BioCycle GLOBAL 2011 CONFERENCE PREVIEW
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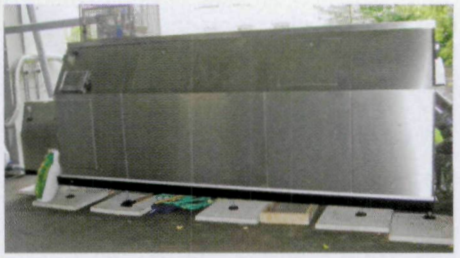
Correction The pull out quote below, as well as in the article, should read "Mid-sized compost systems - with capacity ranging from approximately 5 lbs to 10,000 lbs/day of food scraps -"

CRITICAL CONSIDERATIONS

IN-VESSEL COMPOSTING OPTIONS FOR MEDIUM-SCALE FOOD WASTE GENERATORS



The Big Hanna in-vessel unit is installed at McGill University in Montreal, Quebec, Canada. The biofilter is at the far left in the photo.

Mid-sized compost systems — with capacity ranging from approximately 5,000 to 10,000 lbs/day of food scraps —are appropriate for small institutions including schools, hospitals and nursing homes and commercial establishments.

Jean Bonhotal, Mary Schwarz and Gary Feinland

GOING through an old file drawer, it is easy to see the evolution of mid-sized composting units. Fifteen to 20 years ago, only a few options were available. We're glad to report those are still around, with innovative changes, and they have company. After all, composting is a process and that has not changed. However, systems can be fine-tuned to expedite the process, e.g., facilitate optimum air exchange, implement innovative turning or agitation and instruct operators how to manage moisture.

Mid-sized compost systems are appropriate for small institutions including schools, hospitals and nursing homes and commercial establishments such as grocery stores, hotels, businesses with cafeterias and restaurants. The capacity of a mid-sized system ranges from approximately 5,000 to 10,000 pounds per day (lbs/day) of food scraps.

In-vessel compost technology is promoted for managing food scraps in areas with limited space. This is a great solution as long as the compost unit's characteristics meet the needs of the institution managing the organic residuals. There are a number of parameters to consider: amount of waste/week; amount of space available for primary and secondary processing; carbon material required and where it can be sourced and stored; batch or continuous feed; retention time; and space needed for curing. Even in-vessel composting has a primary and secondary processing stage and the amount of time

ON-SITE FOOD WASTE MANAGEMENT WORKSHOP

BioCycle's On-Site Food Waste Management Preconference Workshop — Monday April 11, 2011, 8:30 am–4:30 pm at the Town & Country Resort Hotel in San Diego — is designed for institutions and commercial establishments. Topics to be covered include Food Waste Reduction, Food Donation; Processing Options and Site-Specific Factors; Food Waste Containers, Collection and Training; Campus-Wide Composting Options; Vermicomposting Systems And Strategies; and On-Site Food Waste Composting In Tribal Communities. The day-long workshop ends with case studies including a casino, brewery, university and fairgrounds.

For agenda and registration details, visit www.BioCycleGlobal.com.

MID-SIZED IN-VESSEL COMPOSTING UNIT DIRECTORY

BW Organics
Rt. 8, Box 729/CR 2300
Sulphur Springs, TX 75482
903-438-2525
www.bworganics.com

ComposTumbler
1834 Freedom Rd.
Lancaster, PA 17601
800-880-2345
www.compostumbler.com

DTEnvironmental
8540 Benson Rd.
Lynden, WA 98264
800-701-3632
www.dtenvironmental.com

Eco Value Technology, Inc.
PO Box 893
Alpena, MI 49707
877-344-6701
www.ecovalutech.com

FOR Solutions, LLC
903 Rock Lane
Newton, NJ 07860-4575
973-945-9150
forsolutions@hotmail.com

Green Mountain Technologies
5350 McDonal Ave.
Bainbridge Island, WA 98110
802-368-7291
www.compostingtechnology.com

Hot Rot Organic Solutions/
Hatch Engineering
902-452-9411
www.hatch.ca

Jet Composting/StillMeadows Farms
215 Woodland Way
New Boston, TX 75570
972-754-7083, 903-628-0275
http://jetcompost.com

North American Trading House, LLC
8 Westchester Plaza
Elmsford, NY 10523
212-729-1757
http://natradinghouse.com/index.ph

O2 Compost
Price-Moon Enterprises
312 Maple Ave., Suite C
Snohomish, WA 98290
360-568-8085
www.o2compost.com/index.htm

Open Road of New York
346 East 9th St.
New York, NY 10003
212-260-1896
http://playgrounddesign.blogspot.com/2008/05/hotbox-food-waste-composting.html

Vertal, Inc.
492 Place Blaise
Montreal, Ile-Bizard
Ste-Geneviève, QC Canada H9C 1Y9
514-772-5069
www.vertal.ca/en/

Wright Environmental Management
511 Woodland Acres Crescent
Maple, ON, Canada L6A 3G2
905-881-32950
www.wrightenvironmental.com

XACT Systems
Box 4303 40 Sidney St.
Trenton, ON, Canada K8V 5R6
800-920-0630
http://xactsystemscomposting.com

For additional companies visit BioCycle's online Equipment & Systems Directory at http://www.jgpress.com/products.html

spent in each can be manipulated. For example, if the unit has a 3-day retention time, more time and space will be required in the secondary stage outside the unit. It is difficult to produce finished compost in less than three months. Composters with experience report a lot of variation in how long it takes to produce mature compost in any system. After all, feedstock and bulking materials vary in carbon, nitrogen, lignin, cellulose, moisture, particle size and a multitude of other variables.

To determine if a given system is appropriately sized, it is important to know the volume of compostable materials generated on a daily basis — including the bulking material. The amount and type of bulking material required depends primarily upon the moisture and porosity of the materials to be added. For example, food scraps tend to be relatively moist and nonporous and will require significant bulking material in order to obtain the proper moisture and air spaces needed for composting.

However, the *type* of food scraps greatly affects its moisture content and porosity. The target moisture for any type of composting is 60 percent and in-vessel units, by design, tend to keep moisture in the unit. A correctional facility that serves precooked meals from a centralized food prepa-

Table 1. In-vessel composting options for medium-scale food waste generators, size and cost of mid-sized in-vessel compost units

In-Vessel Composter Name *Company Name*	*Model(s)*	*Unit Size* *(ft)*	*Maximum Capacity [1,2]*	*Costs* *($)*	*Notes [1]*
Big Hanna Vertal, Inc.	T60	4 x 8	150-250 kg FS/wk	38,000	Continuous aeration with auger. 6-8 weeks retention time. Needs additional curing
	T75	4 x 10	225-325 kg FS/wk	42,000	
	T120	5 x 13	300-500 kg FS/wk	48,000	
	T240	5 x 17	400-1,200 kg FS/wk	76,000	
BW Organics Rotating Drum	306	8 x 10	1 yd^3 total capacity FS & BM	8,910 + additional equipment	1 yd^3 batch system available to universities and testing laboratories.
	105	5 x 7	1 yd^3 FS/day	16,390+	Continuous flow system. 3-6 day retention time. Needs additional composting/curing
	205	5 x 12	2 yd^3 FS/day	25,696+	
	305	5 x 18	3 yd^3 FS/day	36,362+	
	405	5 x 24	4 yd^3 FS/day	43,362+	
Compost Tumbler		3 x 4	1 yd^3 total capacity FS & BM	500	1 yd^3 batch system. May require use of 2 tumblers to continuously compost. Full unit needs to be rotated daily. Use second container for next batch.
Earth Tub Green Mountain Technologies		7.5 diameter	40-150 lbs FS & BM/day	10,000	Continuous flow system. 3-4 weeks of active composting. Needs additional curing
Earth Bin Green Mountain Technologies		5 x 24	0.25-2 tons FS & BM/day	88,000	
Eco Value Technology In-Vessel Composter	C825	5 x 18	825 lbs FS/wk	30,000	Continuous flow. 1-2 week retention time. Needs additional outside curing. Other units available with up to 3,500 lbs/wk capacity as well as custom manufacturing
Enviro-Drum DTE Environmental	408	4 x 8	0.9 yd^3 FS & BM/day	45,000-65,000	Continuous flow. 3 day retention time. Needs additional composting/curing
	514	5 x 14	2.5 yd^3 FS & BM/day	85,000-130,000	
	616	6 x 16	4.2 yd^3 FS & BM/day	100,000-150,000	
	632	6 x 32	8.4 yd^3 FS & BM/day	140,000-200,000	
	840	8 x 40	18.6 yd^3 FS & BM/day	220,000-300,000	
FOR Solutions Drum	1000		800 lbs FS/day		Custom-built units available. Continuous flow.
Hot Box Open Road of New York		3 x 3	1 yd^3 total capacity FS & BM	~ 200-400 depending on lumber and PVC prices	1 yd^3 (FS & BM) batch system. Additional boxes may be needed for new batches and additional space for curing
Hot Rot	1206	4 x 20	600-800 lbs FS & BM/day	125,000	Continuous flow. 14 day retention time. Needs additional composting/curing
	1509	5 x 29	1,000-3,000 lbs FS & BM/day	240,000-320,000	
	1811	6 x 36	4,000-5,000 lbs FS & BM/day	290,000-360,000	
Jet Composting Drum	3672	3 x 6	24 ft^3 capacity	8,000	Batch system
	72144	6 x 12	7.5 yd^3 capacity	70,000	Continuous flow
	72288	6 x 24	15 yd^3 capacity	90,000	Continuous flow
Micro-bin O2 Compost		4 x 4	1 yd^3 total capacity FS & BM	~ 350 not including aeration	1 yd^3 (FS & BM) batch system. Additional boxes may be needed for new batches and additional space for curing
Rocket North American Trading House	A500	2 x 8	80 gal FS/wk	~ 18,500-89,000	
	A700	3 x 10	180 gal FS/wk		
	A900	3 x 13	460 gal FS/wk		
	A1200	5 x 23	925 gal FS/wk		
WEMI-1000 Wright Environmental			1,000 lbs FS/day		Continuous flow. 7-10 day retention time. Needs additional composting/curing
XACT BioReactor XACT Systems	5' diam	5 x 10	1 yd^3 FS & BM/day	18,000-75,000	Continuous flow. Amount of FS & BM added daily is based on total volume of the composter divided by the retention time which averages about 5 days. Needs additional composting curing depending on use of product
		5 x 15	1.5 yd^3 FS & BM/day		
		5 x 20	2 yd^3 FS & BM/day		
	6' diam	6 x 10	1.5 yd^3 FS & BM/day		
		6 x 15	2.2 yd^3 FS & BM/day		
		6 x 20	2.9 yd^3 FS & BM/day		

[1]FS = food scraps, BM = bulking material. [2]Capacity reported in this column is the maximum capacity reported by manufacturer/seller. Some capacity is reported by weight (lbs or kg), some by volume (cubic yards). Some give capacity of food scraps only, while others give capacity of food scraps mixed with bulking material. Some report amount that can be added per day or week, while others give total capacity of unit.

Candor School District students help with food waste composting in the Compost Tumbler units.

ration kitchen will generate primarily leftover prepared foods including soup, chili and mashed potatoes. This material is quite moist, has a low porosity and will require a considerable amount of bulking material. A cafeteria that offers a salad bar and is collecting preconsumer food scraps will produce lettuce, carrot trimmings and other items with moderate moisture and porosity. Finally, a school that collects pre and postconsumer food scraps including napkins, compostable plates, bowls, cups and flatware, will have relatively low moisture and more porous food scraps, and will therefore require less bulking material.

It is a good idea to do an audit and determine the average daily weight or volume of the food scraps, as well as their moisture and porosity. This helps determine how much bulking material is needed to create a proper mix and identify what capacity is needed prior to purchasing an in-vessel unit.

ODOR AND CLIMATE

Odor control is one of the reasons in-vessel technology is employed. However, if the recipe or balance is not correct or if the compost system is not really designed to manage the intended feedstock, there will be odors and they will escape from any unit. Limitations of the chosen in-vessel unit must be identified. It is helpful to process some different batches to find an optimum recipe. Even if the intent is to compost in an in-vessel unit, it is generally a good practice to test the recipe in a 5 to 6 cu. ft. pile and designate a good manager who understands the process and cares about the end product. Keep in mind that an odor event may occur at any time, but good management will keep those to a minimum. Neighbors will forgive an occasional odor but not weekly events.

Another factor to consider is the climate in which the composter will be used. If operating in Hawaii there may be some moisture challenges but the unit will not freeze. In New York and other northern areas, units will freeze if adequate precautions are not implemented. This means units may need to be sized a bit larger and more bulking material added to retain heat and keep an appropriate volume in the compost container. Other options include heat tape, keeping the unit in a building, insulating the unit or using fair and foul weather strategies. Small noninsulated units are more likely to freeze especially if there are times when no feedstock is added.

Good signage for those sorting organics and those using the compost unit is the key to success. Especially at a hospital, school or institution, there may be more than one operator and that staff person may change on an annual basis. Good, explicit, laminated signage will help keep the unit operating in the manner it was intended. For example, some of the most efficient composting occurs in composting toilets. Use instructions are posted by the toilet, the carbon source is supplied and an appropriately sized container is provided to add the right amount of carbon for each use. Keep the processing simple.

IN-VESSEL COMPOSTING IN LARGE CITIES

Many large cities want to compost but it is a tremendous challenge in densely populated areas where space is at a premium, if available at all. A strategy to consider — where there is some room, but not enough for curing — is to have a small footprint in the city with in-vessel processing units and an industrially zoned, suburban

CUSTOMIZING THE PROCESS FOR SUCCESS

Composting is not a one-size fits all process. To select a unit that meets project needs, compile a list of questions specific to the organic residual(s) being managed. Considerations and questions include:

- Type of feedstock (material to compost), moisture content and porosity
- Amount of material to compost
- Bulking material required
- Space needed to store bulking material
- Space available for a compost unit and how well it fits the location selected
- Curing space needed
- Working space needed
- How will feedstock be collected (type of collection container)?
- Will the collection container work with the compost unit (i.e. easy to load)?
- Will the system need down time?
- Will it work in freezing weather?
- Does it have to be protected?
- Are there parts that will need to be replaced?
- Are there movable parts on the outside of the system that may catch on jackets or other clothing?
- What type of maintenance will be needed?
- What material is the compost unit made of?
- What is the cost per volume of materials to be composted?

A 5-foot wide by 24-foot long Earth Bin is installed at a school in the West Irondequoit School District. The auger that agitates the composting feedstocks is shown at right.

or rural location for curing. During the primary phase of composting, there is a volume reduction of between 20 to 50 percent of the raw materials.

This scenario allows primary composting to occur in the area where waste is generated, reducing the amount of trucking required for transportation of raw materials. Completing the process in a suburban or rural location may also move the compost to an area where there is more demand for product. However, it will require management at two or more sites. When siting any compost activity, it is helpful to employ appropriate technology and effective, well-maintained biofilters as needed. Care, planning and not taking in more material than a unit can manage will help facilities succeed.

SYSTEM SELECTION

Table 1 lists, in alphabetical order, some options for in-vessel units sized for medium-scale food waste generators. The table provides information on the amount of space that will be needed for the unit itself, the maximum capacity of the unit, an approximate price and additional details about the unit. The accompanying directory has information about the company that sells and manufactures the unit. Cornell Waste Management Institute and the New York State Department of Environmental Conservation do not endorse any specific vendor of composting systems.

Some of the options listed are just starting to be installed in the U.S., whereas others have been in place for many years. This provides an opportunity to see the units in action, as well as learn about operating experiences with similar feedstock streams and climates.

HYPOTHETICAL EXAMPLE

Verde Hospital is a full-service 424-bed hospital that serves the medical needs of suburban Greener, New York and the surrounding communities. The hospital prepares three meals a day for patients and a 70-seat, three-meal a day cafeteria for employees and visitors. Preconsumer waste is mostly egg shells, fruit and vegetable peelings/scraps and coffee grounds. Postconsumer plate waste ranges from half eaten burgers and pasta plates to full bowls of soup and fish bones and degradable service ware. This mixture of material is around 75 percent moisture and is fairly dense. The hospital generates about 200 lbs/day of this preconsumer and plate waste.

Verde Hospital plans on using soiled paper and yard trimmings from its one-acre property as the primary bulking material. Knowing that this will not be enough to achieve the proper moisture, density and carbon to nitrogen ratio, a place to store either sawdust/shavings from the local wood mill or chips from the utility company will be added.

The hospital is situated on an acre of land in the middle of downtown with neighbors on either side. It has a loading dock with a paved area where a composting unit could be located. If the unit itself takes up no more than 200 square feet, there will still be room to pile the product after it has gone through the unit for additional curing. The hospital needs a unit in which the kitchen staff can easily empty the feedstock from the 30-gallon totes used for collection. Although winter temperatures can fall well below freezing, it is assumed that the volume of material going into the composter daily will keep it from freezing. Verde Hospital is looking for a unit that will require the least amount of maintenance as it does not want to hire additional personnel to keep it running. The budget for the project is under $35,000. ■

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