COMPOSTING HOSPITAL FOOD WASTE

Technical Information Paper No. 37-015-0413

PURPOSE. To provide technical information and references to assist hospital personnel in evaluating, planning and implementing the composting of hospital food waste.

REFERENCES. See Appendix A for a list of reference information.

POINTS OF MAJOR INTEREST AND FACTS.

BACKGROUND

Food waste is the single largest component of the US municipal solid waste (MSW) that enters landfills and incinerators; it accounted for 14 percent of the MSW generated in the US in 2010. According to the U.S. Environmental Protection Agency (USAEPA), only 3 percent of MSW was recycled, and the remainder was disposed (USEPA 2011). USEPA Region 10 identified the methane emissions from landfilled food waste as a significant contributor to greenhouse gas (USEPA Region 10 2011). The Assistant Secretary of the Army for Installations, Energy and Environment (ASA (IE&E)) has developed the Army's Net Zero Installation Strategy, the goal of which is for installations to achieve net zero energy, net zero water and net zero solid waste. The USEPA recommends the following priorities for reducing food waste: reduce the amount of waste generated, donate excess food to feed people or to farmers to feed animals, provide fats for rendering, and recycle food through composting (USEPA 1999).

The following definitions were taken from Schwab 2010 and Christensen 2009. Waste is *degradable* if it breaks down; for example, large pieces of Styrofoam will weather into smaller pieces. Waste is *biodegradable* if microbes will eventually consume it—even if the process takes centuries. Waste is *compostable* if it biodegrades at the same rate as paper does in a commercial composting facility. *Organic waste* is from sources that either once grew (fruits, vegetables, leaves and grass, breads, egg shells, hair and fur, seafood, and animals) or that were manufactured from something that once grew (paper and bags, and utensils, plates, cups, and bowls manufactured from materials such as corn and potato starch). *Food residuals* are pre- and post-consumer foods and food by-products as well as the organic

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wastes which may accompany food, such as soiled paper products and manufactured organics. The Biodegradable Products Institute (BPI) certifies and labels compostable manufactured products by means of testing performed in accordance with the American Society for Testing and Materials (ASTM) standards for biodegradability and compostability (BPI 2011). The BPI standard for *compostable* material (summarized) is that the item must break down into carbon dioxide, water, and biomass at the same rate as paper; cannot exceed toxicity limits; and must be able to support plant life.

The first step in improving the management of any waste or pollution is measuring the amounts of waste generated over time. Techniques and software for measuring food wastes are available from USEPA, other references, and commercial vendors (USEPA unk, Practice Greenhealth 2011b, Dilly 1998, LeanPath 2011). Such measurements should be taken over as long a time period as is necessary to be representative, should include notations about the waste-generating processes and any unusual circumstances at the facility, and should be documented and retained.

A rough estimate of hospital food residuals can be made using any of the equations below.

Pounds per *meal-equivalent* (any of an inpatient meal, a same-day surgery meal, or one cafeteria customer; Dilly 1998) per year: 0.85 pounds of food residuals/meal-equivalent * number of meal-equivalents per year. Note that this method is based on actual measurements taken at two Army hospitals over a two-week period.

Cubic yards of volume per meal-equivalent per week (Dilly 1998; based on uncollapsed volumes): 0.35 gallons/meal-equivalent * 1 cubic yard/202 gallons * number of meal-equivalents per week. Cubic yards are the appropriate measurement for dumpsters and for negotiating with offsite composters.

Pounds per number of beds per year (Draper/Lennon 2001): Number of beds * 5.7 meals/bed/day * 0.6 pounds food residuals/meal * 365 days/year. Note that the authors based this equation on a review of existing literature, and it produces estimates that are 30-50 percent higher than those produced by the meal-equivalent method above.

ALTERNATIVES

Use Practice Greenhealth's **Ten Step Guide to Food Composting** (Practice Greenhealth 2009). This publication is a concise reference on the process of evaluating, coordinating, and implementing a food composting program. Consider this 6-page document to be a checklist.

Reduce food waste prior to composting. The USEPA recommends optimizing the amount of food prepared and then donating any excess to feed people or animals (USEPA 1999). Reducing food waste requires site-specific measurement, study, and collaboration. A study of Army hospital food wastes (Dilly 1998) found that the amount of food residuals was affected by the following:

- Whether food was prepared from scratch or already-prepared meats, vegetables, and baked goods. Preparing from scratch produces more waste.
- When preparing food from scratch: the quality of the produce received.
- Whether or not patients could select from a menu. Having a choice of meals results in less waste.
- Effective hospital tray insulation. Cold food is more likely to be wasted.
- Food portions. Women are especially prone to state that typical portions are too large.
- Patient satisfaction with the food.
- In the cafeteria: both the availability of carryout containers and how often such containers are used for dining in the cafeteria instead of being carried elsewhere.

Change the processes. Another study found there was a greater chance of wasted food on hospital trays for every day a patient remained in the hospital (Kandiah 2006). Process improvements that reduced food residuals at one hospital (Cedar Rapids Gazette 2011) included cooking vegetables in half-pans, as needed, instead of full pans; and moving employee break times to occur before serving times so that kitchen staff would not have to cook additional food to cover the demand during their absence. Other process improvement success stories can be found on the USEPA Waste Reduction Record-Setters Project web page for food waste, at http://www.epa.gov/epawaste/conserve/materials/organics/pubs/throw/index.htm.

Guidance on food donation and associated regulatory, liability, and safety issues can be found in USEPA's publication *Waste Not Want Not: Feeding the Hungry* *and Reducing Solid Waste through Food Recovery* (USEPA 1999) and/or obtained from state and regional agencies.

Compost the waste offsite. Composting at a site other than the hospital grounds includes composting at a central, onpost composting facility or an offpost municipal, farm, or commercial composting facility. Such composting is feasible if such a facility exists, can accept the amounts of hospital food residuals generated, and is near enough to the hospital that transportation costs are acceptable. Two current websites for locating composting facilities are Biocycle's FindAComposter (Biocycle 2010) and HelpMeCompost.com's Find a Composter (HelpMeCompost.com 2010). The Biocycle site lists the composters that have registered there; the HelpMeCompost.com site lists all known or possible composters, registered or not. Local resources, such as the garrison solid waste manager or the local government, may be more knowledgeable about offsite composting facilities.

The amount of food residuals a composting facility can accept is governed by the size of its composting operation, the chemistry of the composting feedstock, and any regulatory restrictions to its operation. The receiving facility can only accept as much food residual waste as it can work into the compost process immediately upon the waste's arrival; otherwise, the decomposing materials smell, attract pests, and may become a source of pathogens. Composting mixes work best with an optimum chemistry of carbon/nitrogen mix, moisture content, and with only small volumes of vegetable oils (5-10 percent). The volume of manufactured organics may also be restricted because these can take longer to compost. Meat and bone may only be accepted if the facility operator can manage the risks of odors, pests, and pathogens. The regulatory status of composting operations varies by state and ranges from minimal requirements to a restrictive and explicit operating permit.

Questions to ask a composting facility include the following (Shakman 2010):

- What hauling options does it offer (if any), and at what pick-up frequency?
- Will it accept compostable single-use products such as cups, plates and cutlery? Does it accept all BPI-certified products, or does it have special requirements?
- How does the facility respond to contamination?
- What type of training will it offer for your staff?
- Will it provide totes or other collection equipment at your site?
- What liners/bags does it accept?
- Would it prefer pulped product or not?

- What do the economics look like, and how do they compare to those of your other options?
- What is the facility's operating history? Has it been cited, fined, or has it experienced problems with odors, pests, etc.?

The U.S. Composting Council publication *Best Management Practices (BMPs) for Incorporating Food Residuals into Existing Yard Waste Composting Operations* (Christensen 2009) offers an excellent guide to offsite composting. Although written primarily for the composting facility operator, the document includes information a hospital administrator should know when considering offsite composting, such as feedstock characteristics and management, odor prevention and remedy, safe handling of food residuals, and transportation considerations. Example language for a contract between a hospital and composting facility is also provided.

The advantages of offsite composting are waste and cost reduction and outsourcing the management of the composting operations: stakeholder and neighbor relations, regulatory compliance, marketing the finished product, and, in some cases, transportation of the food residuals to the facility. Disadvantages include transportation costs, loss of use of the compost or the income from selling the finished compost, and vulnerability to business failures or changes.

Compost the waste onsite. Composting on the hospital grounds requires sufficient space for the composting and investments in in-vessel composting equipment that must be supplied with electricity, water, or sewer connections. Often, bulking and carbon materials such as wood chips, cardboard, or paper to enhance the composting mix are needed. Equipment with which to load and unload the vessels daily or weekly as well as ample storage space for the finished compost are also required. Other considerations are compliance with any regulatory requirements, committing personnel to load, unload, operate, and maintain the composter; and disposing or marketing the finished product (which might be used onsite by hospital or post groundskeepers).

Offsite composters often compost waste in windrows or piles that require land and the equipment necessary for mixing and turning the compost. By contrast, in-vessel composting is similar to using a bread machine: add the ingredients, turn on the device, and it will mix, cook, and signify when the process is finished. The in-vessel composting equipment requires less space than windrows or piles and has built-in pest prevention and odor control. The in-vessel process can also be faster than windrow or pile composting. On the other hand, the equipment requires a significant up-front investment, uses energy (and may require water and sewer connections), and can malfunction.

The California Department of Resources, Recycling and Recovery website lists in-vessel technology vendors (CalRecycle 2011). Although the site includes composters as well as *digesters,* which produce a liquid that is intended to be routed to the wastewater system, this TIP focuses on composters only. The table below summarizes information about in-vessel composting equipment provided by the vendors on this site. Note that not every category will apply to every device , and that ranges of operating criteria will vary by capacity and equipment design. Although costs are not included on the manufacturers' or retailers' websites, further research reveals that in-vessel composter costs range from tens to hundreds of thousands of dollars.

Table 1. Summary of Onsite, In-vessel Composting Information

Site Preparation Requirements	Operating Cost (omitting labor)	Capacity	Residence Time	Product	Contaminants	Volume Reduction
Concrete pad for equipment and loading/unloading; 220 volts electricity; drain connection to sewer or collection site; roof or building; vehicle access for loading/unloading waste (from forklifts to trucks)	600-15,000 kilowatt hours (kwh)/year electricity; additives; filters	100 to 3,000 lbs/day	24 hours to 14 days. Several composters offer continuous operation, allowing feed into and product removal from the equipment daily.	Either a soil additive or mulch requiring further curing or composting; water	Linen (can bind up units); large items (bowls, beef thigh bones, glass containers)	70-90 percent of feed volume

Determine how the finished product will be managed before starting to compost. If the finished product—soil additive, mulch, or compost—will be used by the hospital or garrison groundskeepers, its quality, finish, and consistency may not matter (CWMI 2004a). If the finished product will be sold or donated offsite, the hospital will need to: (1) provide time and space for the soil amendment or mulch to mature into compost, (2) oversee the process—especially when adding any bulking or nitrogen amendments such as grass clippings or newspapers—to ensure no contaminants such as herbicides or chemicals are mixed in, and (3) test the compost at least annually. Other issues that may have to be dealt with are storm water management and the possibility of vagrants seeking food.

The advantages of onsite composting are waste and cost reduction, absence of transportation costs or issues, use of the product, and control of the operation. Disadvantages include the complexity of the composting process and equipment, high startup costs, pest, vagrant, odor, and storm water management; and regulatory compliance.

Attributes Affecting Adoption of Composting

Relative advantage over existing practices. Reducing food residuals by any method will reduce the amount of waste, the waste disposal costs, and the possible greenhouse gas emissions that could occur if the final disposal would have been in a landfill. Food residuals are typically managed either by collecting and transporting them to a landfill or scraping them into a garbage disposal to send them to the wastewater treatment plant. Costs for landfill disposal include pickup and transportation contracts as well as landfill tipping fees. The use of garbage disposers incurs water, electricity, and wastewater costs. A commercial garbage disposal suitable for a clinic or hospital uses 8 gallons of water per minute (350,000 gallons/year, assuming 2 hours' operation per day, every day) and, assuming the disposal uses a ¾ horsepower motor, about 1.1 kwh/day (402 kwh/year). A garbage disposal suitable for a larger medical center uses 14 gallons of water per minute (613,000 gallons/year, assuming 2 hours' operation/day, every day) and, assuming a 5 horsepower motor is in use, about 7.5 kwh/day (2,738 kwh/year).

Life cycle cost analysis. An economic analysis should be performed before a composting program is initiated. The analysis should include the life cycle of the operation, cost avoidance (as discussed above), as well as costs. The return-on-investment calculations for offsite composting will reconcile transportation to the composting site, and any fees, with the current cost of waste collection, transportation, and tipping fees or the current cost of water, electricity, and wastewater for the garbage disposal. For onsite composting, the return-on-investment calculations will weigh the initial investment in in-vessel composting equipment and the recurring costs of electricity, supplies (such as bulking materials), and labor against the current cost of waste collection, transportation, and tipping fees or the current cost of water, electricity, and wastewater for the garbage disposal.

Reduced greenhouse gas emissions. To calculate the potential reduction in greenhouse gas emission that would result from composting food residuals instead of landfilling them, USEPA uses an emissions reduction factor, based on carbon storage alone, of 0.20 metric tons carbon dioxide equivalent ($MTCO_2e$)/ton food residuals composted (USEPA Region 10 2011). California uses a factor of 0.42 $MTCO_2e$/ton food residuals composted (USEPA Region 10 2011), twice the EPA's factor, because it includes decreased water use, decreased soil erosion, and reduced fertilizer and herbicide use. Climate Action Reserve has issued protocols for organic waste digestion and composting that set standards for quantifying greenhouse gas emission reductions in order to sell carbon offset credits (Climate Action Reserve 2010).

Compatibility with existing waste collection, transportation, and disposal. The Walmart corporation (Fanning 2010) has identified a number of obstacles to implementing net zero food residuals management:

- Infrastructure: Local haulers aren't equipped to handle food residuals, and some locations lack composting facilities or end-use outlets for compost.
- Transportation costs over long distances are high.
- Governments continue to regulate as waste those source-separated organic materials that are recoverable and may prohibit transporting food residuals out of the county or state.
- Local governments don't want to give up the income from tipping fees at the landfill.
- Separate collection for oils and meats to prevent contamination.
- Personnel ergonomics when lifting or moving food residuals and the finished product.
- For composting onsite, have to learn to deal with pests (ants, bees, bears), storm water, odors, and vagrants seeking food.

Complexity. Collecting food residuals for offsite composting is only slightly more complex than existing waste management methods, primarily due to the care necessary to prevent contamination by containers, meat, or oils. Setting up and managing onsite in-vessel composting is significantly more complex than existing waste management and is different from most hospital management functions.

Sustainability. For this TIP, the USAPHC informally surveyed twelve hospitals that had begun composting in order to find out if they had sustained their composting programs. Eight responded; six of these were still composting, and the remaining two were trying to re-start their composting programs.

The hospitals stated the following reasons for continuing to compost:

- A good start. The facility had a point person for sustainability, a justification for composting that focused on waste, efficiency, and saving money more than on being “green,” the food service personnel led the project design (it’s their workspace and labor after all), and upgrades such as including biodegradable to-go-ware were phased in slowly.
- Composting as implemented did save money or at least broke even when compared to waste disposal.
- Availability of offsite composting facilities and food waste transporters.
- If composting on-site, partnering with grounds maintenance or operations and maintenance staff to maintain composting equipment.
- Composting only pre-consumer food waste and no free liquids. Post-consumer food residuals were contaminated with paper and too time-consuming to separate; free liquids led to spills in storage.
- Staff quickly adjusted to separating compostable food residuals from trash, and the separation did not cause additional labor.
- The facility had enough space and the right containers or equipment to store or process food residuals without causing odors or attracting pests or vectors. For offsite composting, this included a pickup frequency that prevented odors or pests.
- As an unexpected benefit, weighing all food waste before disposal raised the kitchen staff’s awareness of wasteful practices and reduced food waste significantly.

The hospitals stated the following reasons for discontinuing their composting activities:

- Offsite composting facilities or transporters went out of business or stopped accepting food residuals.
- Onsite composting equipment broke down, the manufacturer was no longer in business, and no one onsite could repair it.

- Staff turnover resulted in failure to separate compostable food residual from waste.
- Poorly designed storage containers or composting equipment allowed odors and attracted vectors and pests.

ENHANCING TECHNOLOGY

Waste pulpers reduce the volume, moisture, and weight of food residuals, thereby reducing the transportation and management costs but increasing investment and energy costs. See the Waste Pulper Recycler page of the *Joint Service Pollution Prevention Opportunity Handbook* (NFESC 2003) for more information on food pulpers.

CONCLUSION.

A hospital food residuals composting program can save money, reduce waste and reduce greenhouse gas emissions if the hospital understands and optimizes its processes that waste food, researches on- and off-site composting options, performs a life-cycle cost analysis, involves hospital and garrison personnel fully, and commits to sustaining the program.

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Appendix A

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