

INTRODUCTION

Background

The Alachua County Public Works Department, Waste Management Division developed a project to compost institutional food waste, yard trash and contaminated paper to demonstrate the benefits of in-vessel composting. The Florida Department of Environmental Protection (DEP) funded this project through its 1998-99 Innovative Recycling Grants Program. The project was managed and administered by Alachua County Waste Management staff and implemented at Alachua County's Leveda Brown Environmental Park (LBEP).

The project was conducted in cooperation with Tacachale, a licensed specialty hospital, offering a wide range of medical, therapeutic, and social services to approximately 450 mentally impaired or disabled residents. Tacachale is located on a 100-acre campus setting just east of Gainesville and only 4.5 miles from the Environmental Park. The institution's staff of 1,400 provides maintenance, dietary and food services, and operational support services. The institution's central food service prepares and serves approximately 1,500 meals each day. In addition, Alachua County worked with the University of Florida (UF) and local recyclers to help resolve a historical recycling problem involving low grade mixed paper.

Project Objectives

The main grant project objective was to demonstrate the benefits and determine the feasibility for Florida counties to use in-vessel composting technology to recover food waste, paper and yard trash. While accomplishing this objective, Alachua County would also show the benefits of recycling non-traditional materials such as contaminated paper and institutional food waste. In addition, Alachua County committed to providing educational information about in-vessel composting to the public and to other Florida counties.

Description of Project Innovation

According to FDEP estimates, the compostable fraction of Florida's municipal solid waste (MSW) stream (*i.e.*, food, paper, and yard trash) made up 46 percent of total

MSW collected in 1998. Conventional recycling programs are widely available to recycle the portion of the organic fraction made up of office paper and corrugated paper, and many Florida counties process yard trash to produce mulch. On the other hand, food waste, contaminated paper, and low-grade mixed paper are not commonly recovered, and these materials are excellent targets for waste reduction efforts. In Alachua County, organics constitute the largest fraction (over 30 percent) of the institutional/government waste stream; the largest organic components are food-contaminated paper (about 20 percent) and food waste (about 7 percent). Therefore, institutions that generate large quantities of food waste at a single location, such as Tacachale, offer promising opportunities for innovative recovery programs.

The project also employs innovative uses of advanced technology and processing. The project incorporates in-vessel composting technology not commonly used in Florida. As of 1999, Florida had only ten permitted composting facilities, and only one of these ten facilities (Sumter County Solid Waste Facility) uses in-vessel technology. Furthermore, while a number of yard trash composting facilities operate throughout the state, food waste composting represents an advanced process that is not commonly used in Florida.

The project uses advanced in-vessel composting technology to add value to materials not commonly processed in combination in Florida. Separately, food waste and contaminated and unrecyclable paper represent a negative value, and yard trash mulch often has little commercial value. In combination, however, these materials constitute an excellent composting feedstock. Thus, the project not only diverts substantial quantities of food waste and waste paper, but also adds value to these materials and to yard trash mulch by generating a high quality compost product, a valuable amendment for Florida's poor soils.

In-vessel composting, the most advanced composting technology available, offers substantial advantages over conventional windrow processing. The selected composting system manufactured by Wright Environmental Management, Inc. (WEMI) provides favorable aerobic conditions to promote rapid biological decomposition while controlling odor, leachate and vectors and eliminates airborne dust and pathogens. In

addition, less area is required for this in-vessel composting technology than for windrow processing.

Equipment Purchased and Use

Figure 1, *Containers for Food Waste Source Separation and Collection*, shows the 35-gallon containers procured by the County for collecting source-separated food waste. In addition, modifications to the composting site were necessary prior to implementing the composting system. These modifications included pouring a concrete pad on which to locate the system, extending water, sewer, and electrical lines to the site, and constructing a road to the system. A chipper/shredder was also purchased in order to shred pizza boxes prior to loading into the composting system.

Table 1, *Equipment Purchased and Description of Use*, lists the items purchased during the project and explains how the equipment was utilized. Alachua County purchased the in-vessel composting system, in which food waste, paper, and yard trash would be processed, and other items used to store and process material prior to composting.



Figure 1. Containers for Food Waste Source Separation and Collection

TABLE 1. LIST OF EQUIPMENT PURCHASED WITH GRANT FUNDS AND DESCRIPTION OF USE		
EQUIPMENT ITEM	DESCRIPTION OF USE	COST
35-gallon containers labeled "Food Waste Only"	Used by Tacachale for collection of food waste	\$1,500.00
Wright Environmental 600 pound-per-day Composting System	Located at Alachua County's Leveda Brown Environmental Park and used to compost food waste, wood chips, and contaminated paper	\$66,161.00
Troybuilt Shredder	Used for shredding pizza boxes from UF prior to loading into the composting system	\$788.34
Site Modifications	Modifications to site at the LBEP necessary to prepare the selected site for the composting system includes: concrete pad, installation of electrical transformer and water connections	\$67,869.35

Local Cooperative Recycling Effort

Tacachale, located near Alachua County's LBEP, participates in this study by separating its kitchen food waste from other garbage. The material is stored in 35-gallon containers in a cold room and picked up daily for transport to the composting system at the LBEP. In addition, a local recycler who collects paper from the University of Florida helped to collect pizza boxes from the University and other contaminated paper.

Technology Review

In order to select the most appropriate system for Alachua County's specific needs and objectives, a technology review of available composting systems was conducted. First, Alachua County developed criteria to evaluate the technologies, such as compatibility of equipment size with available site area, capacity of the equipment, and capital cost of the equipment. The County employed Kessler Consulting to collect information about composting technologies and to compare the information received to the County's criteria. The technologies were ranked based on the County's evaluation criteria. County staff along with Kessler Consulting participated in site visits to operational composting facilities as well. After this extensive review, the County chose the Wright Environmental Management, Inc., 600 pound per day (WEMI 600) composting system (Figure 2).



Figure 2. WEMI 600 In-Vessel Composting System

Food Waste from Tacachale

At Tacachale, kitchen staff separates food waste discards from other garbage. The food waste is placed in 35-gallon carts and wheeled to the food service loading dock where it is temporarily stored in a large, walk-in cooler until it is collected. Approximately 400 pounds per day, or 1.2 tons per 6-day work week, of food waste was collected and processed in the composting system at the LBEP. Excess food waste is given to a local hog farmer.

Pizza Boxes from Dormitories at UF

Currently, the UF recycling program collects mixed paper at university dormitories. Historically, the most significant and troublesome contaminant in this paper stream has been pizza boxes. This project proposed to recover this material from dormitories for composting. It was determined at the onset of the project, that pizza boxes were an inappropriate particle size for inclusion as a bulking agent. If the bulking agent could be reduced to an appropriate size, preliminary estimates suggest that eventually up to 300 pounds of pizza boxes per week could be recovered from this source.

Yard Waste Currently Processed at the LBEP

The County processes about 1,200 tons per year of yard waste and waste pallets, producing a mulch product that is available to residents for no charge. Figure 3, *Mulched Yard Trash*, shows the yard trash material after it is processed into mulch. The County's current contractor for processing the yard and wood waste into mulch has agreed to process the material to a size of about 2 inches or less, which was determined to be the size necessary for use in the WEMI 600. Composting adds substantial value to processed yard and wood waste and enhances product marketability.



Figure 3. Mulched Yard Trash

Timeline

The original timeline for this project was one year for project initiation, project activities, report preparation and a presentation of results. The timeline was modified based on delays described in, *Problems Encountered and Solutions Developed*. The project was extended for one additional year. Alachua County Waste Alternatives has a budget of \$40,000 for FY 2002 and FY 2003 to continue this project to determine the economic feasibility for future expansion of this program.

Problems Encountered and Solutions Developed

Delays with procuring the composting system and site work forced the extension of the project timeline. During the technology review, the County determined that site visits were necessary for a thorough evaluation of the two highest-ranked composting systems.

The location for the composting system within the LBEP was chosen and plans were drawn for site work to begin. However, other construction projects and additional

growth at the LBEP required County engineers to revise the site plans and relocate the composting site. At the time, the County was constructing the 18,000 square-foot Recovered Materials Processing Facility at the LBEP and locating the composter within the frame work of the RMPF construction project resulted in some delays.

During the third quarter of the project, Wright Environmental discontinued its 500 pound-per-day system and replaced it with a 600 pound-per-day system with new features and improvements. Site specifications changed as a result of this, and additional changes at the LBEP required the County’s engineer to redraw site plans and reevaluate the location of the system.

During the final six months of the project, additional delays in site work continued to push back the starting date for composting. These delays involved utility hookups for electricity, water, and sewer and resulted from other construction issues at the LBEP. To accommodate the additional electricity needed to operate the WEMI 600, the County added an additional electrical transformer at the LBEP.



Figure 4. Loading Food Waste

Despite these delays, the County initiated training for the composting system on May 9, 2001. The initial process of loading the system (Figure 4) included four days of loading only wood chips, after which a mixture of food waste and bulking agent was loaded daily. As with all new composting operations, the County experienced a number of initial problems in the composting process. Finding the best mixture of food waste and bulking agent has been the biggest challenge. The moisture content of the food waste was not consistent from day to day. This inconsistency resulted in low temperatures in the composting system when the ratio of food waste to bulking agent was not sufficient to account for the moisture content of the food waste. This learning curve is normal and operators have become comfortable with the feedstock mixture. Also, Tacachale has cooperated by reducing the amount of grease and liquid in the food waste it sends to the County. This ensures a more consistent moisture content.

Figure 5, Summary of Compost Temperatures in WEMI 600 Zones 1 and 2 (May 9 – August 11, 2001), shows the fluctuation in temperatures resulting from moisture content problems.

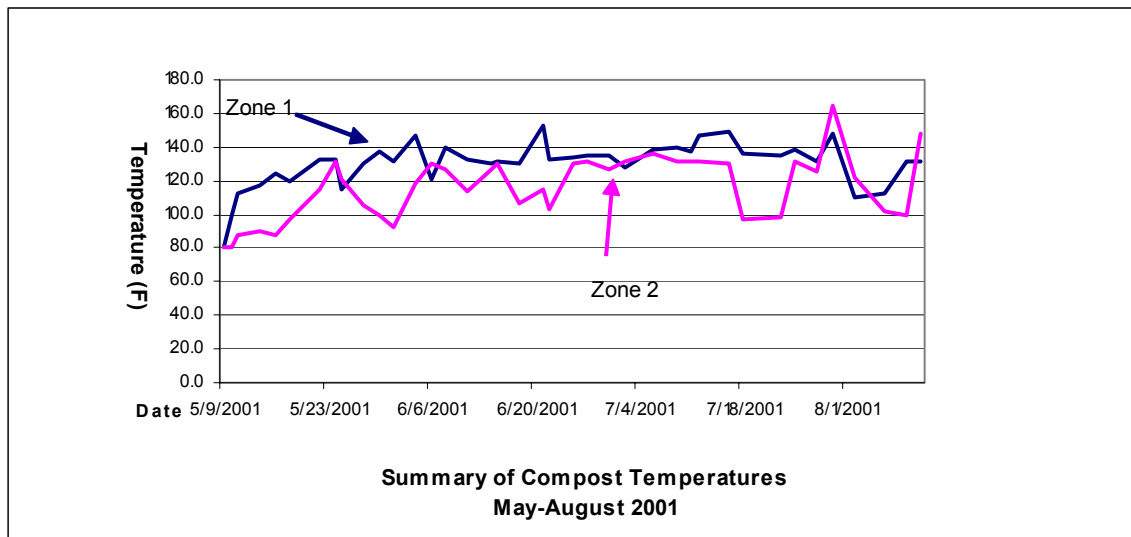


Figure 5. Summary of Compost Temperatures May-August 2001

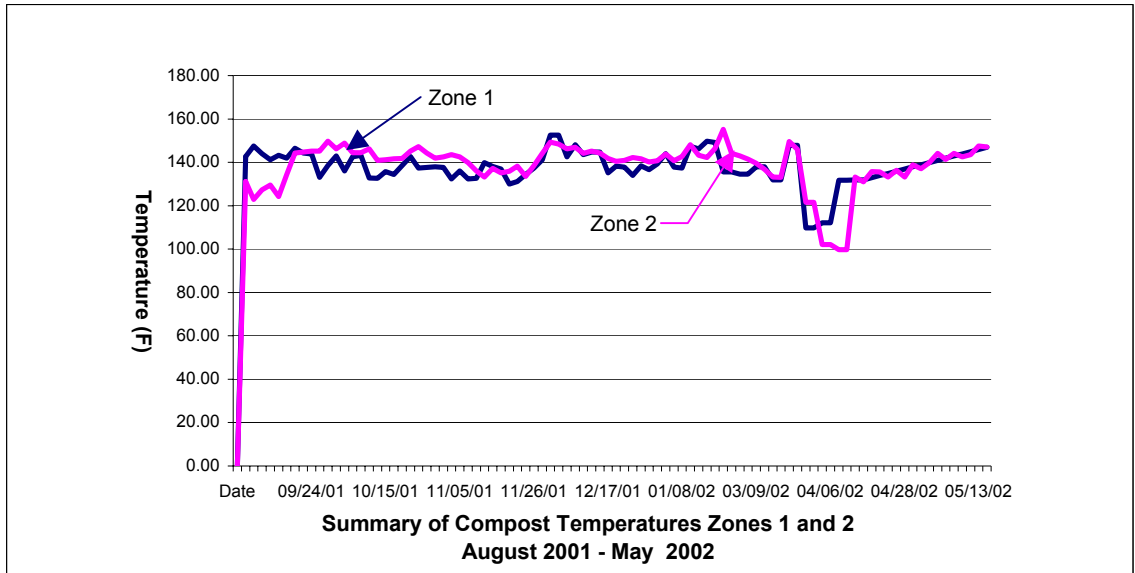


Figure 6. Summary of Compost Temperatures August 2001-May 2002

The County also experienced some problems with its bulking agents. The shredder purchased to reduce the particle size of both pizza boxes and wood chips has not reduced the particle size small enough. Once composted material was discharged from the composting system, the County realized that feedstock material greater than 1 inch is not composted to a smaller particle size by the time it is discharged from the system. To address this problem, the County has negotiated with the current wood processing contractor to grind wood waste and waste pallets to 2 inches or less in size. The wood processor will also provide the County with its processing fines. The County is currently investigating other methods for reducing the particle size of the shredded pizza boxes, including a shredding system that could attach to the loading area of the WEMI 600.

Because of the issue of particle size, the County has not been able to recover the tonnages of pizza boxes originally anticipated. Staff continues to work on ways to reduce bulking agent waste to the proper particle size.

Despite these problems, the County has produced mature compost and plans to test the compost to determine its classification according to DEP compost standards. The County is committed to operating the composting system for at least six months

utilizing the current feedstock to determine the feasibility of composting food waste, paper, yard and wood waste in Alachua County. The County has committed to funding and experimenting with the compost project for at least one and a half years with a variety of feedstocks and bulking agents, such as food waste from restaurants, schools, and hospitals. The County also hopes to process a sample batch of biosolids in the composting systems, as originally proposed.

Since we have begun using a reduced particle size bulking agent, and reduced the amount of liquids, we have observed a much more stable temperature of compost in the WEMI 600. Figure 6, *Summary of Compost Temperatures in WEMI 600 Zones 1 and 2 (September 1, 2001 – May 15, 2002)*, shows the stabilization of temperatures resulting from better control of moisture content.

Project Enhancement of Non-Traditional Materials

Food waste is the third largest component by weight of waste generated nationally; and, because it is not typically targeted for recovery, it is the largest component by weight of disposed waste. Florida generates large amounts of food waste compared to other states because of its growing population, large tourism industry, and large agriculture industry. Food waste generation in Florida is expected to increase as population and tourism increase. Also, food processing residuals are generated at a high rate in Florida because of its citrus industry and vegetable production. Despite this growing problem of food waste generation, the composting rate for food waste in Florida is low.

A 1998 food waste diversion report submitted to the FDEP estimated that institutions in Florida like Tacachale generated approximately 60,110 tons per year of food waste. This material is not typically targeted for recovery. In addition, contaminated paper, such as pizza boxes, are not traditionally recycled. In fact, this material often contaminates paper recycling streams and has a negative value. This project targeted food waste and pizza boxes for recovery to add value to traditionally negative-value materials. Yard trash and wood waste were also targeted during this project, because they add bulk and carbon to the compost feedstock. As a compost feedstock, yard trash and wood waste typically low values are increased.

Because Alachua County is committed to innovative recycling, the County will continue processing food waste, yard trash, with possible other amendments and fund the project for a total of at least two years. After compost produced by the County is mature, the County will test the material according to procedures outlined in Florida Administrative Code Chapter 62-709, Criteria for the Production and Use of Compost Made from Solid Waste. The County anticipates the material will be classified as Type A compost, because food waste is a good source of nitrogen, yard trash provides good bulk and carbon, and the material is source separated to minimize contamination. Type A compost is allowed unlimited distribution

Analysis of Cost Effectiveness

Because of the problems discussed in, *Problems Encountered and Solutions Developed*, the cost effectiveness of this project is difficult to assess. However, cost effectiveness can be estimated. This project will also create important benefits from the value added material produced.

Savings Through Tip Fee Avoidance

Alachua County's current tip fee for disposal of solid waste at its transfer station is \$40.00 per ton. Since estimated material recovery for the first year pilot period is only approximately 48 tons, tip fee savings would be minimal. However, this project was set up as a pilot project to determine the feasibility of institutional food waste composting and, if determined to be feasible, could result in a larger operation of approximately 25 tons per day.

Cost/Benefit Ratio for the Project

Based on results accumulated over the past 18 months, this pilot project diverted an average of 6 tons per month of food waste from disposal. Because this was a pilot project, no tip fee revenue was assumed from the project, however we will measure disposal cost avoidance. At \$40 per ton, disposal cost avoidance is \$240 per month. In addition, approximately 1.5 tons of yard and wood waste per month was used as a bulking agent in the composting process. Composting this material transformed yard and wood waste mulch with little commercial value into high quality Class A compost with an established market value. Class A compost is highly marketable as an

amendment to Florida's sandy and dry soils and currently has a commercial market value of approximately \$30 per ton. If approximately 4 tons of compost is produced from food waste, yard waste and wood waste, the project would generate approximately \$120 per month in added value.

\$2,880/year Disposal cost avoidance from food waste

\$740/year Tip fee revenue from wood waste/bulking agent

\$1,440/year Value added through food waste, paper, and mulch composting

\$5,060/year Total cost recovery through cost avoidance and value added

\$190,000 (Grant Funds) divided by \$5,060/year (Cost Recovery Rate) equals 37 years. Although 37 years seems high, this project was not intended to be the composting solution for the County's composting needs, but to identify the feasibility of utilizing this equipment in an institutional environment. The cost recovery rate would probably be lower in an environment where this particular equipment would be utilized on-site at an institution or corporation.

If Alachua County determines that a larger project would be feasible for a countywide composting program and implements a 25 ton-per-day composting system, the system would divert about 470 tons per month of food waste from disposal. At \$40 per ton, disposal cost avoidance would be \$18,880 per month. Additional savings could result from diversion of contaminated paper (pizza boxes and low grade mixed paper) from UF's mixed paper recycling program (approximately \$4,600 per month). In addition, approximately 115 tons of yard waste and wood waste per month would be used as a bulking agent in the composting process. Composting this material would transform yard trash and wood waste mulch with no commercial value into high quality Class A compost with an established market value. Class A compost is highly marketable as an amendment to Florida's sandy soils and currently has a commercial market value of approximately \$30 per ton. If approximately 325 tons of compost is produced from food waste, yard waste, wood waste and contaminated paper monthly, the project could generate approximately \$9,750 per month in added value.

\$225,600/year Disposal cost avoidance from food waste and paper

\$117,000/year Value added through food waste, paper, and mulch composting

\$342,600/year Total cost recovery through cost avoidance and value added

\$1,000,000 (approximate cost of 25 ton-per-day Composting System {vessel, mixer, in-feed and out-feed conveyors, biofilter medium without front-end equipment} divided by \$342,600/year (Cost Recovery Rate) equals 2.92 years. Based on the above assumptions, Table 2 represents project revenue, costs and net value. Also included are scenarios reflecting a tip fee differential as an incentive for customers to source separate food waste. Represented below are revenues based on \$40/ton, \$30/ton, \$20/ton and \$10/ton.

REVENUES		
Tip fee for food waste	5640 TPY @ \$40/ton	\$225,600
Sale of compost product	3900 TPY finished compost @\$30/ton	\$117,000
Total		\$340,600
Tip fee for food waste	5640 TPY @ \$30/ton	\$169,200
Sale of compost product	3900 TPY finished compost @\$30/ton	\$117,000
Total		\$286,200
Tip fee for food waste	5640 TPY @ \$20/ton	\$112,800
Sale of compost product	3900 TPY finished compost @\$30/ton	\$117,000
Total		\$229,800
Tip fee for food waste	5640 TPY @ \$10/ton	\$56,400
Sale of compost product	3900 TPY finished compost @\$30/ton	\$117,000
Total		\$173,400
EXPENSES		
Equipment/Capital**		
WEMI 2500 25/TPD In Vessel Composter**		\$100,000
Bandit 150 XP 80 hp Chipper/Shredder		\$2,168
Dura Tech HD8 Tub Grinder		\$5,485

BobCat 963 Skid loader		\$4,541
Star Screen 6012 Compost Screen		\$5,600
Wildcat TS514-185 Windrow turner		\$7,900
John Deere Tractor w/ bucket		\$6,100
Building/Site improvements		\$25,000
Sub Total		\$156,794
Admin/Personnel		
Equipment operators	3 FTE's @ \$34,000	\$102,000
Utilities	(assumption)	\$10,000
Administrative fees	(assumption)	\$25,000
Sub Total		\$137,000
Total		\$293,794

TIP FEE		NET GAIN/LOSS
@ \$40/ton	\$220,206 / 7,750 (25 TPD/310 DPY = 7,750)	\$28.41/ton
@ \$30/ton	(\$7,584) / 7,750	- \$0.97/ton
@ \$20/ton	(\$63,994) / 7,750	- \$8.26/ton
@ \$10/ton	(120,394) / 7,750	- \$15.53/ton

Future Plans

The pilot project for composting food waste is complete. A new and innovative project called FORCE (Florida Organics Recycling Center for Excellence) is being developed in Sumter County. FORCE is Florida's organics recycling effort involving the Florida Department of Environmental Protection (FDEP), the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS), and Sumter County. The legislatively funded project provides a framework to promote organics recycling and

research in a statewide effort to streamline compost processing, research, demonstration, marketing, and education in Florida.

The program objectives of FORCE include environmental research related to organic feedstocks from agricultural, municipal and industrial sources, the development of a wide range of organic products for Florida's end-use markets, and the promotion of integrating feedstocks and technologies. FORCE will advance the state's organics recycling infrastructure by bringing together academic research, entrepreneurs, and users to evolve solid, practical solutions to problems. Over the course of this five-year endeavor, a variety of field projects will be conducted relating to organics recycling technologies and products.

Part of the business plan for the project includes the evaluation and selection of composting technology to be used for research. The Wright Environmental System has been identified as a technology FORCE would like to use in testing of technology and feedstock. To that end, Alachua County Waste Management Division is joining in partnership with FORCE to have the WEMI system currently owned by Alachua County, donated to the FORCE project. This will ensure that the equipment is used in the future to continue the testing of feedstocks and further prove the sustainability of in-vessel composting.