sander dust. The fibrous sludge is recovered from the primary clarifier and dewatered by a screw press to 40–45% solids. Fines are generated from the chip thickness screening system and are conveyed to the fuel pile for use as a residual fuel. An adjacent company-owned MDF facility generates sander dust from the process of manufacturing MDF board. This sander dust is pneumatically conveyed into a storage silo prior to use in a hogged fuel boiler.

Clarifier sludge and screened fines are mixed and blended with the hogged fuel (bark) prior to firing in the boiler. Sander dust is pneumatically injected into the boiler through multiple sander dust burners. The Marlboro mill uses the hogged fuel boiler to generate steam required for the papermaking processes.

### Waste reclamation program

Since waste costs are an increasing business expense and since Willamette's corporate philosophy encourages responsible stewardship, significant effort is made to reduce solid wastes and increase recycling activities. These activities include segregation of mill solid wastes, collection and recycling of used petroleum products and hazardous wastes, efficient landfill management practices, and aggressive land application programs.

### Solid-waste minimization

Mill solid wastes are segregated according to their construction or makeup. The segregation of wastes requires the involvement of all mill personnel and is simplified by a colored dumpster system. **Table I** describes the different colored dumpsters located throughout the mill and depicts their solid-waste contents. Employees and contractors are responsible for segregating solid wastes at the initial disposal site. This provides the first step in efficiently managing the mill's solid wastes.

**I.** Dumpster color and waste contents

| *Dumpster color* | *Waste contents* |
|---|---|
| White | Recyclable cardboard |
| Green | General mill debris |
| Blue | Office and food waste |
| Orange | Scrap steel |
| Gray | Scrap aluminum |
| Red | Scrap copper |
| Brown | Fibrous sludge, fines, and reject chips |
| Yellow | Hog boiler ash |
| Black | Oversized wood waste |

Other examples of responsible waste management include the sale of scrap steel, aluminum, and copper for revenue, recycling of scrap and off-grade paper into top-quality fine paper, recycling of miscut or scrap paper cores into new cores by the local vendor, and the recycling or reuse of used, good condition wood pallets. Further, gross over-sized screen rejects from the mill's bark and screen systems are stockpiled for "hogging." The resulting fine "mulch" is again stockpiled and is available to employees and the local community as landscape mulch and, with time, compost. This activity is an approved and permitted activity by the state of South Carolina.

### Petroleum and hazardous waste management

Several satellite sites located throughout the mill are used to collect waste oil and hazardous wastes. The locations of these sites were chosen by operating personnel to ensure user friendliness. These sites are set up to collect both solid and liquid wastes. These collection sites are routinely audited to ensure good housekeeping as well as regulatory compliance. Vendors and suppliers of these products are used to collect and transport the wastes out of the mill for recycling purposes. Spill control and containment items are also placed at the collection sites as re-

quired by the mill's Spill Prevention Control and Countermeasures Plan and Best Management Plan.

## Landfill management

Efficient management of the on-site landfill is critical to effectively meet the objectives of the waste minimization program. Landfill objectives include extending the useful life as well as controlling the material deposited in the landfill. Willamette is permitted to operate an inert solid-waste landfill. Items approved for disposal in the landfill include general mill wastes such as discarded paper machine clothing, general mill construction debris, nonrecyclable packaging materials, etc. Items not permitted for use in the landfill include sanitary wastes. While causticizing wastes and boiler fly-ash can be placed in the landfill, Willamette has pursued land application of these by-products, eliminating them as landfilled wastes.

Since sanitary wastes require daily covering and since the percentage of sanitary waste to general mill wastes is relatively small, these wastes are landfilled in the regional public landfill. Tipping fees are more than offset since the company is not required to cover the landfill on a daily basis. Other examples of effective landfill management include approval to cover on a quarterly basis instead of the initial monthly basis and approval to use hogged fuel boiler "grate" ash as a cover material. Both of these items reduce the amount of fill required to cover, resulting in increased incremental landfill life. Further, the use of grate ash kills two birds with one stone since the landfilled material doubles as cover material. Additionally, an inert landfill does not have the strenuous requirements associated with an industrial landfill (i.e., monitoring wells, synthetic liner, and leachate collection). The net result is a landfill that can receive 90% of "true" mill wastes in a long-term, cost-effective, and environmentally responsible manner. In practical terms, waste minimization associated with the landfill is estimated to extend the original life expectancy by 11 years.

## By-products land application

Land application of causticizing by-products and boiler fly-ash originated from a similar Willamette facility in Oregon. The Marlboro mill's program consists of applying causticizing grits, dregs, occasional excess lime mud, and hogged fuel boiler fly-ash to the land for agricultural benefit. These by-products are available at low and no cost to local area farmers as an agricultural lime substitute. Area interest and feedback to date have been very favorable.

Clemson University and the South Carolina Department of Health and Environmental Control (SCDHEC) reviewed and supported our program, ensuring both regulatory and technical success prior to implementation. With respect to SCDHEC, both the Bureaus of Water Pollution Control and Solid and Hazardous Wastes were involved in the regulatory review. SCDHEC required Toxicity Characteristic Leaching Procedure (TCLP), nutrients, and metals analyses to determine land application feasibility. Since TCLP results passed drinking water standards and since metals and nutrients proved to be low in concentration, SCDHEC approved the land application program. Although a permit was not required or issued, Willamette adopted the requirements specified in SCDHEC's *Land Application Sludge Guidance Manual*[1] as the practical criteria for the hauling and spreading of by-products. These recommendations include:

1. Transporting the material with covered trucks
2. Documenting the amount of material applied to an area
3. Storing the material so that runoff to surface water or groundwater does not occur
4. Applying the material to property that has a minimum depth to seasonally high water of 30 in.
5. Using a 50-ft setback buffer for property boundaries and public and private roads
6. Using a 100-ft setback buffer for dwellings, wells, and surface water
7. Testing the soil in the proposed application area to determine proper application rate
8. Testing the material on a periodic basis to ensure that the TCLP levels do not rise above drinking water standards.

Clemson University reviewed agricultural analyses and provided guidance on suitable crop applications and equivalent agricultural lime application rates.[2] Lime substitution application rates range from 1.3 tons of lime mud to equal 1 ton of agricultural lime to 3 tons of fly-ash to equal 1 ton of agricultural lime. All by-products contain sufficient and usable nutrients for good crop production. Since lime mud most closely resembles agricultural limestone and since lime mud is available for sale at a low cost, lime mud has become a registered agricultural product through the Clemson University Department of Agriculture, which has regulatory responsibility for agricultural products in South Carolina. Since the remaining by-products are available free of cost, registration is not required.

To communicate the benefits of the mill's by-products, several meetings were held with local area farmers and local Clemson agricultural extension personnel to present and discuss our by-products program.

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[1]South Carolina Department of Health and Environmental Control, *Land Application of Sludge Guidance Manual*, 1987.

[2]Camberato, J. J., *Application Letters*, Clemson University, Clemson, SC, 1992, 1993, and 1994.

These meetings resulted in an understanding of the program by the community as well as ensuring Willamette support to individuals in managing spreading logistics. Again, Clemson University's involvement at the meetings validated our program with local area farmers. Without a doubt, the support and cooperation from both Clemson University and SCDHEC have been essential elements to the success of our land application program.

Spreading of the materials proved to be a challenge since the "consistency" of the products varied widely. After many trials, a Knight side slinger spreader proved to be effective in efficiently spreading the materials to the recommended particle size for good agricultural benefit. Two spreaders now operate routinely in spreading the by-product materials.

Land application of these by-products results in about 15,000 tons/year of material beneficially used. From another view, Willamette has eliminated 15,000 tons (approximately 23,000 cubic yards) of material from being placed in the on-site landfill.

## Benefits

There are many reasons why Willamette Industries chooses to aggressively pursue waste minimization activities at its Marlboro mill. First, waste minimization is an important element in managing waste costs. The goal of the company is to manage waste dollars in the most responsible and agreeable manner.

Second, with the hiring of new operating and maintenance technicians, waste minimization activities could become the expected norm as opposed to "just another program" implemented at a later date. It is our intent to make waste minimization part of the mill's culture.

Third, waste minimization results in much less environmental liability. Willamette is better able to control "hot spots" by extending management over traditional waste streams. The result is a trend toward by-products management as opposed to waste generation.

Fourth, it is the Marlboro mill's intent to remain a positive, responsible community member. Our efforts to support the local agricultural economy result in a positive public image of the mill.

Finally, waste minimization activities at the Marlboro mill support the corporate philosophy toward environmental responsibility. Simply put, it's the right thing to do. TJ

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