COMMUNITY TOOLKIT:

Adding Food Waste to a Yard Trimmings Compost Facility

SECTIONS:

Ackowledgements

Authors
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Foreword
The Center for EcoTechnology and *BioCycle* developed this resource in response to inquiries each organization received from municipal operators considering adding food waste to yard trimmings composting sites. This toolkit helps operators determine whether introducing food waste to their operation is a good fit. Topics covered include: why an operation may want to expand, evaluation of the existing site, best practices for composting food waste, collection and hauling consideration, regulatory requirements, types of food waste, economic considerations, and compost markets.

About The Center for EcoTechnology
The Center for EcoTechnology helps people and businesses save energy and reduce waste. Our innovative non-profit works with partners throughout the country to address climate change by transforming the way we live and work - for a better community, economy, and environment. For over two decades, the Center for EcoTechnology has been an award-winning leader and pioneer in developing and implementing sustainable solutions to the problem of wasted food. For more information, visit wastedfood.cetonline.org.

About *BioCycle*
Published since 1960, *BioCycle* - the Organics Recycling Authority (BioCycle.net) - is the leading source of information on composting, compost utilization, food recovery and recycling, anaerobic digestion and biogas. Through online content and conferences, *BioCycle* guides the industry and the public on how to process organic residuals such as yard trimmings, food waste, woody materials, biosolids, manure, high strength organic wastes and other source separated feedstocks into value-added products.

For more information, sign up for *BioCycle*'s complimentary e-newsletter, BIOCYCLE CONNECT, to access the latest content, including feature articles, organics recycling news and insights from thought leaders.

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As the issue of wasted food continues to gain traction across the country, the need for more infrastructure to handle food waste at all levels of the EPA Food Recovery Hierarchy is apparent. Composting is an important option for food waste management, but siting new facilities can be challenging. When decision makers evaluate the range of possible options for composting sites, existing leaf and yard trimmings facilities often come under consideration. These facilities may represent significant potential for processing capacity in many areas, but introducing food waste should not be taken lightly. This toolkit is designed to help decision makers contemplating this path; a series of considerations are presented that will help them determine if food waste is appropriate for the site, and how to move in that direction.

Section I. Why Do You Want to Compost Food Waste?

A variety of factors may be driving municipalities to consider introducing food waste to their yard trimmings composting facility. These include state or local requirements to divert food waste from disposal facilities, or passage of mandatory diversion goals that can only be achieved by recycling food waste. Examples of these requirements and goals are in the accompanying boxes.

The factor that best fits your municipality's situation must be considered during your decision making process. For example, if your state has a ban or mandate to divert food waste from disposal, a municipality's need for composting infrastructure that can process food waste will be in demand going forward. Conversely, if your community has adopted a voluntary Zero Waste goal, e.g., 70% landfill diversion by 2030, the path to develop infrastructure to compost food waste may or may not be municipally driven.

STATE FOOD WASTE DISPOSAL BANS & DIVERSION MANDATES

- Four New England states — Massachusetts, Connecticut, Rhode Island, and Vermont — have had food waste disposal bans for a number of years. The ban in Massachusetts was adopted via a regulation; the other three states passed laws. Other states outside New England have similar situations. California included a diversion mandate (vs. a disposal ban) in its 2016 SB 1383 legislation that applies to all organic waste, including food waste. It establishes targets to achieve a 50 percent reduction in the level of statewide disposal of organic waste from the 2014 level by 2020, and a 75 percent reduction by 2025. In 2019, New York State passed a food waste disposal ban.

Several highlights regarding these state requirements:

- Vermont's ban on disposal of all food waste in landfills by 2020 applies to all food waste — residential, commercial, institutional, and industrial.
- The Rhode Island, Connecticut, and New York State bans include "proximity" language — i.e., a food waste recycling facility must be within "x" miles of the generator — as well as tonnage exclusions, e.g., generating <2 tons/week. Massachusetts' ban is based on a tons generated threshold (> 1 ton/week of food waste), with no proximity language.
- Prior to SB 1383, California enacted AB 1826, which initially required that businesses generating 8 cubic yards/week or more of organic waste (e.g., food waste, yard trimmings), must arrange to have that material recycled. In 2019, the law requires that any business generating 4 cubic yards or more of commercial solid waste per week must arrange for recycling services.

Local jurisdictions, e.g., a city, may adopt a landfill diversion requirement for food waste generators. In New York City, for example, Local Law 146 requires the following size businesses to separate their organic waste for recycling:

- Restaurants with a floor area of at least 15,000 square feet.
- Chain restaurants with 100 or more locations in the city that operate under common ownership or control, are individually franchised outlets of a parent business, or do business under the same corporate name.
- Food retailers (grocery stores) with a floor area space of at least 25,000 square feet.

The report, Bans and Beyond: Designing and Implementing Organic Waste Bans and Mandatory Organics Recycling Laws, developed by the Center for EcoTechnology and the Harvard Food Law & Policy Clinic, provides an excellent summary of state and local food waste diversion requirements.

ZERO WASTE GOALS & FOOD WASTE DIVERSION

Some states and local jurisdictions enact diversion goals (vs. requirements) that include food waste. For example, the state of Minnesota has a law that requires municipalities to have a plan to divert 75% of waste from landfills by the year 2020. To achieve that goal, municipalities may have to consider diversion of food waste.

Other jurisdictions adopt Zero Waste to Landfill goals, which typically are voluntary in terms of compliance. For example, a municipality might set a zero waste goal of 90% municipal solid waste diversion from the landfill by 2040. These Zero Waste plans typically target recyclables and organics in the waste stream, as well as promote reuse and overall reduction strategies. A few municipalities in the U.S., e.g., Austin, Texas and Boulder, Colorado, have adopted Zero Waste ordinances. Boulder's requires the commercial sector, as well as institutions and multifamily buildings, to separate organics for composting.

States in many regions of the country offer grants to local jurisdictions and private businesses to initiate food waste collection and/or processing. Grants may be available for food waste collection vehicles, collection bins/carts, food waste preprocessing equipment, and composting equipment. Some state grants require a match, e.g., state of Vermont; others do not, e.g., California's organics recycling infrastructure grants.

CURRENT MUNICIPAL SOLID WASTE (MSW) CONTRACTS

Before getting too far down the road in exploring the addition of food waste to a yard trimmings composting site, be sure there are no clauses in any existing municipal solid waste (MSW) management contracts that may either preclude or limit the ability to divert food waste. Questions to answer include:

- Are there existing contracts with solid waste management facilities that preclude diversion of a portion of the MSW stream to composting, e.g., put or pay contracts with a landfill or waste-to-energy incinerator?
- Do current waste collection contracts include stipulations that may limit the ability to add collection of a food waste stream? This can be a factor for institutions such as school districts.
- In general, are there any contractual restrictions on your municipality's ability to have food waste diverted to your composting site?

If you answered no to each question, then existing MSW contracts should not be an obstacle. If you answered yes, the most challenging to deal with are long-term "put or pay" contracts, as the financing of the incinerator or landfill is likely dependent on fees your municipality is currently paying for that disposal option.

Collection contracts can sometimes be amended, especially if the same hauler will provide the additional food waste collection service.

Another consideration is if your municipality utilizes Pay-As-You-Throw (PAYT) volume-based pricing for its MSW collection, where rates vary based on the amount of trash that is set out for collection. Many local governments utilize PAYT to incentivize recycling and organics diversion by offering reduced rates for those streams — and charging less for trash collection based on the size of container or bag set out.

CURRENT MSW MANAGEMENT INFRASTRUCTURE

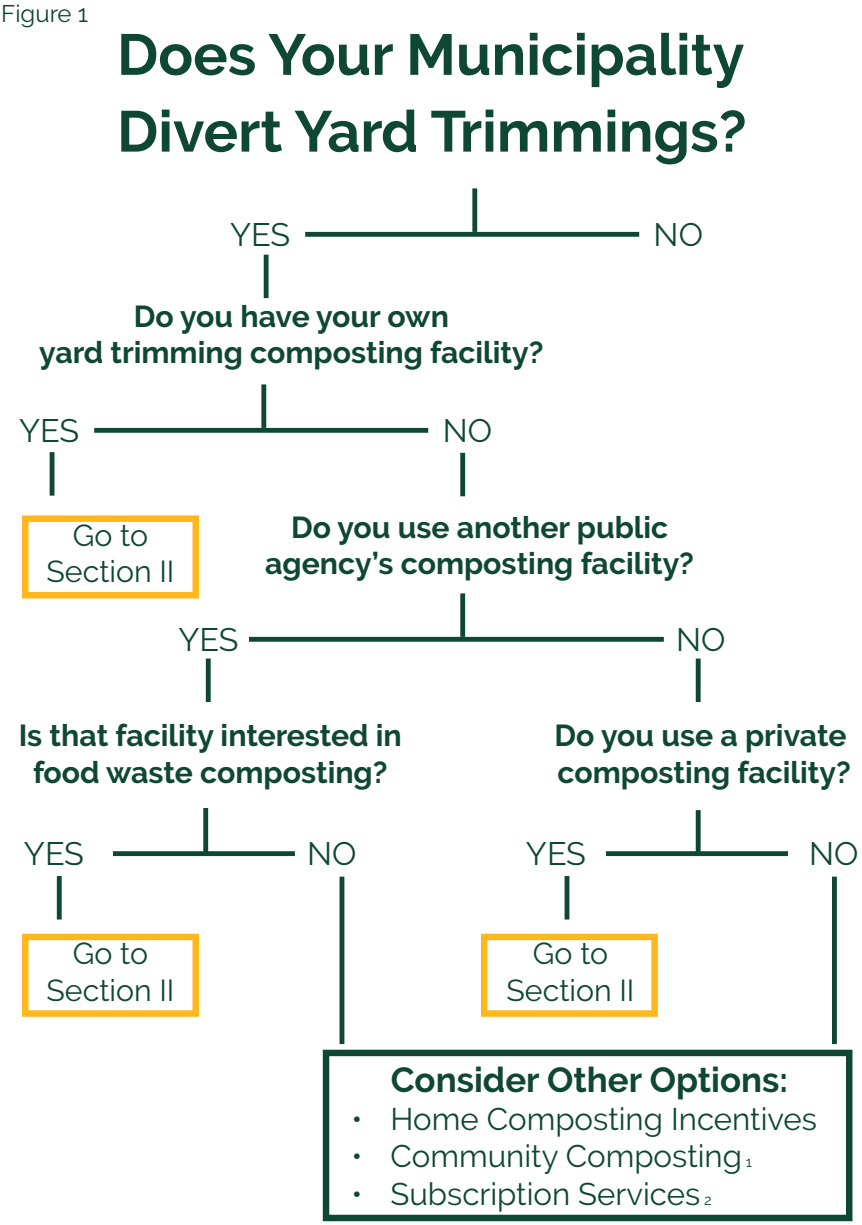
How does your municipality currently manage its solid waste — trash, yard trimmings and other organics, and recycling? The existing waste management infrastructure will influence your decisions regarding food waste composting. Here are some considerations:

- **Open/closed landfill in jurisdiction or nearby jurisdictions.** If there is an open landfill, and there is not a ban or mandate on food waste disposal, i.e., separation of food waste by generators is voluntary, procuring a regular flow of food waste can be a challenge. One solution, which is utilized by some communities, is to offer a lower fee for separate food waste collection than the current fee the generator pays for trash collection.

  If all local landfills are closed and your municipality's trash is currently disposed of in a more distant landfill, there typically is a greater incentive to separate out food waste due to its weight — and as a way to reduce frequency of trash collection.

- **Transfer station/network of transfer stations in jurisdiction.** Most municipalities faced with a longer haul for trash disposal utilize transfer stations where waste can be consolidated into long-haul trailers. In rural communities, transfer stations often also serve as drop-off centers where residents and smaller commercial enterprises can "self-haul" their trash, recyclables, and, increasingly, food waste. Vermont's Universal Recycling Law (Act 148), which bans all food waste disposal by 2020, required all transfer stations and drop-off facilities in Vermont, many in rural areas, to accept food waste by July, 2017.

Figure 1



1- Community Composting: A small-scale operation that enables community members to manage organic material on a neighborhood scale, e.g. at community garden or urban farm. The facility accepts feedstocks, (e.g., food scraps), from off-site. This method seeks to keep organics in a closed loop (e.g., neighborhood), from source of feedstocks to use of compost.
2- Subscription Service: Household and small businesses subscribe to a food scraps collection service offered by businesses and nonprofits. This service is typically available in communities without curbside food waste collection offered by the municipality.

- **Existing yard trimmings composting facility?** Does your municipality have its own yard trimmings composting facility? Or does it divert municipal yard trimmings to a private facility or another jurisdiction's facility under a contract or inter-municipal agreement? Answers to these questions present various "if, then" scenarios in your decision-making process. **Figure 1** outlines a decision-making tree for current yard trimmings management. If you respond "yes" to all the questions, your municipality may be better situated to initiate food waste composting. A detailed questionnaire is presented in **Section II**. If you respond no to all the questions, your municipality may need to pursue alternative options for food waste composting.

Section II. Is Your Yard Trimmings Composting Site Food Waste Ready?

The majority of municipal yard trimmings composting sites operate on a fairly low technology and minimal staffing basis. Many are staffed seasonally, e.g., several days a week during the fall leaf collection months, and then in the spring and summer when lawns are being mowed, weeds are being pulled, and trees are being trimmed. Incoming yard trimmings such as leaves and brush may be stockpiled for a few days or longer if there is adequate storage, until a staff person is available to process the materials and put them into windrows or static piles. These are turned occasionally, unless there are large loads of grass clippings, which require more active initial management. Sites are staffed when materials are received and/or need to be processed.

Conversely, municipal yard trimmings composting facilities in larger cities that operate on a year-round basis, and receive feedstocks daily, are usually staffed during regular business hours. Due to the amount of organics being received, the facilities may operate on a paved surface and be required, for example, to collect and treat leachate and manage storm water in retention ponds.

Both scales of facilities are candidates for receiving source separated food waste. However, the smaller, seasonally operated sites may need to make staffing adjustments, as well as some site improvements. Section II is written in the form of a questionnaire to enable users to determine if the site is food waste-ready.

FOOD WASTE COMPOSTING GROUND RULES

1. Always have carbonaceous material (e.g., wood chips, ground brush, mulch, screened overs) available to mix with incoming food waste.

2. Never let a fresh load of food waste sit on the pad once unloaded. Immediately mix in carbon amendment (roughly 3 parts carbon to 1-part food waste). If you can't mix the food waste with the amendment within the first hour after receipt, cover the food waste with a 3- to 4-inch layer of compost or a 6- to 8-inch layer of wood chips to deter birds and other vectors.

3. Incorporate mixed feedstocks into an active composting pile as soon as possible. Once all incoming loads are processed and in the windrow, consider putting a layer of wood chips or finished compost on the surface to suppress odors.

4. At the end of the day — or even twice a day — scrape down the surface of the food waste receiving area to eliminate any fresh food waste remnants.

SAMPLE PHYSICAL SITE ASSESSMENT

1. Composting pad surface type?

[ ] Compacted dirt pad
[ ] Low permeability pad, e.g., concrete, asphalt
[ ] Compacted gravel pad on top of fabric
[ ] Other (describe): _____

Rule of Thumb: State regulations typically indicate the type of pad required to receive and compost food waste, especially if all food waste streams (including meat, fish, and dairy) are being received. Because loads heavy in vegetative food waste contain an abundance of liquid in addition to the solids, the receiving pad should be free of any ruts or uneven surfaces where the liquid can pool. Some facilities opt for a compacted or paved surface (low permeability) pad in the food waste receiving and mixing area to eliminate the potential for seepage to groundwater and facilitate capture of any liquid. [See Section III, Best Practices, for further information on pads.]

2. Can site accommodate incoming truckloads (packer, dump truck, trailer) of food waste?

[ ] Yes [ ] No

Rule of Thumb: Because food waste is typically collected in end dump trucks, 25 cubic yard (cy) compactors, or box trucks carrying filled carts, the site should be able to accommodate trucks and trailers.

If you answered no, you may be limited to only accepting food waste being dropped off by households and/or small businesses (e.g., a coffee shop, bakery, etc.) in collection carts, or possibly a pick-up truck with an insert for collecting food waste.

3. Does the site have space for a dedicated food waste receiving area?

[ ] Yes [ ] No

Rule of Thumb: Dedicated space for food waste receiving and mixing is critical. The space must be large enough to create a U-shaped berm, the center of which is filled with a 10- to 12-inch layer of mulch or wood chips. Surrounding berms, often 18- to 24-inches high, should also be made out of mulch, screened overs (oversized fractions from compost or mulch screening), and/or wood chips. The berm must be wide enough to enable a dump truck, trailer, or 25-cy compactor to unload into. Some sites opt for a paved, downward sloping pad with retaining walls for unloading. Carbonaceous material (e.g., wood chips, tree trimmings) can be placed at the base of the pad to facilitate mixing.

If you answered no, you may be limited to only accepting food waste being dropped off by households and/or small businesses (e.g., a coffee shop, bakery, etc.), or possibly a pick-up truck with an insert for collecting food waste.

4. Storm water and leachate management, retention ponds

[ ] Collect and retain all storm water in pond
[ ] Vegetated buffers and treatment areas, vegetated filter strips to treat storm water as it runs off site
[ ] Sloped pad to capture leachate from active composting piles into a tank
[ ] Other (describe)

Rule of Thumb: State regulations typically indicate what type of leachate and storm water collection is required to receive and compost food waste, especially if all food waste streams (including meat, fish, and dairy) are being received. Oftentimes this is determined by the types and/or quantity of food waste to be processed. (See Section IV, Food Waste Composting Regulatory Requirements.)

At a minimum, having vegetated buffers and treatment areas, or vegetated filter strips to treat storm water as it runs off site, is a good practice at any composting facility with active composting piles or windrows, and open curing areas.

5. Site neighbors?

Type(s) of site neighbors: [ ] Residential [ ] Retail/commercial [ ] Industrial [ ] School(s)
[ ] Other waste/wastewater management operations [ ] Other:_____

Rule of Thumb: Increasing truck traffic can raise red flags, especially if a composting site is located in a residential, retail, and/or commercial neighborhood, and/or near a school. Best practice is to always let site neighbors know about changes in your operation, and to follow good neighbor practices, e.g., scheduling deliveries when typical traffic around your site is lighter — and definitely not when children are going to, or leaving from, school. [See Section III, Good Neighbor Practices.]

Ironically, being located near another waste or wastewater management facility can be a detriment, as site neighbors may cite the composting facility as the odor source when it is one of the other operations.

6. Proximity of site neighbors: [ ] <500 feet [ ] 500-1,000 feet [ ] >1,000 feet

Human nature is such that people smell with their eyes. The closer neighbors are to a composting facility, the more vigilant operators need to be about avoiding negative impacts. (Following Best Management Practices, regardless of distance to site neighbors, is essential to avoiding negative impacts and addressing them if they arise.)

Rule of Thumb: Composting is a biological process that will, from time to time, emit odors that travel off-site. No matter what feedstocks are being accepted, composting facilities should establish an odor management plan before the facility opens. The plan incorporates best practices for controlling odors, including timing of when piles are turned (e.g., not when the prevailing wind is blowing toward site neighbors).

It also is very important to engage site neighbors and explain what your facility is doing. Provide tours, and samples of finished compost. Also give them a phone number where they can register any complaints and be ensured of a fast response.

ZONING, PERMITING

1. Zoning:

How is facility zoned? [ ] Industrial [ ] Commercial [ ] Agricultural [ ] Other: _____

Composting (or digestion) facilities are very rarely defined in local zoning ordinances and rules. As a result, land use planners and zoning officials tend to classify it as a waste management activity, which is usually a highly restricted land use.

Rule of Thumb: Existing yard trimmings composting facilities typically have gone through a zoning process (although this is dependent on specific locale). Often, these facilities are located in a Public Works yard (municipal or industrial use), or at a solid waste facility, e.g., landfill or transfer station. Accepting food waste is likely not a condition of the site's existing zoning, but it's always good to double check.

Agricultural operations may have restrictions on receiving organic waste not generated on the farm. In many states, farm-based composting operations are regulated under the Department of Agriculture, not an Environmental Department, and are exempt from some types of permitting.

2. Does the facility have a Conditional Use Permit with restrictions, e.g., on facility operations?

[ ] Yes [ ] No
If yes, do those restrictions allow acceptance of food waste? [ ] Yes [ ] No

Zoning approvals can be classified as "permitted by right," "permitted by variance," "permitted subject to Special Exception," "permitted subject to a Conditional Use permit," and "not permitted." A land use permitted subject to Conditional Use Permit (CUP) is a Special Exception that has to be approved by a governing body. This is the approvals process that most composting and anaerobic digestion (AD) facilities fall into.

Rule of Thumb: CUPs give local governments a sense of control over the application, and as most governing body deliberations are public events, CUP hearings give neighbors and other affected parties a voice in the approval process. Prior to any public hearings, be sure to invest time in educating elected officials, citizen groups, and site neighbors about your plans. Flying under the radar is not advised.

3. Current permit status and allowed throughput:

[ ] Permit by rule or registration for yard trimmings only
[ ] Wood grinding registration
[ ] Permitted to accept source separated organics that include food waste
[ ] Agricultural composting exemption or allowance
[ ] Other: _____

State regulations for composting facilities have been evolving, from all being characterized as solid waste operations, to, more recently, creating permitting tiers based on the feedstocks being accepted and/or quantity being received (annually, or on site at any one time).

Rule of Thumb: In most states, facilities composting only yard trimmings (leaves, brush, grass, sawdust) may only be required to register their site with the state regulatory authority. In some states, this falls under a permit by rule. Most states do not allow yard trimmings composting sites that operate under a permit by rule or registration to accept food waste. These sites are typically required to apply for a source separated organics composting permit, or go through some type of regulatory permitting process in order to receive food waste. (In many states, however, food waste composting falls under permit by rule status, albeit one of a different tier or class, reflecting the higher pathogenicity of food wastes.) Some states have adopted permitting tiers that reduce the difficulty of getting a permit to receive pre-consumer vegetative food waste, e.g., from a food processor or a produce wholesaler. Section V. Food Waste Composting Regulatory Requirements, has more details on composting regulations.

4. Does facility have a limit on volume or weight of material it can accept annually or at any one time?

[ ] Yes [ ] No
If yes, what is the limit?: ____ cy/year ____ tons/year ____cy at any one time

Rule of Thumb: Some states include a material quantity allowed to be processed at a site at any one time. Others make the size determination by quantity of compost produced annually. For example, the Maryland Department of Environment's "Tier 2-Small" applies to operations producing less than or equal to 10,000 cy/year of compost. "Tier 2-Large" covers facilities producing >10,000 cy/year of compost.

SITE OPERATIONS

1. Access, hours of operation

[ ] Site open year round
[ ] Site accessible to public
[ ] Site open weekdays, business hours (e.g., 8-4)
[ ] Site open seasonally
[ ] Site restricted to municipal access only
[ ] Site open limited hours, days of week

Rule of Thumb: Composting facilities accepting food waste from organics haulers should be open year-round and staffed to accept loads of food waste during regular business hours. Facilities opened and staffed for limited hours may be able to make arrangements with food waste haulers to come only at those times. Sites restricted to municipal access only may be able to receive food waste if collection is done by the municipality (e.g., from food scrap drop-off sites at farmer's markets, transfer stations, etc.).

Exceptions to needing to be open and staffed year round may occur when the facility is in a resort community, with significant variation in population over the course of the year; when the facility only services food waste from special events; and/or when the primary food waste generator is a college or university where the student population decreases during the summer months.

2. Yard trimmings feedstocks currently accepted

[ ] Leaves [ ] Ground brush/smaller tree limbs [ ] Wood chips
[ ] Chipped tree trimmings from landscapers and tree services
[ ] Sawdust [ ] Whole trees [ ] Grass [ ] Stumps [ ] Other: _____

Rule of Thumb: Food waste is dense and high in moisture, and therefore needs to be composted with amendments that provide structure to maintain free air space in the pile. It is common for food waste composting facilities to use wood chips, tree trimmings, ground wood and brush, and similar feedstocks to provide that structure. Other carbon sources can be added, but there must be a combination of larger particles balanced with smaller ones. Too many fine particles will close off air channels and squeeze out oxygen. Too many larger particles will bring too much air into the pile, cooling the interior. Either condition will slow down the decomposition of the material.

In addition, food waste is beneficial at a yard and wood residuals facility that would like to balance out its carbon-to-nitrogen ratio, as yard trimmings alone often have a higher carbon-to-nitrogen ratio than the desired 25 to 1. In the summertime, and/or during drought-prone months, the composting process may be accelerated by moisture-laden food residuals because the piles are on the drier side, without much grass coming in to the facility, and lack of adequate moisture slows down decomposition of the material. However, during the winter and periods of heavy precipitation, or in the fall with abundant wet leaves coming to the facility, food waste may actually slow down the composting process and could potentially cause the compost piles to become anaerobic.

3. Labor

[ ] Full-time operator, year-round
[ ] Full-time operator, seasonal
[ ] Part-time operator, e.g., as needed

Rule of Thumb: As noted earlier in this section, loads of food waste must be mixed with carbonaceous materials upon arrival. Therefore, an equipment operator needs to be on site — whether that individual is part- or full-time. The same operator, or another staff person, needs to be available to check incoming food waste loads for contamination, and remove it or reject the load.

Most state regulations require that food waste composting meets PFRP (Process to Further Reduce Pathogens) requirements (see Section V). For windrow facilities, meeting PFRP does require a set number of turnings over a specific period of time. Facilities with aerated static pile systems do not need to turn the piles, but must achieve and hold a specific temperature for a set period of time. Therefore, labor must be available to turn the windrows and/or monitor temperatures. The latter (temperature monitoring) can be done remotely.

4. Equipment (check all that apply)

[ ] Front-end loader [ ] Excavator with grapple [ ] Mechanical mixer
[ ] Windrow turner [ ] Compost screen [ ] Aeration (for static piles)
[ ] Structure (specify how used, e.g, compost storage): _____

Rule of Thumb: At a minimum, a front-end bucket loader is needed to compost food waste. An excavator (backhoe) can be used, but may not be adequate to thoroughly mix incoming food waste with carbonaceous materials. Very small facilities receiving small quantities of food waste may find a small skid steer loader to be adequate. Some facilities opt to use a mechanical mixer, which can also size reduce food waste (e.g., melons).

Compost screens — whether rented or owned — can remove most contaminants in the finished compost. Problematic items that often arrive with the food waste, such as produce stickers and produce bags, can be a challenge to remove, even with a smaller-holed screen.

An increasing number of facilities — especially those in climates receiving a lot of rain — are installing fabric-covered structures where food waste is unloaded and mixed with carbonaceous materials. These structures have to be high enough for a dump truck or trailer to unload.

5. Odor Control

[ ] Rely on process control only, including monitoring of wind direction before turning piles
[ ] Cover new piles with finished compost or screened overs
[ ] Utilize biofilter
[ ] Other: _____

Rule of Thumb: Odor control is essential, no matter what materials are being composted. Always pay attention to wind direction and weather conditions that cause odorous emissions to stay close to the ground. Avoid conditions that can lead to anaerobic pockets in the piles — including build-up of liquid around the base of piles, lack of oxygen in active composting piles, and excessive moisture in the piles.

A very common practice is to cover active windrows with a layer of finished compost or wood chips. These materials act like a biofilter to control odor emissions. This practice is effective with windrows, static piles, and aerated static piles operated in a positive airflow (i.e., air that is pushed up through the pile).

IS YOUR YARD TRIMMINGS SITE FOOD WASTE-READY? THE BOTTOM LINE

Based on the Rules of Thumb, the following responses to the *Physical Site Assessment* and *Site Operations* portions of the questionnaire just reviewed are what are recommended *at a minimum* to accept source separated food waste. Under most state regulations, facilities accepting >1,000 cubic yards/year of food waste are typically required to have some type of source separated organics composting permit. The following practice physical site assessment indicates what is a "better" option than just the minimum.

PRACTICE PHYSICAL SITE ASSESSMENT

Time to Assess if Your Site is Food Waste Ready!

1. Composting pad surface type?

[ ] Compacted dirt pad
[ ] Low permeability pad, e.g., concrete, asphalt
[ ] Compacted gravel pad
[ ] Other: _____
Minimum: Compacted gravel pad
Better: Low permeability pad, e.g., concrete, asphalt

2. Can site accommodate incoming truckloads (packer, dump truck, trailer) of food waste?

[ ] Yes [ ] No
Minimum: Yes, if only getting pick-up truck loads or self-hauled loads from households and small businesses
Better: Yes, able to accommodate truckloads

3. Does site have space for a dedicated food waste receiving area?

[ ] Yes [ ] No
Minimum: Able to create space as needed when receive loads of food waste
Better: Have a dedicated food waste receiving area

4. Storm water and leachate management, retention ponds

[ ] Collect and retain all storm water in pond
[ ] Vegetated buffers and treatment areas, vegetated filter strips to treat storm water as it runs off site
[ ] Sloped pad to capture leachate from active composting piles
[ ] Other
Minimum: Have buffers and treatment areas
Better: Have sloped pad to capture leachate

<u>Site Operations</u>

1. Access, hours of operation

[ ] Site open year round
[ ] Site accessible to public
[ ] Site open weekdays, business hours (e.g., 8-4)
[ ] Site open seasonally
[ ] Site restricted to municipal access only
[ ] Site open limited hours, days of week
Minimum: Site open limited hours
Better: Site open year round

2. Yard trimmings feedstocks currently accept

[ ] Leaves [ ] Ground brush/smaller tree limbs [ ] Wood chips
[ ] Chipped tree trimmings from landscapers and tree services
[ ] Grass [ ] Stumps [ ] Sawdust [ ] Whole trees [ ] Other: _____
Minimum: Accept ground brush and smaller tree limbs
Better: Accept wood chips and chipped tree trimmings

3. Labor

[ ] Full-time operator, year-round
[ ] Full-time operator, seasonal
[ ] Part-time operator, as needed
Minimum: Part-time operator as needed
Better: Full-time operator, year round — if receiving food waste continually (vs. only during scheduled hours)

4. Equipment (check all that apply)

[ ] Front-end loader [ ] Excavator with grapple [ ] Mechanical mixer
[ ] Windrow turner [ ] Compost screen [ ] Aeration (for static piles)
[ ] Structure (specify how used, e.g, compost storage): _____

Minimum: Excavator with grapple
Better: Front-end loader

5. Odor Control

[ ] Rely on process control only, including monitoring of wind direction before turning piles
[ ] Cover fresh piles with finished compost, wood chips or screened overs
[ ] Utilize biofilter

Minimum: Rely on process control only
Better: Cover fresh piles with finished compost, wood chips or screened overs

Section III. Best Practices to Compost Food Waste

If you've determined that your yard trimmings composting site is food waste-ready, the next step is to become familiar with system design considerations and best practices. Section III reviews the fundamental steps involved with adding food waste to an existing yard trimmings composting facility. Where applicable, best practices for specific steps are highlighted.

GENERAL SITE DESIGN CONSIDERATIONS

How a composting facility is designed very much depends on the size and location of the site, proximity to neighbors, road access, and many other factors. Fortunately, plenty of valuable guidance documents are in the public domain to walk new and existing facilities through the essential elements that must be considered. Several of these are listed below.

- Turned Windrow Composting: Site Identification and Design Considerations, available from the Vermont Department of Environmental Conservation. While developed for operators in Vermont, this guidance reviews requirements for composting, including processing food waste. Discusses all aspects of composting, including pads, feedstock receiving and mixing, windrow construction, space considerations, storm water management, and more.

- Siting and Operating Composting Facilities in Washington State: Good Management Practices. Although specific to Washington State in terms of rules and regulations, this document is helpful for creating a list of all the "boxes to check" as a facility is being developed.

- Lean Compost Manufacturing, (*BioCycle,* May 2019) discusses the importance of creating a systematic compost manufacturing process that is efficient and effective at achieving a quality product. "At the end of the day," noted Ted Dirkx of Vermeer Corporation, "lean manufacturing is the ability to identify and eliminate waste in the production process." Dirkx's "DOWNTIME" checklist highlights common forms of waste related to labor, transportation, motion, etc. at composting facilities.

- Compost Fact Sheet #6: Compost Pads, available from the Cornell Waste Management Institute (CWMI), discusses selecting, siting, sizing, and constructing compost pads. Overall, there is general consensus that having a paved service is optimal for a composting facility to allow year round access; keep gravel, dirt or clay out of the finished product; and enable better housekeeping, including less ponding and puddles that can be an odor source. With more paved surface, however, comes more runoff to collect and treat, and cost can be a significant factor. CWMI also has a number of composting-related fact sheets available.

Pad maintenance is important, especially with compacted gravel pads. For example, if a facility has a 3-foot thick compacted sandy gravel composting pad, two key maintenance steps are "front blading" — skimming the top of the pad with the flat bucket of the loader to clear off any particles of food waste or active compost, and "back blading" — smoothing out areas around the compost piles to avoid divots where rainwater can collect and treads where mud can freeze in cold weather making the pad bumpy.

COMPOSTING METHODS

Because this guidance is written for existing yard trimmings composting facilities, a composting method is already in place. Therefore, the question to ask is whether the composting method being used is adequate to "meet the demands" of also processing food waste.

Food waste and yard trimmings can be composted using any method — windrow, static pile, aerated static pile, or in-vessel. Because food waste is high in moisture and nitrogenous, it is critical to get the initial recipe correct to optimize the carbon: nitrogen (C:N) ratio (see below). Equally critical is process control, avoiding anaerobic pockets, achieving regulatory requirements to meet the required process to further reduce pathogens (PFRP; see Section V. Regulations), and maintaining the optimum moisture content.

Another consideration, discussed in "Facility Footprint" in Section VII (Costs and Economic Considerations), is switching from the existing composting method to a different one. This can be driven by a desire to increase annual throughput (tonnage) without increasing the physical footprint, or by a desire for better process control, e.g., to capture and treat odorous air, automate temperature and oxygen control via airflow, etc.

Several facility examples can be found in the article Adding Throughput, Without Expanding The Footprint (*BioCycle*, Jan. 2008).

FOOD WASTE RECEIVING AND MIXING

The receiving area — where incoming food waste is unloaded — should be staged with carbonaceous material. In addition to leaf/yard material and wood chips, carbon-rich feedstocks include sawdust and animal bedding. As noted elsewhere in this guidance, many facilities form the carbonaceous materials into a pad, typically with berms that are several feet high on the perimeter to capture liquid from the food waste. The food waste is unloaded, visible contaminants are removed, and then a bucket loader mixes the carbonaceous materials with the food waste and the operator makes any adjustments (e.g., adding sawdust or wood chips) to get the optimum C:N ratio for composting.

Facilities equipped with a slow speed shredder or a mechanical mixer (i.e., with vertical augers) can load both yard trimmings and food waste into the unit to pregrind and blend the feedstocks and reduce the particle size. This mixing and size reduction step helps optimize the disintegration of certified compostable packaging, as well as food-soiled cardboard, if those materials are included in the food waste stream. It also is beneficial with loads that contain produce such as watermelons, cantaloupe, and pumpkins. For example, one composting facility uses a vertical mixer to size-reduce food waste, compostable products, and the corrugated cardboard it receives (*BioCycle*, Aug. 2016). Some facilities that use mechanical mixers will actually discharge the blended material directly onto the composting pad if the mixer is mounted on a truck or trailer.

RECIPES

Food waste is beneficial at a yard and wood residuals facility that would like to balance out its carbon ratio. The quantity to mix in may have to be adjusted depending on the season. For instance, during drought-prone months the process may be accelerated by moisture-laden food residuals because the piles are on the drier side. During the winter and periods of heavy precipitation, or in the fall with wet leaves, food waste may actually slow down the composting process and potentially cause the compost piles to become anaerobic. The key to year round composting with food waste, therefore, is the recipe, which may need to be adjusted at different times of the year.

Developing Composting Recipes For Process Control (*BioCycle*, Dec. 2012) by Craig Coker, is a very useful guide to the critical steps. The following discussion about process control variables and building a recipe is excerpted from Coker's article:

Process Control Variables: The four main process control variables to be considered in developing a composting recipe are carbon-to-nitrogen ratio (C:N), moisture content (%), volatile solids content (%), and predicted free air space (%). C:N is the ratio of the mass of total carbon in a pile to the mass of total nitrogen, and should be between 25 and 30 to 1. Moisture content should be between 50 and 55 percent (a little higher in the initial mix for aerated static pile composting). Volatile solids (VS) are the non-ash solids in a material. Total VS should be higher than 90 percent, although only about 70 to 75 percent of the VS in an organic material will be biodegradable. Free air space is the ratio of gas (air) volume to total volume and should be between 40 and 60 percent.

Five Key Steps to Building a Recipe:

- Step 1-Sampling Feedstocks**:** The first step in building a recipe is to understand the physical and chemical nature of the feedstocks. Obtain a representative sample of the material and have it analyzed by a commercial laboratory. Ideally, the sample should be obtained from the point of generation, as this helps develop an understanding of the source of the waste, how it is generated and handled, and what potential exists for physical or chemical contamination.

- Step 2-Bulk Density Measurement: Bulk density (BD) measurements are used to estimate the free air space (FAS) in the mixture. Bulk density measurements also offer an easy way for loader operators to know how many buckets of each feedstock to add to the mix. Measuring soluble salts is advised in order to select a bulking agent amendment that does not increase salts to unacceptable levels (e.g., poultry litter). A procedure for how to calculate bulk density is available.

- Step 3-Bulking Agent: Factoring in the right amount and type of bulking agent is important in recipe development. Bulking agents serve two purposes: they provide structure to enhance free air space and pile porosity (important for maintaining aerobic conditions), and they often add biodegradable carbon to help offset the nitrogen-heavy nature of most compostable feedstocks. Bulking agents can be anything from shredded paper and cardboard to agricultural residuals (like corn stover) to sawdust and wood chips. Often, a composting recipe will use more than one kind of bulking agent, with one chosen for its contribution to the C:N ratio and one chosen for its contribution to structural porosity.

- Step 4-Proportions: Proportions depend on how many feedstocks come to the composting facility. Small facilities can use their sense of observation to know if the mix has a good recipe. Visually, the operator can look to see if the feedstocks are evenly mixed. Moisture content can be assessed with a squeeze test, and, after composting has begun, detecting foul odors is a signal that something is wrong with the mix. Large composting facilities that take in more than three to four different feedstocks should do the math. For an explanation of the math behind balancing C:N ratio and moisture, visit the Cornell University composting website.

- Step 5-Blending: No recipe will work well without proper proportioning and good mixing. Site operators don't necessarily need to understand the math of recipes, but need to understand the volumes of the recipe (e.g., three loader buckets of sawdust for every loader bucket of manure). Mixing can be done by bucket-blending, building a "layer cake" of feedstocks and turning them in together with a windrow turner, or with one of the many mechanical mixers on the market.

CONTAMINANT REMOVAL

Yard trimmings composting facilities are familiar with the challenges that contamination poses to their operations. Garden hoses, film plastic bags, glass, plastic bottles, and more find their way into the leaves, brush, and yard trimmings that arrive at the composting facility. Some items can be removed by hand picking in the tipping area; others, like metal, are removed by the magnets on grinding equipment. The remainder are screened out of the finished compost.

Food waste also has its share of contamination — various packaging that food comes in, produce bags and stickers, and other items that get put in the food waste carts and compactors at the collection point. Without a doubt, the most effective and efficient way to manage contamination is at the source where the food waste is generated (e.g., the grocery store, cafeteria, restaurant, or household). Inevitably, however, contamination does make its way to the composting site and has to be managed. Hand picking is important (and some facilities actually have a sorting station ahead of composting), but isn't always practical or cost-effective — and it is hard to remove smaller and less noticeable items. Equipment to remove contamination falls into two general categories: front end and back end.

Resources for Contamination

- Review the Center for EcoTechnology's Best Management Practices for Source Separation for recommendations on types of containers, storage practices, and frequency of pickup to reduce overall contamination.
- Discussed in Bans and Beyond; educating the public about how to avoid contamination requires reaching a much larger audience than conducting outreach only to businesses and institutions. To reduce overall contamination, education and outreach should be directed to both commercial and residential sectors.

Front End: As noted above, a handful of companies utilize a mechanical hand sorting line — essentially a conveyor belt where sorters standing on each side pick out contamination. One facility in the Pacific Northwest put commingled yard trimmings and food waste (from household curbside collection) into a slow-speed shredder with a magnetic separator to both size reduce and mix the feedstocks. This material was conveyed to a sorting line where employees picked out contaminants before it was moved to the composting pad (*BioCycle,* Dec. 2014).

More recently, composting and anaerobic digestion facilities have started to install depackaging equipment designed to separate the food waste from its packaging — as well as remove other contaminants. The food waste is then discharged as a slurry that can be added to composting piles or to anaerobic digesters. However, depackaging equipment also removes compostable products, as well as some of the paper that may be commingled with the food waste.

Back End: Many yard trimmings composters already own or lease screens to process the finished compost. The three main types of screens are trommel, star, and vibratory. Screen decks are available in different hole sizes, enabling composting facilities to produce composts and blends for a variety of markets. Some composting operations pair a screen with an air classifier like a wind sifter to "blow" film plastic particles out of screened compost. Air classification is typically used to remove film plastic from the "compost overs" (larger fraction material that does not fall through the screen openings).

Separation 'Code & Switch' In Contaminant Removal (*BioCycle*, Sept. 2016) is an excellent primer for front end and back end removal of contaminants.

GOOD NEIGHBOR STRATEGIES

Wherever the existing composting facility is located — in an urban, suburban, or rural setting — best practice is to *always* be a good neighbor. Good neighbor practice #1 is not to try to fly "under the radar," i.e., letting only those who need to approve the facility know that it exists. Sometimes, public meetings are required as part of the site's permitting process. Engaging the community before the public meeting — building relationships — is always a good investment.

Despite employing all the best practices for odor control or nuisances related to litter or truck traffic, unavoidable incidents happen. Be sure to educate and exchange information when times are good; waiting until an incident happens makes it too late for any sympathy or understanding. Credibility is lost, and with a public health issue, fear and emotion dominate the dialogue. Much has been written in *BioCycle* and elsewhere in the literature about effective odor management strategies, and most facilities utilize various combinations. See for example:

- Cost-Effective Odor Control (*BioCycle*, Nov. 2014)
- Controlling Composting Odors (*BioCycle*, Feb. 2016)

BioCycle has also had a number of articles on good neighbor strategies over the decades:

- Resolving Odor Challenges (*BioCycle,* Nov. 2012)
- Public Perceptions of Biosolids Recycling (*BioCycle*, April 2005)

Unfortunately, too many facilities do not employ these common sense best practices, nor allocate money in their operating budget to cover the ongoing investment in building positive and productive public relationships. Examples of these best practices are summarized in the following bullets:

- **Treat Your Neighbors Well**: Jayne Merner Senecal of Earth Care Farms in Rhode Island wrote, "Just like every composter, we have unavoidable odor and traffic from time to time, despite working hard to minimize both. We've found the best way to navigate these challenges is to connect our neighbors to what we are doing. We give gift certificates to the farm to pick produce, provide tours, and host bonfires… When the public is connected to your site and understands the value of the service you provide, a lot of problems are avoided." (*BioCycle,* May 2019).

- **Reach Out Early and Often**: Educate your neighbors and the community about the composting process and provide samples of your compost. Provide realistic expectations of site performance, and make it very easy to be contacted (e.g., set up a 24/7 hotline) to register complaints or concerns related to odors, truck traffic, etc. Engage the media, and hold events at the composting facility for parks and roads departments, K-12 school classes, garden clubs, landscape architects, and others. Provide compost free-of-charge to community gardens.
- **Have A Data-Driven Complaint Response Plan**: Utilize weather station equipment to record wind direction and speed. Observe weather patterns over the course of the day, e.g., temperature inversions when the layer of cool air at the surface is overlain by a layer of warmer air, which may cause odorous emissions to stay close to the ground as the air moves, increasing potential for offsite impacts. Use this data when responding to complaints, as it can help explain why a neighbor was impacted, or why the composting facility may not be the source of the odor if the wind was blowing in a different direction. In addition, establish least impact routes for haulers bringing material to the facility. Neighbors may be accustomed to trucks going to the site with loads of fall leaves or yard trimmings, but less familiar with trucks bringing loads of food waste and the frequency of those trips. Work with haulers to ensure that drivers know the route to take, and that they alert the facility if that route is not taken and why in case it receives complaints.
- **Respond to Complaints Quickly and Empathetically**: Have a response plan in place, including staff trained in complaint response etiquette and protocol (e.g., not losing their cool, understanding and respecting that people are angry about the odors or truck traffic and fearful of a public health impact). Listen and learn before responding. Bring data that will be helpful in the response. Know the limits of your knowledge. Do not fill in gaps with speculation and educated guessing. Instead, acknowledge you do not know the answer, but will identify and bring in someone who does. And finally, especially with odor complaints, it may be necessary to utilize equipment such as a field olfactometer to measure and quantify the strength of the odor in the ambient air.
- **Always Be Cooperative**: Give all potentially impacted parties, including neighbors, elected officials, and community leaders, full cooperation from day one. You want to be, and should be, held accountable. If a problem arises and an acceptable solution has been worked out with all stakeholders, the composting facility will have an established framework in which to address any current or future problems.

Section IV. Food Waste Collection & Hauling Considerations

As an operator, there are a few considerations when working with haulers and/or generators of food waste. First and foremost, is your municipality interested in hauling food waste, allowing residential or commercial to drop off their material, or working with existing haulers? If you are interested in hauling material, considerations may include price structures, container sizes, communication about contamination, and potential for contractual agreements. The facility will also need equipment to transfer and contain the material. Michigan's "Compost Operator Guidebook: Best Management Practices for Commercial Scale Composting Operations," outlines a variety of equipment options for hauling and types of collection containers for generators.

Secondly, some municipalities offer residential and commercial drop off to reduce costs and manage potential contamination. This may be an opportunity to start accepting a smaller volume of organic material. If allowing for drop off, consider offering educational workshops because understanding where materials go and how they are processed has been proven to help increase participation in programs and decrease overall contamination. Lastly, there is the option of working with private haulers. Does your facility have existing relationships with any haulers that are interested in, or already, collecting food waste? If a facility decides to work with a private hauler, facilities should discuss what will happen if a load does not meet the standards of the facility. Refer to the Center for EcoTechnology's Guidance for Businesses Contracting for Trash, Recycling, and Food Waste Services for more information on how generators and haulers may communicate to estimate waste, reduce contamination, and adjust contracts.

Regardless of who is transporting the material, it is also important to estimate the expected composition and volume of the waste stream. For instance, if there will be anything other than food scraps, e.g., compostable-ware, it is critical to communicate if that material is acceptable or not at the facility. Communicate with haulers what the expected specifications of the food waste collected will be because this will influence the overall design of the composting operation.

Section V. Food Waste Composting Regulatory Requirements (State, Local)

Composting sites are regulated at the state and local levels. Yard trimmings composting sites are commonly the least regulated facilities, often requiring only a registration with the state environmental agency or a "permit by rule" designation. Facilities that want to begin accepting food waste streams typically fall under a separate set of state composting regulations that become more restrictive based on the types and quantity of food waste received.

PERMIT TIERS

Many states utilize a tiered approach to their food waste composting regulations. Here are two examples:

Maryland:
Maryland's composting rules were revised in 2015. The regulations divide feedstocks into three general types: Type 1 is yard trimmings; Type 2 includes food waste, non-recyclable paper, Maryland Department of Environment (MDE)-approved animal manure and bedding, MDE-approved industrial food processing materials, animal mortalities, and compostable products; and Type 3 covers biosolids, soiled diapers, and mixed MSW. Natural wood waste, e.g., trees and stumps, is in its own category.

Type 3 feedstocks and facilities composting natural wood waste only are covered under existing MDE regulations/permits and will not be subjected to the new rules. MDE created two new tiers, with Tier 2 divided into smaller and larger facilities. Tier 1 regulations are for facilities composting only Type 1 materials, i.e., yard trimmings. Tier 2 is for facilities composting Type 1 and 2 materials. Tier 2-Small applies to operations producing less than or equal to 10,000 cubic yards (cy)/year of compost. Tier 2-Large covers facilities producing >10,000 cy/year of compost.

The MDE rules exempt a Tier 1 or 2 composting facility from having a permit when the site has no more than 5,000 square feet "in support of composting" and meets maximum pile height restrictions. Feedstock piles may not be higher than 9 feet and all other piles are limited to a height of 12 feet. When determining the area used in support of composting, areas used for feedstock receiving and preparation (such as mixing, shredding, and water addition), active composting, curing, and storage (including compost, equipment, and waste) must be included. The areas do not need to be contiguous, and spaces not used for any of these activities listed above may be omitted, including empty fields and roads.

New York:
The New York State Department of Conservation (NYDEC) revised its Part 360 Solid Waste regulations and expanded the limits to which a composting facility is considered exempt, registered, or permitted. One goal of the revisions, effective in November 2017, was to address the expansion of community composting in the state. The following revisions apply to Source Separated Organics (SSO) Composting that includes food waste:

Exempt: Before November 2017, there were no exemptions for source separated composting that included food scraps. Post November 2017, a composting facility that accepts, measured on a monthly average, no more than 1,000 pounds (lbs.) or 1 cubic yard (cy), whichever is greater, of source separated organics (SSO) per week is exempt, provided no more than 2,000 lbs. are accepted in any one week.

Registration Required: Before November 2017, a composting facility that accepted no more than 1,000 cy/year of SSO or a composting facility for food processing waste had to register. As of November 2017, a composting facility that accepts no more than 5,000 cy or 2,500 wet tons, whichever is less, of SSO per year, provided that no more than 800 cy are accepted in any month, has to register.

Permit Required: A permit is required to compost any amount of SSO above the registered amount, which also was the case prior to the November 2017 revisions.

COMPOSTING PFRP REQUIREMENTS

Almost all state food waste composting regulations utilize the U.S. EPA 40 CFR Part 503 regulations for pathogen and vector attraction reduction that were originally written for biosolids composting. The specific rule is called PFRP, or Process to Further Reduce Pathogens. Specifications are different for composting done with forced aeration (aerated static pile composting) versus windrow composting (turned windrows with no forced air). These are described below:

PFRP for Aerated Static Pile Method
- Pile temperatures shall be maintained at 55˚C (131˚F) or higher for a minimum of 3 days (i.e., piles must be covered to ensure minimum temperatures throughout the pile); and
- Fecal coliform must be less than 1,000 most probable numbers (MPN) per gram total solids (dry-weight-basis); or
- Salmonella sp. Bacteria must be less than 3 MPN per 4 grams of total solids (dry-weight-basis).

PFRP for Windrow Composting Method
- Pile temperature be maintained at 55˚C (131˚F) or higher for 15 days or longer with a minimum of 5 turnings during this period.
- Fecal coliform must be less than 1,000 most probable numbers (MPN) per gram total solids (dry-weight-basis); or
- *Salmonella sp*. Bacteria must be less than 3 MPN per 4 grams of total solids (dry-weight-basis).

COMPOSTING: CONTAMINATION & ODOR MANAGEMENT

Contamination

Most state composting rules set limits on "inert" contaminants (e.g., glass, metal, plastic) in finished compost. Several states, however, have adopted more stringent requirements. For example, on January 1, 2018, the California Department of Resources Recycling and Recovery's (CalRecycle) contamination limits in composted material took effect. Limits are: "The compostable material and/or digestate does not contain more than 0.5% by dry weight of physical contaminants greater than 4 millimeters (no more than 20% by dry weight of this 0.5% shall be film plastic greater than 4 millimeters), as specified in section 17868.3.1, at the time of land application."

Because food waste streams may contain film plastic, glass, and other inerts, it is important to verify contaminant limits for finished compost stipulated in the state's composting regulations.

Odor Management Plans

Some states require composting facilities to write an odor management plan. For example, all composting facilities are required by the Washington State Department of Ecology (WADOE) to have an odor management plan that must include information on how compost facility operators will prevent or reduce odors created at the facility from migrating beyond the facility's boundaries. The WADOE created a document, Odor Prevention, Management/Mitigation Plan Requirements, that helps composting facilities develop the plan. Even if states or local agencies do not require facilities to have a plan like this, it is strongly recommended that one be developed and followed.

REGIONAL AND LOCAL REGULATIONS, AND REQUIREMENTS

Air Quality, Local Health Department Requirements

In some states, regional or local air quality management districts and/or public health agencies have their own sets of requirements for composting facilities. In California, for example, regional air quality districts regulate emissions from equipment (e.g., front-end loaders) and, in some areas, also regulate emissions from the composting process (e.g., volatile organic compounds and ammonia).

The local Boards of Health (municipal or county) in some states may have requirements that composting facilities have to meet. These may be related to vectors (e.g., rats, pests), financial assurances for site cleanup/remediation if the facility closes, etc.

Zoning Considerations

Composting facilities are very rarely defined in local zoning ordinances and rules. As a result, land use planners and zoning officials tend to classify composting as a waste management activity, which is usually a highly restricted land use. Composting facilities already permitted for yard trimmings may not need to go through another zoning approval process, but it is always wise to be certain.

Zoning is not the only local approval typically required to site a facility. Others include building permits, sediment and erosion control permits, and similar local approvals. For any composting facility required to go through a zoning process, the following tips from Craig Coker, a composting consultant and *BioCycle* Senior Editor, are helpful:

- *Zoning Amendment*: One approach to consider if challenged by existing zoning categories is to get a zoning text amendment passed, which specifically defines and allows composting in a particular zoning category. Here is example language:
  Composting Facility: A manufacturing facility that processes agricultural and horticultural residuals, municipal residuals, and/or industrial residuals using a controlled process of microbial degradation of organic material into a stable, nuisance-free, humus-like agricultural and horticultural product. No toxic, hazardous, or radiological residuals can be processed at a composting facility. All primary processing of residuals must take place inside an enclosed building.
- *Be Prepared*: Applicants seeking zoning approvals for composting facilities should try to get correct information into the hands of decision makers and influencers, as well as the general public. It is best to be completely prepared for any issues about the proposed facility, and don't be surprised if ancillary issues unrelated to the zoning application arise. The key is to be transparent, available, responsive, and patient throughout the process, be willing to conduct further research to address concerns and/or bring in an agreed upon third party expert, and set up mechanisms for informed neighbors and community members to stay in touch.

Section VI. Types of Food Waste to be Composted

Food waste is a catch-all term for organic residuals that contain a food product — from potato peels to French fries. Food waste is produced along the food supply chain, from farms and food processors to grocery stores and households. The types of food waste feedstock streams to be accepted for composting directly impact facility design, needed infrastructure, and in some states, permitting category. Depending on what food waste streams are accepted, contamination management may or may not be a top consideration. Section VI reviews the primary food waste categories and types; impacts (if any) on facility design, infrastructure, and composting process; and feedstock acceptance terms.

FOOD WASTE CATEGORIES & TYPES

Pre-consumer and Post-consumer: The two main categories of food waste are *pre-consumer* and *post-consumer*:

- Pre-consumer, as it sounds, is any food waste that has not been sold or served. Generators of pre-consumer food waste include farms, food manufacturers, produce warehouses and food distributors,

and grocery stores. Pre-consumer also includes kitchen food prep, and prepared and packaged foods no longer safe for human consumption.

- Post-consumer is any food waste that has been sold or served to a consumer. This includes food that households buy and no longer deem edible, as well as plate scrapings. It also includes food that has been prepared and served at a restaurant, cafeteria, event, etc.

Subcategories: Within the pre- and post-consumer food waste streams, there are subcategories that include:

- Pre-consumer Vegetative: Primarily fruit and vegetable trimmings, food processing (vegetative only) waste, spoiled produce, grains, coffee grounds, brewery waste, and similar materials; it can also include no longer edible bakery products. Because this stream is food dominant, these materials typically contain a lot of liquid when delivered to the composting site (usually 65 to 75 percent water). Facilities managing loads of primarily vegetative food waste (with no other organic wastes in the load, such as soiled paper and corrugated cardboard), need to be prepared to manage the liquid.
- Pre-consumer, All Food Waste: In addition to the vegetative stream, pre-consumer "all food waste" includes meat, dairy, and fish wasted during production, transport, and/or storage, as well as food prep.
- Post-consumer Vegetative: Same materials as pre-consumer; however, post-consumer vegetative has been prepared and served, but not consumed and is being thrown away. Generally speaking, most food waste recycling programs accepting post-consumer streams typically take all food waste vs. exclusively vegetative.
- Post-consumer, All Food Waste: Same materials as pre-consumer; however, post-consumer "all food waste" includes meat, dairy, and fish that has been prepared but not consumed and is being thrown away. If these loads also contain more paper, the water content is around 22 to 30 percent.
- "Back-of-House" and "Front-of-House": A more recent distinction — primarily established for cafeterias, restaurants, venues, and special events — is back-of-house and front-of-house. Back-of-house is the kitchen and food prep areas (pre-consumer), whereas front-of-house is food and compostable foodservice products from areas where the public discard material (post-consumer). Many food waste recycling programs start with back-of-house for several reasons: a higher quantity of food waste is generated, and there is a lower risk of the food waste stream becoming contaminated. Front-of-house can be added to increase waste diversion, as well as have all food waste diverted, thereby reducing the frequency of trash collection.

Pre-consumer

Post-consumer

A number of food waste recycling programs include food-soiled paper, some corrugated or waxed corrugated cardboard, and in some programs, certified compostable bioplastics and paper foodservice packaging products. The main certifier of these products is the Biodegradable Products Institute (BPI). Certified products have the BPI logo on the label.

Post-consumer food waste streams, although source separated, may rely on the consumer (e.g., household, cafeteria customer, festival attendee) to separate the compostable organics from recyclables and trash. This makes the food waste stream vulnerable to becoming contaminated, unless controls are put in place to ensure sorting is done correctly.

Potential for contamination also comes from produce stickers, produce and breads still in their packaging, rubber bands around produce, etc. Establishing protocols with food waste generators to remove these items is critical (See Section IV). Inevitably, some of this contamination still makes its way to the composting site, and must be removed prior to mixing incoming loads, or screened out of the finished compost.

REGULATORY CONSIDERATIONS

Some state regulations may allow a limited amount of pre-consumer vegetative only food waste to be accepted at yard trimmings composting facilities, especially if these materials are received infrequently, without any change in their regulatory status. Otherwise, states may have less restrictive permitting requirements for sites taking pre-consumer vegetative only food waste. However, more recently, some states are basing tiers for food waste composting facilities more on quantity or physical size (see Section V) versus whether the food waste is pre or post-consumer, or includes meat, fish, and dairy products.

While it is good practice for all facilities to meet the PFRP requirements explained in Section V, it is critically important for facilities that receive meat, fish, and dairy products to do so, primarily because these food waste streams can contain pathogens.

As noted, pre-consumer vegetative food waste loads are high in liquids, especially if these loads are collected but not immediately delivered to the composting site. Therefore, facilities must be equipped to handle high liquid loads, as was discussed in Section II. Loads of all food waste also contain a fair amount of liquid, as there is typically vegetative food waste in the load.

Unlike leaves, brush, and tree trimmings, food waste is highly putrescible — in short, it does not degrade gracefully. In addition to liquid, odor generation potential is a factor as well. Some food waste haulers opt to collect food waste more frequently during the warm season; thus, composting facilities that are not open on a daily basis may need to be open and staffed on a more frequent schedule. This helps reduce the odor potential of the loads — especially the liquid fraction. Immediately mixing incoming loads with carbonaceous material is critical, along with getting it into the pile and covered with a layer of wood chips or finished compost.

Section VII. Costs and Economic Considerations

Section VII is essentially about the "business" of composting food waste at an existing yard trimmings composting facility. Among the business considerations are tipping fees for source separated loads of food waste, impact on facility footprint, labor and equipment requirements and the associated costs, changes in regulatory status and the associated costs, and impact, if any, on compost markets. Climate is also a business consideration, due to the high liquid nature of food waste and the ability to service food waste generators year round. Another factor is whether the state has some type of food waste disposal ban in place or pending and how that ban is being enforced.

Generally speaking, the following rules of thumb are useful while making business decisions. Some of these have already been discussed in earlier sections:

- **Equipment**: The minimum equipment required is a bucket loader or equivalent, as food waste must be mixed immediately after it is unloaded with carbonaceous amendment(s).

- **Labor**: At least one equipment operator must be present to manage the arriving food waste. That person also may need to remove any contamination prior to mixing the load. The Center for EcoTechnology produced Guidance for Commercial Food Waste Separation to provide best practices for acceptable handling, storage, and hauling of this material. This guidance can be distributed to local businesses to reduce contamination. There are additional resources to address contamination concerns such as Recycle Across America's example signage.

- **Facility Footprint**: Adding food waste to an existing yard trimmings composting facility can be done incrementally on the same footprint, e.g., mixing a certain volume of food waste into the existing operation, or built out as a separate component at the existing site. Because food waste is a fast-acting source of nitrogen made up primarily of water, it has a massive reduction ratio, i.e., it doesn't add much volume to a pile.

- **Process Control**: To meet pathogen and vector attraction reduction requirements, pile temperatures must be taken and recorded. This can be done via wireless sensors and data recording (thus an employee doesn't have to be on site). Piles also need to be monitored for leachate (too much moisture) and odor generation.

- **Compost Markets**: Food waste can add more nutrients to the compost, as well as have an impact on salt content. This can be a consideration if the compost is being used in a growing media (e.g., at nurseries), or in green roof mix or other green infrastructure application where increases in nutrients might be a factor. Generally speaking, however, adding food waste doesn't have an impact on most bulk compost markets, e.g., landscaping, general turf application, etc. Testing the finished compost via laboratory analyses and in-house seed germination tests is recommended.

COSTS

Controlling costs is key to making money or staying on budget in compost manufacturing, which is a volumetric materials handling activity. Every time product is handled in the manufacturing process, a cost is incurred. As such, the goal in designing a compost "manufacturing plant" (i.e., a facility designed to "manufacture" compost "products") is to ensure that, as much as possible, materials move efficiently through the manufacturing process. Efficiency means materials move in as linear a fashion as site constraints allow — from manufacturing step to manufacturing step with the least number of material handlings, and in transport mechanisms of optimal capacity.

At most compost manufacturing facilities, labor and fuel costs are the highest when analyzing the Costs of Goods Sold (COGS). Because adding food waste requires increased labor and increased equipment operation, the COGS are likely to increase, and therefore must be a consideration when establishing the

tipping fee for food waste loads. Yard trimmings facilities composting primarily leaves, grass, and brush will likely need to acquire wood chips to ensure pile porosity and structure. In many cases, arrangements can be made with local tree trimming operations to accept their wood chips at no cost. Review Controlling Costs In Compost Manufacturing (*BioCycle,* Sept. 2010) for an excellent framework to assess the impact of adding food waste to the facility's costs.

FACILITY FOOTPRINT

As noted, adding food waste to a yard and wood debris composting operation allows for more throughput (and thus revenue) without necessarily increasing the footprint, because food waste is a fast-acting source of nitrogen made up primarily of water, with a massive reduction ratio. Smaller volumes can typically be managed with the available carbon sources (i.e., the yard trimmings), and the existing receiving pad. However, the greater the volume of food waste, the greater the likelihood that the physical footprint of a site may need to be modified given the increased quantity of carbon-containing material needed to amend that food waste. Increasing the quantity accepted also will likely require a larger dedicated area for food waste receiving, and additional storm water treatment capacity.

There are several ways to add processing capacity without increasing the acreage of a composting pad and, therefore, reducing the capital investment. For example, a small operation looking to grow could increase throughput by 80 to 85 percent on one acre by increasing windrow size from 5 feet by 10 feet to 6 feet by 16 feet. Larger windrows will increase space utilization efficiency. However, it should be noted that windrows can be constructed too large and potentially cause nuisance problems. And if a windrow turner is used at the facility, it may not be able to accommodate higher piles.

Another way to add capacity without enlarging the existing footprint is to change the method of composting, such as from windrows to aerated static piles (ASP). ASPs utilize space more efficiently than windrows, since they eliminate the need for wide aisles and turn around, and because the individual piles have larger dimensions. Perforated piping underneath the piles provides airflow — pushing air up through the pile (positive mode) or pulling it down via suction (negative mode). Growing numbers of composting facilities installing aerated static piles push air up through the piles, and then add a layer of wood chips, mulch, or finished compost to act as an odor-controlling biofilter. Because the piles are not turned during active composting, it is important that the materials are thoroughly mixed in the proper carbon-to-nitrogen ratio (see Recipes in Section III).

Opting to switch to aerated static piles requires an investment in a forced aeration system — perforated pipes, fans, and a timer to turn the fans on and off to control temperature in the pile. That investment can be fairly minimal for smaller facilities if they opt to lay the perforated pipes on top of the pad and use small blowers that can be run on electricity from solar panels. Costs increase if the pipes are put in trenches and covered with grates, if larger blower systems are required, and/or if remote wireless process monitoring is used. New England Compost in Danbury, Connecticut is an example of a facility that uses ASP to compost food waste and yard trimmings. Its aeration pipes are on top of the pad and solar panels power the aeration fans (*BioCycle*, Nov. 2015). New England Compost started with a 240-volt, 60 hz system that consisted of eight 6-volt, deep-cycle golf cart batteries, and three 275 watt monocrystalline photovoltaic (PV) panels. Designed by Apollo Solar in Bethel, Connecticut, it can power one 1.5 horsepower (hp) blower, and cost about $15,000 when New England Compost installed it in 2015. The facility then switched to six 315 watt monocrystalline PV panels, and expected to run two 1.5 hp blowers without increasing the existing battery bank.

Some yard trimmings facilities opt to expand their acreage in order to take greater volumes of food waste. They typically invest in a paved surface, at least for food waste receiving and active composting. Some opt to build bays with forced aeration in trenches to further improve process control. These types of site improvements come with associated capital investments. For instance, the Onondagua County Resource Recovery Facility near Syracuse, New York, switched to an aerated bay configuration (*BioCycle*, Nov. 2014).

TIPPING FEE CONSIDERATIONS

Although it can vary by region of the country, a general rule of thumb is that the tipping fee for source separated loads of food waste tracks fairly closely to the tipping fee for landfill disposal — and that the food waste fee is equal to or less than the landfill fee. This is especially true in places without a law or regulation that requires food waste to be diverted from landfill disposal. As only six states and a handful of municipalities have those requirements, tipping fees at composting sites typically have to stay very competitive with disposal rates.

Some facilities have sliding scales for loads of food waste, such as lower fees if the food waste does not contain any contamination (e.g., from a food manufacturer), and somewhat higher fees if the potential for contamination exists (e.g., pre-consumer food waste from grocery stores). It is essential that all composting facilities have protocols in their contracts with food waste generators (or their haulers) that allow rejection of loads with contamination, and the ability to be compensated for any costs that occur with managing that material. For municipal yard trimmings composting sites that process only loads collected by municipalities (or under contract to municipalities), a system may need to be established to track the incoming volume or weight of food waste loads and set up a billing and accounting system for the new operation.

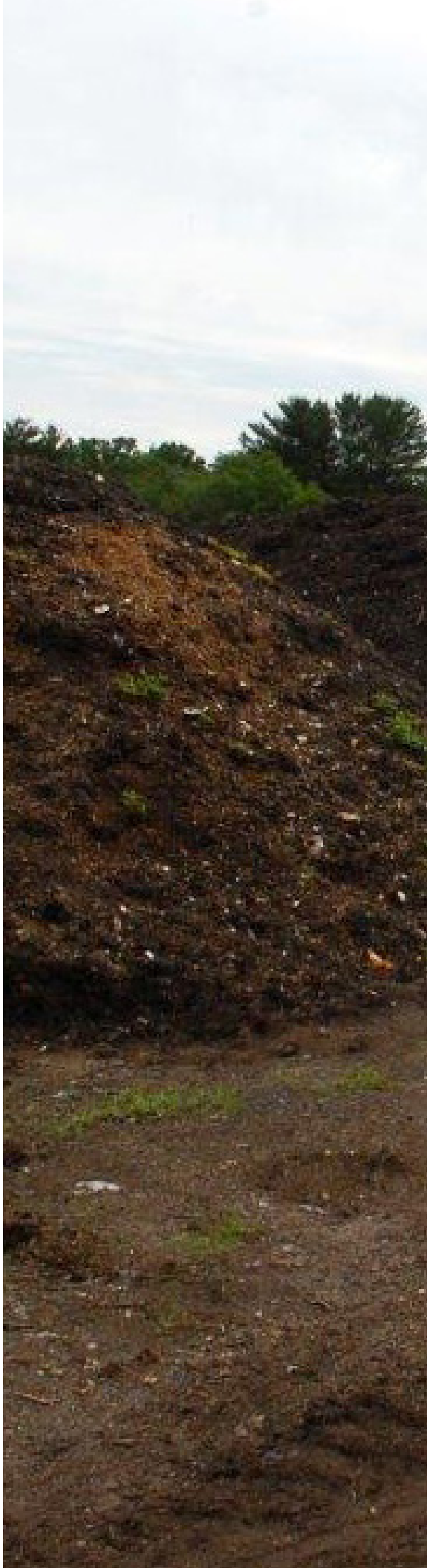
OTHER FACTORS

Climate Impacts

Climate is a consideration when evaluating the economics of food waste composting — primarily because the facility should plan to be open to receive loads year round. In areas with a lot of rainfall or prolonged periods of below freezing temperatures, facilities may want to consider investing in a fabric building structure to receive food waste and mix it with amendment, and perhaps store carbonaceous materials. Installing a structure is an additional capital expense.

Food Waste Disposal Bans

States with a mandate or regulation to divert source separated food waste from disposal help create demand for management alternatives, including composting. In the early years following enactment of the ban or mandate (i.e., once food waste generators and/or their haulers need to start complying), tipping fees may start out higher, especially for clean loads of food waste where the facility does not need to have additional labor and/or equipment to remove contaminants.



Over time, however, composting and anaerobic digestion facilities may have to reduce their fees in order to continue to attract these clean loads — especially as more facilities capable of receiving food waste open. In some states, this has led the hauler and/or composting or digester facility to start accepting loads with more contamination. In some cases, the facilities and/or their hauler(s) install depackaging/contaminant removal equipment that yields a food waste only feedstock (typically a slurry). Yard trimmings composting facilities considering taking in food waste should determine what other organics recycling operations are in their region (up to a 40-50-mile radius) and what their capacities are to receive food waste. Some states have locator maps to facilitate that research. Examples include Connecticut, Illinois, Ohio, and Vermont.

Facilities evaluating acceptance of food waste in states with legislative or regulatory bans on food waste disposal should become familiar with the states' intentions to enforce the ban. Generators, waste haulers, and disposal sites are all responsible for properly handling waste according to local, state, and federal regulations. Many generators are not aware that their states may have banned a number of materials from disposal. If a municipality offers an opportunity to compost, it can be a way to help educate the community about the waste bans and regulations.

Section VIII. Compost Markets

Several books have been written on marketing compost. Ron Alexander's *The Practical Guide to Compost Marketing and Sales*, and Rod Tyler's *Winning the Organics Game - The Compost Marketers Handbook* are both excellent references — and should be consulted before the first load of compost is manufactured. Section VIII reviews a few compost market fundamentals.

What's in Your Compost?

Step 1 in compost marketing: Know what is in the compost, e.g., its N-P-K (nitrogen-phosphorus-potassium) nutrient value, percent organic matter, soluble salt content, etc., as well as the types and amount of contaminants, such as plastic and glass. Step 2 is answering this question: Are these properties/contaminant levels suitable for the application or market segment being targeted, e.g., landscapers, plant nurseries, vegetable farmers? Answering that question requires having the proper technical understanding of the market segment in which the compost will be sold.

Laboratory tests establish a finished compost's biological and chemical characteristics, including nutrient and organic matter content. Here are two resources for how to take compost samples to send to a laboratory:

- Sampling Plans For Organics Recycling Facilities (*BioCycle*, Nov. 2016)
- Compost Sampling Videos and Reference Guide

Another parameter is the stability of the compost, which can be tested by the composting facility operator using a commercially available maturity test, as well as doing seed germination tests with sensitive plants, e.g., radish seeds. Instructions on how to conduct a germination test are available.

Several states have lowered their limits on the amount of physical contamination allowed in finished compost (see Section V. Food Waste Composting Regulatory Requirements (State, Local)). Physical Contaminant Testing Of Composts (*BioCycle,* Sept. 2016) describes a process to measure contamination.

Compost Market Categories

Traditional markets for compost include landscaping, topdressing of turf, and agricultural application. Increasingly, compost manufacturers sell compost blends developed for specific end uses, e.g., potting soil, vegetable gardens, sports turf, golf course greens, and even marijuana cultivation. These blends, depending on the market, have a much higher price point than compost by itself.

Another market that has been growing steadily is use of compost for storm water management and sediment and erosion control. For example, a compost-wood chip mix contained in a mesh sock is a replacement for plastic silt fence. Another is a seeded compost blanket that is applied to an eroded slope to reliably establish vegetation. Compost is also used in engineered soils manufactured for bioswales, green roof media, and other green infrastructure applications. Markets for compost used in these applications have continued to expand on an annual basis. More and more state departments of transportation are using compost blankets and filter socks, and are obtaining excellent results. This October 2004 *BioCycle* article explains how compost used in these applications greatly increases its value.

Compost also can be used to suppress plant diseases. A significant body of research exists on compost's disease suppressive qualities when used on turf, in containerized plant production, vineyard applications, and more. Search the *BioCycle* archives using "compost and plant disease suppression" to learn more about this field of research.

Compost Standards, Certifications and Registration

Seal of Testing Assurance

The US Composting Council (USCC) established its Seal of Testing Assurance (STA) Program primarily to improve customer confidence in compost selection and utilization, thus improving compost's image and marketability.

Other benefits of the program include:

- Serving as a quality control function for compost manufacturers
- Standardizing a set of test parameters (and methods) for use in evaluating compost product quality
- Acting as a framework to allow implementation of established numerical product standards/ specifications (e.g., state Departments of Transportation)
- Assisting in implementation of an inspection or quality verification program for compost specifiers.

Registering with State Fertilizer Regulator

Composters are also more frequently having their products appropriately registered for sale through state departments of agriculture as soil amendments and fertilizers in the states in which they are marketed. What can be said legally about "compost" on a product label and/or promotional materials is controlled on a state level in the U.S. The "Control Officials" in each state Department of Agriculture (DOA) are members of the American Association of Plant Food Control Officials (AAPFCO), who register and regulate the distribution of fertilizer, soil amendments, and liming agents (and sometimes pesticides and animal feed). AAPFCO's primary goals pertain to consumer protection, requiring "truth in labeling" and uniform regulation from state to state. It should be noted, however, that its model laws, regulations and Statements of Uniform Interpretation and Policy (SUIP) are created to provide guidance to states. They are not forced upon them. In 2017, AAPFCO updated its definition of compost, with input from the US Composting Council: "Compost is the product manufactured through the controlled aerobic, biological decomposition of biodegradable materials. The product has undergone mesophilic and thermophilic temperatures, which significantly reduce the viability of pathogens and weed seeds, and stabilize the carbon such that it is beneficial to plant growth. Compost [is] typically used as a soil amendment, but may also contribute plant nutrients."

The last line in the new definition, explains compost marketing consultant Ron Alexander, "basically allows composters to register their product as a soil amendment or fertilizer. … 'fertilizer' in labeling and registration just means that the product can legally make nutrient claims, depending on their labeling claims and overall desire" (*BioCycle*, Sept. 2017).

Certified Organic

More and more composters are listing their products through OMRI (the Organic Materials Review Institute), allowing for usage of their composts in certified organic farm production. Reasons for this, explains composting consultant Ron Alexander, (*BioCycle,* March 2019) include:

- Allows for (easier) sale to certified organic farmers
- Some wholesale customers desire or require a Listing (e.g. "Bay Friendly" trained landscapers in California)
- Mass merchants are requesting or requiring it on various lawn and garden products (e.g., compost, soil amendments and media, fertilizers)
- Use of OMRI Listing for product differentiation, to try to raise value, as well as to assist in product branding.

Section IX. Final Takeaways

The majority of municipal yard trimmings composting sites operate on a fairly low technology and minimal staffing basis. Conversely, municipal yard trimmings composting facilities in larger cities that operate on a year-round basis, and receive feedstocks daily, are usually staffed during regular business hours. Both scales of facilities are candidates for receiving source separated food waste. However, the smaller, seasonally operated sites may need to make staffing adjustments, as well as some site improvements.

This guidance has walked through the many factors that ultimately determine if a yard trimmings composting site is food waste-ready. While scale of current operations and types of composting technologies employed inform that determination, never lose sight of the reality that food waste is an organic waste stream that does not degrade gracefully. Operators must act immediately when the load arrives, have plenty of carbonaceous material to mix in, and be vigilant about odor, leachate and contaminant management. For many facilities, the best guidance is to start slow, learn best practices to manage food waste at your facility, and then gradually increase the quantity and types of food waste received.

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