

Food Waste Composting Regulations White Paper
California Integrated Waste Management Board
October 2009

California Integrated Waste Management Board staff was directed by Board Members to review Board regulations to ensure they are grounded in the best available science, address changing market conditions, and take advantage of developing technologies. Board staff developed priority regulatory areas for review as part of the Strategic Directives adopted in February 2007 and to support the [Organics Roadmap](#). One of the priority regulation areas Board staff selected to review is food waste composting regulations.

Compostable organic materials comprise approximately 25 percent, or about 10 million tons, of what is disposed in landfills annually.¹ According to the 2008 Waste Characterization Study, food waste represents 15.5 percent (approximately 6.1 million tons) of the material landfilled in California. Strategic Directive 6.1 calls for a 50 percent reduction in the amount of organics in the waste stream by 2020. An additional 15 million tons of organic material will need to be recycled annually to achieve this goal, requiring the siting of new and expansion of existing organic diversion facilities.

Many jurisdictions are interested in diverting food waste to comply with the 50 percent waste reduction mandate in the California Integrated Waste Management Act of 1989, but are having difficulty finding local facilities that are permitted to compost food waste. Currently, food waste composting requires a full Compostable Materials Handling Facility Permit (unless excluded under Section 17855 of the regulations), and many stakeholders indicate this requirement discourages food waste composting. Other stakeholders indicate food waste is a highly putrescible and odorous, attracts vectors, generates volatile organic compounds (VOCs), and should require a full Compostable Materials Handling Facility Permit. Below are several issues identified by stakeholders during recent informal interviews:

- Requiring a full Compostable Materials Handling Facility Permit to compost food material may be too stringent.
- The current definition of food material is very general.
- Food material contains a large amount of contaminants that are not found in green material which impacts facility operations and product quality.
- The potential negative environmental impacts of composting food material have not been fully researched.
- Current regulations may not comprehensively address compost safety issues.

This paper will examine the regulatory history of composting in California, compost/mulch infrastructure, compost product safety, compost quality, food waste composting in California, air and water quality impacts of composting, and food waste composting regulatory issues identified by stakeholders.

Regulatory History of Composting in California

Composting facilities did not require permits from the Board until the passage of Assembly Bill 3992 (Sher, Chapter 1355, Statutes of 1990). Board Members adopted Green Waste Compost Regulations on July 15, 1993, but the new regulations did not address other material types, such as animal waste, sewage sludge, and mixed solid waste. Each of these material types posed varying degrees of public health and safety and environmental concerns and different operational aspects which required some variation in regulations. During the process of developing minimum standards for composting facilities and examining the need to regulate new solid waste

¹ Dec. 11, 2007 Board Meeting, Agenda Item 15

handling activities, Board Members determined that permitting procedures should be adjusted to more efficiently regulate these new activities.

- In November 1994, Board Members [adopted regulations](#) to implement a tiered regulatory structure to provide a flexible regulatory structure for solid waste facilities and solid waste handling operations. The tiered structure was designed to provide a level of regulatory oversight commensurate with the impacts associated with a solid waste handling or disposal activity. The regulations established [five tiers](#). Figure 1 provides basic information with respect to permitting status and operational standards associated with each tier.²

Subject to minimum operating standards	FULL	Permit
	STANDARDIZED	
	REGISTRATION	
Not subject to min. standards	EA NOTIFICATION	Non-Permit
	EXCLUDED	

Figure 1

- In July 1995, the second version of [composting regulations](#) placed all composting operations into the five tiers: Exclusion, Notification of Enforcement Agency, Registration Permit, Standardized Permit, and Full Solid Waste Facilities Permit. The regulatory tier structure matched the regulatory oversight of a composting facility or operation to the facility's risk or danger to public health, safety, and the environment that needed to be addressed by the Board. The 1995 composting regulations also included additional feedstocks (Green Material, Clean Green Material, Animal Material, Sewage Sludge, and Mixed Solid Waste), removal of some prescriptive requirements, and the addition of some performance-based requirements. The regulations focused on windrow composting operations.
- In 1997, Board Members determined that chipping and grinding and storage resulted in threats to public health, safety, and the environment that needed to be addressed by the Board. Fires at organic materials chipping and grinding and storage activities were documented throughout the state. Board Members adopted emergency regulations for chipping and grinding, and storage of organic materials at their Feb. 26, 1997, meeting, and the emergency regulations were approved by the Office of Administrative Law and became effective on April 7, 1997. The regulations required owners or operators of chipping and grinding or storage activities with 1,000 cubic yards of organic material on site at any one time to meet minimum fire safety, nuisance control, and record-keeping requirements. In addition, clarification was given on which activities associated with vermicomposting were subject to Board regulations. In 1998, chipping, grinding, and additional requirements for vermicomposting regulations took effect. The regulations clarified the vermicomposting exclusion, established minimum standards for storage and chipping and grinding activities, and regulated stabilized compost which had not been sold, bagged for sale, or beneficially used. These regulations did not place storage and chipping and grinding activities into permitting tiers. However, staff was directed by Board Members to accomplish this at a later date.
- In January 2001, Board staff drafted compost regulations based on several “guiding principles,” such as protecting public health, safety, and the environment while increasing opportunities for the diversion and beneficial use of compostable organic materials. In April 2001, Board Members directed staff to

² A [matrix summary of tier elements](#) includes process timeframes, inspection frequency, enforcement tools, and more. The complete regulatory language is contained in the California Code of Regulations, Title 14, [sections 18100 through 18105.11](#).

solicit further stakeholder input, and Board staff initiated one 45-day public comment period and two 15-day public comment periods in 2002.³ Board Members adopted the Compostable Materials Handling Operations regulations at their [Nov. 19-20, 2002](#), meeting. The Office of Administrative Law approved the regulations on April 4, 2003, and they became effective immediately. Some of the [major regulatory changes](#) included:

- Simplifying the tiers to include only Enforcement Agency (EA) Notification and Compostable Materials Handling Facility Permit for composting activities;
 - Allowing volume increases for agricultural, green, and research composting operations within the EA Notification tier;
 - Allowing 500 cubic yards of material on-site at any one time for an excluded green material activity, with up to 10 percent food material;
 - Placing all facilities handling non-green feedstocks such as animal material, biosolids, food material, and municipal solid waste in the Compostable Materials Handling Facility permit tier;
 - Excluding within-vessel composting process activities with less than 50 cubic yard capacities and on-site noncommercial composting of up to one cubic yard of food material.
- In 2008, composting regulations were amended to allow onsite composting of mammalian tissue when associated with research to obtain data on pathogen reduction. Existing emergency waiver standards were also amended to authorize an Enforcement Agency to waive State minimum standards associated with a locally-approved temporary composting activity.

See Attachment 1 for a complete matrix summary of the tiered regulations for Compostable Materials Handling Operations and Facilities Requirements.

Compost/Mulch Infrastructure in California

Landfills are required to report Alternative Daily Cover use via the Board's Disposal Reporting System, but compost and mulch facilities and operations are not required to submit production data to the Board. In order to obtain a better understanding of California's organic materials management industry, the Board conducted surveys in 2001, 2003, and 2008 to obtain data on the number of producers, feedstock sources, products, and markets for compost and mulch. Participants were grouped into two major categories: composters (entities that actively compost organic material) and processors (entities that process material but do not intentionally or actively compost the materials they produce.) Results from the 2008 survey include:⁴

- 115 composters and 115 processors participated in the survey
- Approximately 9.3 million tons of organic materials were processed in California
- Major product categories
 - Compost (33 percent)
 - ADC (23 percent)
 - Boiler Fuel (22 percent)
 - Mulch (13 percent)

³ <http://www.calrecycle.ca.gov/Laws/Rulemaking/Archive/2003/CompMaterial/>

⁴ Third Assessment of California's Compost- and Mulch-Producing Infrastructure —Management Practices and Market Conditions, May 2009

Currently, there are approximately 310 active compost facilities/operations and processors in California: 122 Permitted facilities and 210 EA Notification.⁵ The Board is also funding the [Recycling and Waste Management Infrastructure project](#), which will provide a centralized source of information on California solid waste management and recycling infrastructure, including compost and mulch operations (scheduled to be completed in spring 2010).

Compost Product Safety Requirements in California

Composting operations in California are required to meet sampling, maximum metal concentrations, and pathogen reduction requirements to protect public health and safety.⁶ These requirements are based on U.S. Environmental Protection Agency regulations (Title 40 CFR 503) which were based on scientific research and technology. The 503 regulations were promulgated as part of the Clean Water Act to provide general requirements, pollutant limits, management practices and operational standards, for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works. A summary of California requirements for sampling, maximum metal concentrations, and pathogen reduction at composting operations are listed below:

Section 17868.1. Sampling Requirements.

Composting operations that sell or give away greater than 1,000 cubic yards of compost annually must verify that compost meets the maximum acceptable metal concentration limits. Verification of pathogen reduction requirements occurs at the point where compost is sold and removed from the site, bagged for sale, given away for beneficial use, and removed from the site or otherwise beneficially used. An operator who composts green material, food material, or mixed solid waste is required to take and analyze one composite sample for every 5,000 cubic yards of compost produced. The sampling schedule for operators composting biosolids is based on the amount of compost feedstock produced (see Attachment 2).

Section 17868.2. Maximum Metal Concentrations.

Compost cannot exceed the maximum acceptable metal concentrations for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc (see Attachment 3).

Section 17868.3. Pathogen Reduction.

Compost producers must follow specific procedures to demonstrate adequate pathogen reduction:

- Enclosed or within-vessel composting. Active compost shall be maintained at a temperature of 55 degrees Celsius (131 degrees Fahrenheit) or higher for a pathogen reduction period of three days.
- Windrow composting process. Active compost shall be maintained under aerobic conditions at a temperature of 55 degrees Celsius (131 degrees Fahrenheit) or higher for a pathogen reduction period of 15 days or longer. During the period when the compost is maintained at 55 degrees Celsius or higher, there shall be a minimum of five turnings of the windrow.
- Aerated static pile composting process. Active compost shall be covered with six to 12 inches of insulating material, and the active compost shall be maintained at a temperature of 55 degrees Celsius (131 degrees Fahrenheit) or higher for a pathogen reduction period of three days.
- Alternative methods of compliance may be approved by the EA if the EA determines that the alternative method will provide equivalent pathogen reduction.

⁵ Solid Waste Information System, April 16, 2009

⁶ Title 14, CCR, Section 17868.1, 17868.2, and 17868.3

- Finished compost must meet acceptable levels for fecal coliform (includes *E. coli*) and *Salmonella* (see Attachment 4)

Compost Quality

Several European countries have developed compost standards or guidelines, while there are no national compost standards in the United States.⁷ Compost standards and guidelines in Europe address heavy metal allowable levels, physical composition and contaminants, hygiene levels (pathogens), potentially toxic elements, and maturity and plant growth performance. In the United States, Title 40 CFR 503 regulations address heavy metals and pathogen reduction in biosolids, but there are no national standards on acceptable contaminant levels, compost maturity, and other product properties. Transportation departments in several states have adopted guidelines/rules for compost quality to comply with procurement programs, but the guidelines/rules vary in each state.

Certain compost characteristics can help determine the quality of the product, such as carbon-to-nitrogen ratio, contaminant levels, maturity and stability, moisture content, nutrient content, organic matter content, particle size distribution, pH, phytotoxicity, soluble salts (salinity) trace elements/micronutrients, and weeds and disease organisms. Appropriate ranges for specific characteristics depend on how the compost will be used. In the 1990s, results from laboratories tests of composts varied due to a lack of standardized testing procedures, which made comparisons difficult for end users. In response, the United States Composting Council developed a nationwide composting testing system. The nationwide testing system is comprised of three components: Seal of Testing Assurance Program (STA), Test Methods for the Evaluation of Composting and Compost (TMECC), and Compost Analysis Proficiency (CAP).⁸

Seal of Testing Assurance: The program was created in 2000 to help customers determine if the compost is suitable for their end uses and to help them compare various compost products using a testing program that is performed by a group of independent, certified labs across the country and in Canada. Composters who participate in the STA program collect and submit samples for analysis at STA-certified laboratories, and Test Methods for Evaluation of Compost and Composting tests are conducted on the submitted samples. Compost products are analyzed for the following properties: pH, soluble salts, nutrient content (total N, P₂O₅, K₂O, Ca, Mg), moisture content, organic matter content, bioassay (maturity), stability (respirometry), particle size (report only), pathogen (fecal coliform or *Salmonella*), and trace metals (Part 503 regulated metals). STA-certified compost helps ensure that reliable data has been used to describe the product. Compost facilities participating in the STA program can be found at <http://www.compostingcouncil.org/programs/sta/participants.php>.

Test Methods for Evaluation of Compost and Composting: Standardized methods for testing and evaluating compost quality are needed to verify product safety and market claims. TMECC provides detailed protocols for the composting industry to verify the physical, chemical, and biological condition of composting feedstocks. The protocols describe how composts should be collected and prepared and provides laboratory procedures for measuring compost physical properties (such as bulk density, moisture content, particle size distributions, and dry mass), inorganic chemical properties (such as pH, nitrogen, phosphorous, sodium, and chloride), organic and biological properties (such as organic matter content, maturity, and stability), and how to detect and measure synthetic organic compounds and pathogen indicators.

⁷ [Compost Quality Standards & Guidelines](#), William F. Brinton, Ph.D. Woods End Laboratory, December 2000

⁸ *Compost Use for Landscape and Environmental Enhancement* <http://www.calrecycle.ca.gov/Publications/Organics/44207002.pdf>

Compost Analysis Proficiency: All laboratories enrolled in the CAP program analyze compost samples on a routine basis and use a carefully-monitored laboratory certification process that includes receiving blind samples in triplicate from a certification program manager and sharing test results for precision. All STA program-approved laboratories must be enrolled in the CAP program.

Compost products can be certified by The Organic Materials Review Institute, a national nonprofit organization that determines which input products are allowed for use in organic production and processing. Institute-listed or Institute-approved products may be used on operations that are certified organic under the USDA National Organic Program. Typical examples of the types of Institute reviews are fertilizers for organic farming and feed supplements for organic animal production.

In 2005, the Board partnered with Caltrans, the University of California Riverside Extension, the Association of Compost Producers (ACP), the United States Compost Council (USCC), UC Cooperative Extension, Filtrexx, and Soil Control Laboratories to identify and address the barriers preventing Caltrans from maximizing its use of compost. The stakeholders developed a variety of compost specifications that resolved historic barriers to compost use including cost, availability, and quality control, and the Caltrans Compost-Use Specifications require compost producers to participate in the U.S. Composting Council's STA Program. Caltrans and the Board conducted workshops in 2006 and 2007 to educate Caltrans staff on the Caltrans Compost-Use Specifications and to discuss managing storm water, controlling erosion, and improving roadside vegetation through compost-based Best Management Practices. The Board is also coordinating a series of workshops in 2009 to encourage local governments to adopt the Caltrans Compost-Use Specifications and continues to offer compost quality information to stakeholders.

Food Waste Composting in California

Food waste composting requires a full Compostable Materials Handling Facility Permit in California unless excluded under Section 17855. Exclusions under Section 17855 include:

- A facility handling no more than 500 cubic yards of green material generated on-site with less than or equal to 10 percent food material and no more than 1,000 cubic yards of material per year is sold or given away.
- Non-commercial composting with less than one cubic yard of food material provided that all compostable material is generated and used on-site.
- Within-vessel composting process activities with less than 50 cubic yards of capacity.

A composter operating without a full Compostable Materials Handling Facility Permit and not excluded under Section 17855 may conduct a composting research operation to compost food waste. There are approximately 12 composting research operations in California.⁹ Operators conducting research composting operations must follow requirements in Section 17862, including: have no more than 5,000 cubic yards of material on-site at any one time; obtain EA approval for within-vessel processing volumes over 5,000 cubic yards; provide a description of the research to be performed, methodology/protocols, data to be gathered, analysis to be performed, timeframes; and complete the project within two years. Several facilities listed as research composting operations have discontinued or not completed or their research (See Attachment 5 for an example of a recent research compost operation that is composting food waste).

Approximately 15 compost facilities are permitted to process food waste in California. The Board does not collect data on materials actually diverted from landfills, so it is difficult to estimate the amount of food waste currently being diverted to the organics processing industry. Many stakeholders indicate that requiring a

⁹ Solid Waste Information System (SWIS)

Compostable Materials Handling Facility Permit to compost food waste has discouraged food waste composting in the state. Other stakeholders indicate food waste is highly putrescible and odorous, attracts vectors, generates VOCs, and should require a full Compostable Materials Handling Facility permit. Food waste composting raises concerns about air and water quality impacts, and the following sections examine air and water quality issues related to food and green waste composting.

Air Quality

Composting operations generate greenhouse gasses (such as methane and carbon dioxide) and [volatile organic compounds](#) (VOCs). Only small amounts of methane are generated during aerobic decomposition in a well-run composting operation.¹⁰ VOCs are a class of more than 1,000 chemicals with varying degrees of reactivity and toxicity. Scientists disagree on how many VOCs are actually released during composting. The types of VOCs being released are not fully understood, and because the reactivity of VOCs varies greatly, it is difficult to determine if VOCs from composting operations are reacting with other pollutants and making a significant contribution to regional air pollution. Several [compost VOC emission studies](#) have been conducted, and emission results vary widely. Preliminary research indicates food waste composting generates more emissions than green waste composting. In a Board-funded emission study at the Modesto Compost Facility, composting green waste generated from 0.8 to 0.9 pounds of VOC per ton of green waste, while green waste mixed with food waste generated from 1.3 to 2.6 pounds of VOCs per ton (see Attachment 6 for summaries of emission studies funded by the Board and San Joaquin Valley Air Pollution Control District).

The Air Resources Board (ARB) is implementing AB 32 (the California Global Warming Solutions Act of 2006), which requires a 25 percent reduction in greenhouse gas emissions by 2020. ARB views composting as an organics management alternative for methane avoidance at landfills. Carbon dioxide emissions from compost facilities are considered “biogenic” by U.S. EPA and are not part of the overall greenhouse gas emissions inventory. The ARB is examining potential N₂O emissions, a potent greenhouse gas, from compost piles versus the ability of compost applied on land to offset the N₂O emissions of chemical fertilizers. The Board and other stakeholders view green waste composting as an important method to avoid landfill methane emissions and sequester additional carbon in the soil. These greenhouse gas reduction benefits are not yet quantified and will not be available within the time frame set out by the local air district for rulemaking.¹¹

Local air pollution districts are required under the federal [Clean Air Act](#) to develop and implement plans for cleaning up any pollutant which exceeds federal standards. Local air districts cannot regulate “mobile sources” of air pollution (cars, trucks, locomotives, and other mobile sources) but can regulate “stationary sources,” such as power plants, refineries, manufacturing facilities, etc. VOCs emitted by compost facilities can exacerbate ground-level ozone, which is a federal Clean Air Act criteria pollutant. Many air districts are looking to reduce VOCs and particulates from compost facilities, increasing regulatory oversight of compost facilities, requiring Federal Title V permits, and potentially requiring facilities to undertake expensive environmental controls. The South Coast Air Quality Management District, San Joaquin Valley Unified Air Pollution Control District, Mojave Desert Air Quality Management District, and the Antelope Valley Air Quality Management District have [adopted regulations to reduce emissions](#) from organic materials diversion operations, and many of these air district rules are modeled after Rule 1133 developed by the South Coast Air Quality Management District (see Attachment 7).

Many stakeholders have indicated that local air district regulations are overly stringent, expensive, and would not provide industry with flexibility for implementing Best Management Practices. Increased costs to comply

¹⁰ [Compost Emissions Work Group](#)

¹¹ Dec.16, 2008, Board meeting, Agenda Item 8

with air district regulations could cause some compost facilities to cease operations and result in an increase of compostable organics being sent to landfills. For example, under the current proposed language by the San Joaquin District, green waste compost facilities processing 50,000 tons per year or more would be required to capture and destroy at least 80 percent of VOCs coming from the piles in order to continue to operate.

Compost operators are utilizing a variety of technologies to reduce odors and VOCs from composting facilities, especially operations that handle food waste. Some operators are covering compost piles with breathable fabrics (Picture 1), and many of these cover systems use positive and negative aeration to create aerobic conditions to reduce emissions. Positive aeration uses pumps to force air into the pile and may rely upon beneficial microbes living under the cover to destroy pollutants, such as VOCs. Negative aeration uses pumps to draw air through the bottom of the piles and route the pulled air through a biofilter, such as wood chips, to destroy VOCs and other emissions.¹² Other emission-reduction technologies include in-vessel composting (Picture 2) and uncovered aerated static piles (Picture 3).

Picture 1
(Breathable fabric covering windrow)



Picture 2
(Stainless steel & concrete in-vessel compost system)



Picture 3 (Uncovered aerated static pile)



¹² <http://www.ciwmb.ca.gov/Organics/Processors/Systems/>

Although these technologies appear to reduce air emissions, these systems are more expensive than traditional windrow composting. Smaller facilities may have the option of using the Best Management Practices operational controls to comply with air district regulations, such as carefully managing carbon-to-nitrogen ratios, moisture content, temperature, and covering windrows with finished compost to reduce odors and emissions.

Water Quality

Leachate and runoff from compost piles can contain organic matter, nitrates, pesticide residues, or other polluting components. The State Water Resources Control Board and Regional Water Quality Control Boards are concerned that leachate from food waste composting facilities may contain elevated levels of salts and nutrients and could infiltrate into groundwater and run off into surface waters. Food waste contains more liquids than green waste which may make it more difficult for operators to control leachate. In 1996, the state Water Board developed a statewide waiver for composting operations that was subsequently adopted by all regional Water Boards. In 1999, Senate Bill 390 required termination of all existing waivers of Waste Discharge Requirements (WDR) by Jan., 1, 2003, unless the regional Water Boards readopted the waiver by that date and readopted it at least every five years. Since SB 390 terminated all existing waivers, compost facilities can now be regulated by the regional Water Boards under Title 27, which would require compost facilities to meet requirements similar to landfills: double liners beneath the entire facility, groundwater monitoring wells, quarterly monitoring, and a financial bond. The state Water Board and the Board recognize the need to maintain a viable composting industry while providing a consistent approach to protecting water quality throughout the state and are collaborating on a rulemaking process to develop a statewide general order with conditional provisions that consider industry best management practices.

The state Water Board currently considers the application of compost as a “discharge of waste to land,” which may require a Report of Waste Discharge, while the Board considers compost a product and not a waste. The state Water Board is also considering whether to characterize leachate from compost feedstocks and/or storm water runoff from compost-amended soils as a “designated waste” due to the salts issue and other potential constituents. This designation could disallow the soil application of compost statewide. By contrast, the Santa Ana Regional Water Quality Control Board issued an emergency waiver so that Report of Waste Discharge is not required under certain circumstances to encourage the use of compost for erosion control on fire-ravaged land. Additionally, the Central Valley regional Water Board has established a Crop Safety Technical Advisory Group to evaluate the use of compost on crops intended for human consumption. Although originally convened to discuss the application of un-composted manure, the Advisory Group has transitioned to developing guidance, standards, and regulations for compost used on food crops, which could impact all composting facilities. Since compost containing food waste can have higher salt and nutrient levels than green waste compost, water quality agencies may regulate the production and application of compost made food waste more closely than green waste compost.

Food Waste Composting Regulatory Issues

Board staff interviewed composting and landfill operators, Local Enforcement Agencies, consultants, environmental groups, and other Board staff to identify the issues related to composting food waste. Staff also visited compost facilities, landfills, contacted representatives from other states, and performed a literature search to gather comprehensive information on food waste composting. Based on the information gathered from these sources, staff has identified the following issues.

1. Requiring a full Compostable Materials Handling Facility Permit to compost food material may be too stringent.
2. The current definition of food material is very general.

3. Food material contains a large amount of contaminants that are not found in green material which impacts facility operations and product quality.
4. The potential negative environmental impacts of composting food material have not been fully researched.
5. Current regulations may not comprehensively address compost safety issues.

The following section examines the above issues and proposes potential options to address these issues.

1. ***Requiring a full Compostable Materials Handling Facility Permit to compost food material may be too stringent.***

Food waste composting requires a full Compostable Materials Handling Facility Permit unless excluded under Section 17855:

- A facility handles no more than 500 cubic yards of green material generated on-site with less than or equal to 10 percent food material and no more than 1,000 cubic yards of material per year is sold or given away
- A Research Composting Operation that has no more than 5,000 cubic yards of feedstock, additives, amendments, chipped & ground material, and compost at any one time
- Non-commercial composting with less than one cubic yard of food material provided that all compostable material is generated and used on-site
- Within-vessel composting process activities with less than 50 cubic yards of capacity

A Green Material Composting Operation (EA Notification tier) cannot compost food waste because green material cannot include food material.¹³ Consequently, a Green Material Composting Operation must obtain a full Compostable Materials Handling Facility Permit to compost food material unless it is excluded under Section 17855. Several jurisdictions in California are interested in diverting food waste to comply with the 50 percent waste reduction mandate and would like to commingle food material with green material in their curbside green waste collection programs. Many stakeholders indicate a Compostable Materials Handling Facility Permit should not be required to compost small amounts of food waste. Stakeholders further indicate that a full permit is costly and time-consuming, and requiring a full Compostable Materials Handling Facility Permit discourages food waste composting. Other stakeholders indicate that food waste is highly putrescible, can cause odor/vector/pathogen problems, and should require a Compostable Materials Handling Facility Permit. Stakeholders also indicate that a compost operation in the EA Notification tier does not require an Environmental Impact Report, which prevents citizens from providing input on potential environmental issues (odors, traffic, etc).

States surveyed for this paper vary in how they regulate food waste composting. Iowa limits the amount of food waste that can be accepted from offsite facilities to two tons per week; accepting over two tons of food waste per week requires a permit by the state. Kansas has five types of composting permits: yard waste, livestock (dead animal), source-separated organics, municipal solid waste, and food waste; either pre- or post-consumer is handled as source-separated organic waste and must meet those permit requirements. Food waste is considered a solid waste in Minnesota, and current rules require an impermeable pad and storm water collection/treatment. Mississippi compost regulations are more stringent for food waste than yard waste, as the receiving and

¹³ Section 17852 (a) (21) "Green Material" means any plant material that is separated at the point of generation, contains no greater than 1.0 percent of physical contaminants by weight, and meets the requirements of section 17868.5. Green material includes, but is not limited to, yard trimmings, untreated wood wastes, natural fiber products, and construction and demolition wood waste. Green material does not include food material, biosolids, mixed solid waste, material processed from commingled collection, wood containing lead-based paint or wood preservative, mixed construction or mixed demolition debris.

composting areas must be covered with a roof and food waste must be processed within 72 hours or disposed. Ohio has four compost facility classifications based on feedstocks accepted, and food waste composting is classified as Class II with more stringent regulatory requirements than green waste only (Class IV) and green waste and manure (Class III). Oregon is proposing to evaluate the degree of environmental risk posed by each compost facility; low risk facilities will operate under a Registration Permit, while higher risk facilities will be required to provide an Operations Plan that addresses identified risks, such as a high water table, sensitive receptors, etc. (See Attachment 8 for other states' regulations).

The following draft table will be presented at the Strategic Directive 8.3 stakeholder workshops. Workshop participants will be provided an opportunity to discuss the potential impacts of adding food material to green material and how regulations may address these areas of concern. The litter impacts section was filled out by Board staff to provide an example of how the table could be utilized at the stakeholder workshops.

Impact	Green Material 12,500 cubic yards	Add Food Material* to Green Material	Examples of Permit Requirements for Food Material	Regulation Status
Odors	Section 17867 and Section 17863.4 (OIMP)			
Noise	Section 17867			
Vectors	Section 17867			
Litter	Section 17867	Increase	Grinding and screening operations shall not occur during high wind conditions & be conducted in a manner that will not create off-site impacts. Fugitive litter shall be collected and disposed of daily. Site shall operate in a manner as to not become a public nuisance. The EA reserves the right to suspend or modify waste receiving & handling operations when deemed necessary due to an emergency, a potential health hazard, or the creation of a public nuisance.	Current regulations may be sufficient
Air emissions	Section 17863.4 (OIMP) and local air district regulations			
Water quality	Section 17867 (2) (12) and regional water quality control board waste discharge requirements			
Compost safety	Section 17868.1. (sampling)			

	Section 17868.2. (Max. metals) Section 17868.3. (pathogen reduction)			
Physical Contaminants	Section 17867 (a) (13) and Section 17868.5. (a)			

*Post-consumer food material similar to the City of San Francisco’s food waste collection program.

Option 1: Continue to require a Compost Materials Handling Facility Permit for food waste composting and allow current exclusions under Section 17855

Option 2: Establish a statewide “green material-to-food material” ratio for Green Material Composting Operations

Option 3: Establish a statewide “green material-to-food material” ratio for Green Material Composting Operations and increase inspections from quarterly to monthly

Option 4: Place Green Material Composting Operations that compost food waste into the Registration Tier instead of EA Notification.

Option 5: Allow food waste to be composted at Green Material Composting Operations (EA Notification) and require specific handling procedures and Best Management Practices to reduce odors, vectors, etc.

Option 6: Place in-vessel food material composting in EA Notification or Registration Tier

2. *The current definition of food material is very general.*

Many stakeholders indicate that the current definition of food material¹⁴ is vague and does not clearly differentiate between pre-consumer, post-consumer material, and agricultural material.¹⁵ Pre-consumer organic material (over-ripe tomatoes at a salsa plant, cannery waste, unsold strawberries at a farmers’ market) and post-consumer organic material (from restaurants, grocery stores, schools, and households) are considered food material under current regulations. Post-consumer food material often contains more contaminants and pathogens than pre-consumer food material, and some stakeholders indicate that pre-consumer food material should not be regulated as stringently as post-consumer food material. Other stakeholders indicate there should not be a distinction between pre-consumer and post-consumer food materials because both materials are highly putrescible, odorous, and attract vectors. Other stakeholders indicate that the current definitions of food material and agricultural material are problematic because some organic materials derived from pre-consumer manufacturing processes are regulated differently. For example, coffee grounds at a coffee shop are considered a food material under current regulations but grape pomace at a winery is considered an agricultural material.

¹⁴ Food material is defined in Section 17852 (a) (20) as “any material that was acquired for animal or human consumption, is separated from the municipal solid waste stream, and that does not meet the definition of “agricultural material.” Food material may include material from food facilities as defined in Health and Safety Code section 113785 **change to 789**, grocery stores, institutional cafeterias (such as, prisons, schools and hospitals) or residential food scrap collection.

¹⁵ Agricultural Material is defined in Section 17852 (a) (5) as “material of plant or animal origin, which result from the production and processing of farm, ranch, agricultural, horticultural, aquacultural, silvicultural, floricultural, vermicultural, or viticultural products, including manures, orchard and vineyard prunings, and crop residues.

Many states surveyed for this paper do not define food waste or distinguish between pre-consumer and post-consumer food waste, while other states classify food waste types. In Washington, pre-consumer food waste and yard waste are defined as “Type 1” feedstocks while post-consumer food waste is a “Type 3” feedstock, and testing frequency of the final compost product increases as the Type number increases (Type 1 composters do not have to document pathogen reduction). Wisconsin regulations distinguish between vegetable food waste and other food residuals, and post-consumer food waste is assumed to include meat and dairy and would not qualify as “vegetable food waste.” Ohio classifies food waste into three feedstocks: source-separated raw, harvested vegetables, fruits, and grains, and the incidental paper packaging; source-separated vegetables, fruits, and grains processed for human or animal consumption; and source-separated dairy products and meats processed for human consumption. The Oregon Department of Environmental Quality is proposing compost facility rule changes and is redefining feedstock types based on physical contaminants and pathogen-carrying properties. Florida regulations do not distinguish between yard waste and pre-consumer vegetable waste, and both material types do not require time/temperature and pathogen reduction. Florida is also developing regulations that will define animal by-products, pre-consumer vegetable waste, and vegetable waste. Wisconsin distinguishes between vegetable food waste and other food residuals, and post-consumer food waste is assumed to contain meat and dairy which means the material would not qualify as vegetative food waste. (See Attachment 8).

Option 1: Change the definition of food material to distinguish between pre-consumer and post-consumer food material and allow Green Material Composting Operations to compost pre-consumer food material (EA Notification tier).

Option 2: Change the definition of food material to distinguish between pre-consumer and post-consumer food material and allow Green Material Composting Operations to compost pre-consumer food material (EA Notification tier) and require specific handling procedures and Best Management Practices to reduce odors, vectors, etc.

Option 3: Change the definition of food material to distinguish between vegetable food material and food material that contains dairy and meat products and allow Green Material Composting Operations to compost vegetable material (EA Notification tier).

Option 4: Revise the definition of agricultural material to include organic materials that are generated during pre-consumer manufacturing process, such as coffee grounds, cannery waste, etc.

Option 5: Retain the current definitions of food material and agricultural material.

3. *Food material contains a large amount of contaminants that are not found in green material which impacts facility operations and product quality.*

Food waste contains varying amounts of contaminants. Pre-consumer organic material (over-ripe tomatoes at a salsa plant, cannery waste, unsold strawberries at a farmers’ market) is relatively free of contaminants. Other types of pre-consumer food waste, such as fruit and vegetable scraps from restaurants and grocery stores, contain varying amounts of plastic shrink wrap, plastic and metal utensils, plastic bags, and other contaminants. Post-consumer food waste collected at restaurants, schools, hospitals, prisons, and other facilities often contain large amounts of plastic contaminants (such as lids, stirrers, film, straws, polystyrene foam, and non-compostable cutlery) as well as glass, metal, and paper (aseptic containers, coated paper, etc.). More plastic products labeled “degradable,” “biodegradable,” or “compostable” are entering the food waste stream, which raises questions regarding how to distinguish these products from other plastic contaminants and whether these plastic products decompose fully in composting facilities. Some compost facilities grind food waste with plastic

buckets/containers, shrink wrap, and other materials, incorporate the commingled material into the windrows, and screen out the contaminants on the back end (see below pictures).

Food material contaminants



Finished compost



Curbside green material collection programs that accept post-consumer food waste may also contain a large amount of contaminants. Green material cannot contain more than 1.0 percent physical contaminants by weight, which makes it difficult for Green Material Composting Operations and Chipping and Grinding Operations to accept contaminated food material and still meet the 1.0 percent contamination threshold. Compostable Material Handling Facilities have difficulty removing contaminants in food waste (especially plastic) on the “front end” and screen out the contaminants at the “back end,” which makes it more expensive for compost facilities to produce quality and visually appealing end products.

Contaminants in windrows (plastic bags, buckets, etc.)



Option 1: Define in regulations a maximum physical contamination level by weight for food material.

Option 2: Define in regulations a maximum physical contamination level by volume for food material.

Option 3: Define in regulations a maximum physical contamination level by volume or weight in the finished compost product.

Option 4: Do not define a maximum physical contamination level in food material.

4. *The potential negative environmental impacts of composting food material have not been fully researched.*

Many stakeholders indicate food waste composting generates more odors and VOCs than green waste composting. Many types of food waste (food processing wastes, fish wastes, meat, dairy) contain amino acids, proteins, urea, and other high-nitrogen organic compounds which can generate volatile nitrogen compounds (ammonia, amines, indoles) and possibly volatile sulfur (organic sulfides, mercaptans, hydrogen sulfide).¹⁶ Food waste tends to degrade faster than woody green waste, and rapidly degrading carbohydrates, fats, and oils can generate volatile fatty acids and produce odors.

Section 17863.4 does require all compostable material handling operations to prepare, implement, and maintain an Odor Impact Minimization Plans, but an odor plan may not be sufficient to comply with local air district emission standards. The Board's [emission study in Modesto](#) and the [San Joaquin Valley Air Pollution Control District emission study](#) indicate that food waste mixed with green waste generates more VOCs than green waste. It may be difficult and costly for compost facilities handling food waste to reduce air emissions to comply with recently enacted air district regulations than green waste compost facilities.

Food waste, especially meat & dairy products, may contain more pathogens and attract more vectors than green waste (see below picture).

Food material collected from sports event (hot dogs, popcorn, etc.)



¹⁶ Comprehensive Compost Odor Response Project

Mixed food waste, dairy, and meat products can contain a variety of pathogens, such as Salmonella, Shigella, E. coli, Campylobacter jejuni, Staphylococcus aureus, Hepatitis A virus, and Streptococcus.¹⁷ Pathogens in food waste are a concern in Washington state which classifies post-consumer food scraps as Type 3, meaning "...low level of risk in hazardous substances and physical contaminants, but are likely to have high levels of human pathogens." Food waste can also attract more vectors (flies, rodents, birds) than green waste, and outdoor windrow systems have the greatest potential for dissemination of pathogens through emissions and vectors.¹⁸

Food waste composting may potentially impact water quality more than green waste composting. Food waste containing meat and dairy products contains fats and oils and may have higher levels of salts and nutrients than green waste. Solid and liquid wastes from food processing industries (including canneries; meat, fruit, and vegetable packers; cheese manufacturers; and wineries) contain significant quantities of organic matter, nutrients, and salts.¹⁹ Food waste contains more liquids than green waste which may make it more difficult for operators to control leachate. The state Water Board and regional Water Boards are concerned that leachate from food waste composting facilities may contain elevated levels of salts and nutrients and could infiltrate into groundwater and run off into surface waters. These agencies could require compost facilities, especially food waste compost facilities, to meet requirements similar to landfills: double liners beneath the entire facility, groundwater monitoring wells, quarterly monitoring, and a financial bond.

Option 1: Board researches the potential negative environmental impacts of food waste composting.

Option 2: Board provides Best Management Practices training courses for food waste compost operators and facilities throughout California to reduce potential negative environmental impacts.

Option 3: Board partners with organizations (such as the U.S. Composting Council) to develop and implement a Compost Operator Training Program to educate operators on reducing the impacts of food waste composting on public health, safety and the environment.

5. Current regulations may not comprehensively address compost safety issues.

Composting operations in California are required to meet sampling, maximum metal concentrations, and pathogen reduction requirements to protect public health and safety (Title 14, CCR, Section 17868.1, 17868.2, and 17868.3). The maximum metal concentrations and pathogen reduction requirements are based on U.S. Environmental Protection Agency regulations (Title 40 CFR 503) regarding biosolids. Land application rates for compost are usually higher than biosolids, so metal levels in compost may be higher than biosolids if compost is applied at a higher rate. Although metal concentrations in compost are generally lower than in biosolids, land application rates for compost are usually higher than biosolids, so metal loading from compost may be higher than biosolids if compost is applied at a higher rate. Beneficial use of compostable materials, which includes land application in accordance with California Department of Food and Agriculture requirements, is exempt from the Board's compost regulations. CDFA's involvement has been limited to verification of product information on bagged compost labels. Board staff is also examining compostable material land application regulatory issues, and results of this regulatory review will be presented to Board Members in late 2009.

¹⁷ Research Concerning Human Pathogens and Environmental Issues Related to Composting of Non-Green Feedstocks. Oregon Department of Environmental Quality, page 23, August 2001

¹⁸ Research Concerning Human Pathogens and Environmental Issues Related to Composting of Non-Green Feedstocks. Oregon Department of Environmental Quality, page 25, August 2001

¹⁹ Update Regarding the Regulation of Food Processing Waste Discharges to Land, March 16-17, 2006 meeting, Central Valley Regional Water Quality Control Board

Maximum metal concentration limits are lower in many European countries than in the United States, especially in regards to cadmium, chromium, copper, mercury, and nickel.²⁰ The U.S. standards are scientifically based on a 14 pathway risk assessment, while the European standards are based on the European Union Directive of 1986 and the precautionary principle.²¹

Heavy metals limit compared: EC states versus U.S. - mg/kg

Metal	Symbol	EU- Range	U.S. biosolids
Cadmium	Cd	0.7 - 10	39
Chromium	Cr	70 - 200	1,200
Copper	Cu	70 - 600	1,500
Mercury	Hg	0.7 - 10	17
Nickel	Ni	20 - 200	420
Lead	Pb	70 - 1,000	300
Zinc	Zn	210 - 4,000	2,800

Current regulations do not address other properties that affect the quality of finished compost, such as soluble salts, maturity, moisture content, pH organic matter content, and physical contaminants. Board staff have observed a variety of contaminants in food and green waste, and some end-users (such as Caltrans) indicated they were concerned about visible contaminants and overall compost quality. In response, the Board partnered with various stakeholders in 2005 to develop Caltrans compost specifications to improve compost quality for erosion control and roadside vegetation projects. The [Caltrans Compost-Use Specifications](#) require compost producers to participate in the U.S. Composting Council’s Seal of Testing Assurance Program (STA).

Composters who participate in the STA program collect and submit samples for analysis at STA- certified laboratories, and TMECC tests are conducted on the submitted samples. Compost products are analyzed for the following properties: pH, soluble salts, nutrient content (total N, P₂O₅, K₂O, Ca, Mg), moisture content, organic matter content, bioassay (maturity), stability (respirometry), particle size, pathogen (fecal coliform or Salmonella), and trace metals (see Attachment 9). STA-certified compost does not guarantee compost quality, but it does provide data to customers to determine if the compost is suitable for their end uses.

The state Water Board and some regional Water Boards are concerned about compost quality. Technical Advisory Groups have been formed to evaluate the use of dairy manure on crops intended for human consumption without processing; to develop guidance, standards, and regulations for compost used on food crops; and to evaluate the regulation of facilities that produce compost and the use of compost for various purposes. Compost safety and quality will be carefully scrutinized by these advisory groups.

Option 1: Lower maximum metal concentrations in 17868.2 to more closely match European standards.

Option 2: Require finished compost to meet quality standards, such as the Seal of Testing Assurance Program.

Option 3: Board partners with the state Water Board’s Workgroup for Compost Use on Crops for Human Consumption and other Technical Advisory Groups to review standards and guidelines for compost safety and quality in California.

²⁰ [Compost Quality Standards & Guidelines](#), William F. Brinton, Ph.D. Woods End Laboratory, December 2000

²¹ Greg Kester (California Association of Sanitation Agencies) during the Strategic Directive 8.3 stakeholder workshop on July 28, 2009 at Cal EPA in Sacramento.

Option 4: Board provides Best Management Practices training courses for compost operators and facilities throughout California to improve compost safety and quality.

Option 5: Board partners with organizations (such as the U.S. Composting Council) to develop and implement a Compost Operator Training Program to educate operators on improving compost safety and quality.

Option 6: Leave current compost safety regulations as is.

Attachment 1

Compostable Materials Tiered Regulatory Placement

Excluded	EA Notification	Registration	Standardized	Full
Compostable materials: Agricultural material derived from an agricultural site and returned to the same site or agricultural site owned or leased by the owner, parent, or subsidiary (≤ 1,000 yd ³ given away or sold annually)	Agricultural Material Composting Operations (all)			Composting Facilities (all) (Any material other than green material)
Compostable materials: Vermicomposting (Note: The handling of compostable materials used as growth medium is not excluded)	Green Material Composting Operations (≤ 12,500 yd ³)			Green Material Composting Operations (> 12,500 yd ³)
Compostable materials: Mushroom farming (Note: The handling of compostable materials used as growth medium is not excluded)	Biosolids Composting Operations at POTWs (all)			
Compostable materials: Green material generated on-site (≤ 500 yd ³ , ≤ 10% food material) (≤ 1,000 yd ³ given away or sold annually)	Research Composting Operations (≤ 5,000 yd ³) (Within-vessel > 5,000 yd ³ with EA determination)			
Compostable materials: (A) An activity, located at a facility with a tiered or full permit and a Report of Facility Information that identifies and describes the activity, which will use the material on-site, or (B) Temporary storage of biosolids at a Publicly Operated Treatment Works, or (C) An activity located at the site of biomass conversion and used for biomass conversion, or (D) Silvicultural operation or wood, paper, or wood product manufacturing operation, or (E) Temporary storage or processing of agricultural material not used in the production of compost or mulch, or (F) Chipping and grinding of materials applied to land owned or leased by the owner, parent, or subsidiary, or (G) Chipping and grinding of agricultural material produced on lands owned or leased by the owner, parent, or subsidiary for use in biomass conversion, or	Chipping and Grinding Operations (≤ 200 tpd)	Chipping and Grinding Operations (200 tpd < x ≤ 500 tpd)		Chipping and Grinding Operations (> 500 tpd)

(H) Animal food manufacturing or rendering, or (I) Storage of yard trimmings at a publicly designated site for the collection of lot clearing necessary for fire protection, or (J) Materials handled in such a way as to preclude the materials from reaching 122 degrees Fahrenheit				
Compostable materials: Noncommercial composting provided all compostable material is generated and used on-site (< 1 yd3 food material)				
Compostable materials: Storage of bagged products (< 5 yd3)				
Compostable materials: Within-vessel composting (< 50 yd3)				
Compostable materials: Beneficial use				

A matrix summary of facilities and operations for which Board Members adopted tiered regulations is available in both [html](#) and [downloadable](#) (MS Word, 23 KB) versions.

Attachment 2

Frequencies of Compost Sampling for Biosolids Composting Facilities

Amount of Biosolids Compost Feedstock (metric tons per 365 day period)	Frequency
Greater than zero but annually fewer than 290	annually
Equal to or greater than 290 but fewer than 1,500	quarterly
Equal to or greater than 1,500 but fewer than 15,000	bimonthly
Equal to or greater than 15,000	monthly

A composite sample shall be representative and random, and may be obtained by taking 12 mixed samples as described below.

- The 12 samples shall be of equal volume.
- The 12 samples shall be extracted from within the compost pile as follows:
- Four samples from one-half the width of the pile, each at a different cross-section;
- Four samples from one-fourth the width of the pile, each at a different cross-section; and,
- Four samples from one-eighth the width of the pile, each at a different cross-section.
- The EA may approve alternative methods of sampling for a green material composting operation or facility that ensures the maximum metal concentration requirements of section 17868.2 and the pathogen reduction requirements of section 17868.3 are met.

Attachment 3

Maximum Acceptable Metal Concentrations

Constituent	Concentration (mg/kg) dry weight basis
Arsenic (As)	41
Cadmium (Cd)	39
Chromium (Cr)	1200
Copper (Cu)	1500
Lead (Pb)	300
Mercury (Hg)	17
Nickel (Ni)	420
Selenium (Se)	36
Zinc (Zn)	2800

Attachment 4

Acceptable Levels of Pathogens in Finished Compost

Pathogen	Acceptable Level
Fecal coliform (includes <i>E. coli</i>)	Less than 1,000 Most Probable Number per gram of total solids (dry weight basis)
<i>Salmonella</i>	Less than 3 Most Probable Number per four grams of total solids (dry weight basis)

Source: Title 14, California Code of Regulations, Section 17868.3

Attachment 5

Examples of Research Composting Operations

Santa Cruz County. The County of Santa Cruz Department of Public Works collects food material, waxed cardboard, and food-soiled products from over 50 restaurants, schools, institutions, residential group homes, and markets. The food material is collected three times per week, and participants are charged one half the normal refuse disposal rate to provide an economic incentive to participate. The material is transported to the green waste composting area of the Buena Vista landfill, and the food material is immediately placed on a prearranged bed of green waste and covered with up to 12 inches of green waste to control odors, draining liquids, and vectors. The commingled food and green material is eventually placed in plastic compost bags in an aerated static pile system for 12-14 weeks, and the material is cured for two months.

The immediate mixing of green and food material appears to reduce odors/vectors and control draining liquids. The facility received two odor complaints in two years; the complaints were in response to green waste processing adjacent to the research composting operation as crews dug into the decomposing green waste during an inversion layer. One of the biggest issues is dealing with plastic contaminants (such as lids, stirrers, film, straws, polystyrene foam, and non-compostable cutlery) as well as glass, metal, and paper (aseptic containers, coated paper, etc.). A county ordinance requiring food service businesses to use food packaging that is either reusable, recyclable, or compostable became effective in September 2008. The County of Santa Cruz Department of Public Works has asked for a one-year extension on the research compost operation to gauge the effect of the ordinance on plastic contaminants in collected food material.

Santa Barbara County. The Engel & Gray, Inc. Regional Compost Facility began accepting source-separated food waste from restaurants and other facilities in the City of Santa Barbara in mid-2007. The objective of Engel & Gray's research compost operation was to demonstrate the facility's ability to handle food waste feedstock as it handles all other feedstocks. Initial loads of food waste were dumped onto a concrete pad to identify feedstock characteristics. Most of the food waste arrived in 33 gallon compostable bags with minor amounts in non-compostable bags. The feedstock contained large amounts of compostable plastic tableware, bags, plates, and cups along with metal cans, large plastic jugs, and glass containers. As the city added more facilities to the program, the volume of this type of material decreased as a percentage of loads.

After three months of becoming familiar with the food waste feedstock, the facility switched to laying out yard trimmings, adding food waste directly into the windrow, mixing in biosolids, and closing the windrow. Vectors and odors were controlled by incorporating the food waste on the same day of delivery and covering the food waste with existing feedstocks in the windrow. Minor odors were observed as the truck unloaded the material but were not noticeable after the food waste was incorporated into the windrow. Load checks were performed and contaminants were removed at the point of unloading the food waste.

Almost 470 tons of food waste was composted during the research project. Load checks, pathogen reduction, and vector/odor control were all achieved with no significant operational changes. Compostable plates and utensils composted well in the first 12 months but appeared in the "overs" during the last 12 months. Lab analysis (at Seal of Testing Assurance-approved laboratories) showed no significant change in the finished compost between normal recipes and windrows that contained food waste. Engel & Gray, Inc. concluded that there was no discernable difference in composting food waste when handled like other putrescible waste, such as biosolids and agricultural byproducts.

Attachment 6

Summary of Emission Studies funded by the Board and San Joaquin Valley Air Pollution Control District

Emissions Testing of Volatile Organic Compounds from Greenwaste Composting at the Modesto Compost Facility in the San Joaquin Valley

In 2006, the Board funded a study of composting VOC emissions, collecting and analyzing 100 emissions samples from four compost windrows at the city of Modesto's composting facility. The test windrows included: a green waste windrow, a green waste windrow that contained 15 percent by weight food waste, a green waste windrow capped with a finished compost blanket, and a green waste windrow with two chemical additives. The study calculated a life-cycle VOC emissions factor for green waste and food waste windrows, and also tested the emissions-reducing potential of two best management practices. Emissions were measured using the U.S. EPA Surface Isolation Flux Chamber Assembly as illustrated below.

U.S. EPA Surface Isolation Flux Chamber Assembly



Composting green waste generated from 0.8 to 0.9 pounds of VOC per ton of green waste while green waste mixed with food waste generated from 1.3 to 2.6 pounds of VOCs per ton. When compared with the green waste windrow (control), the application of the finished compost blanket resulted in an 84 percent reduction in VOC emissions for the first seven days, and a 75 percent reduction for the first 14 days of composting. The application of additives resulted in a 42 percent reduction in VOC emissions during the first week prior to the first turning. The effectiveness of the additives was diminished following the turning event, with VOC emissions reduced by only 14 percent by the end of the second week, indicating the need for additive application following turning events (see Tables 1 and 2).

Table 1 Life Cycle* VOC Emissions Factors (lb VOC per ton – wet basis, 57 days)

Windrow	Emission Factor
Food waste	1.3 - 2.6
Greenwaste	0.8 - 0.9

* VOC reported as non-methane non-ethane organic compounds (NMNEOC). Emission Factor range is dependent on methodology used for venting versus non-venting data

Table 2 Initial 2-Week VOC Emissions Factors (lb VOC per ton – wet basis)

Windrow	Emission Factor
Food waste	0.9 - 1.8
Greenwaste	0.6 - 0.7
Additive (two chemical additives)	0.5 - 0.6
Biofilter (finished compost blanket)	0.1 - 0.4

[Organic Material Composting and Drying focusing on Greenwaste Compost Air Emissions Data Review](#)

The San Joaquin Valley Air Pollution Control District funded a study that compiled compost emission factor data for greenwaste, biosolids-greenwaste co-composting, and food waste. This report focused on total VOC emissions as measured by South Coast Air Quality Management District Method 25.3. The data from greenwaste composting sites is summarized below in Table ES 1. The data are averaged for reference and Board values from the Modesto emissions report were recalculated to be more comparative to the other data. The emission factor was calculated by taking the total process emissions and dividing that by the mass of material that was in the compost process.

Table ES 1 Summary of greenwaste composting full site VOC emission data (#/ton of feedstock).

Source	Site X	Board	NorCal	Average
Stockpile	7.76		2.95	5.36
Windrow	6.30	1.54	5.65	4.50
Total	14.06		8.60	9.86

The most relevant food waste composting data was from only one site and provided emissions for various covered compost technologies. The food waste compost technologies were Ag-Bag®, Compostex®, and micropore covers. Food waste windrow emission factors ranged from 1.7 to 36.7 pounds VOC per ton of throughput. Food waste stockpile emission factors ranged from 0.42 to 1.8 pounds VOC per ton of throughput. The most significant sources of variability in emission factors is likely mostly due to windrow size, feedstock characteristics, waste pile and windrow temperature, and operating characteristics.

Attachment 7

Air District Emission Rules

[South Coast Air Quality Management District Rules 1133, 1133.1, 1133.2](#). Adopted on Jan. 10, 2003, the rules are designed to regulate and reduce emissions from composting and related operations and covers chipping and grinding operations, as well as biosolids co-composting operations. 1133 establishes a registration and annual reporting program for composting-related facilities to better characterize the emissions and operations of this industry and keep track of activity levels. 1133.1 establishes holding and processing time requirements for chipping and grinding activities in order to prevent inadvertent decomposition of green waste and food waste. 1133.2 reduces VOC and ammonia emissions from co-composting operations. Composters who process exclusively greenwaste are currently exempt from Rule 1133; however, the South Coast AQMD indicates it may start work a new section of the rule to cover green waste composting.

Rule 1133.1 impacts how operators handle food waste and green waste feedstocks. Stockpiling food waste and green waste for extended periods will cause the organic materials to decompose anaerobically and generate VOC and ammonia emissions (as well as odors) based on source tests conducted by South Coast AQMD and Board. Food waste is required to be removed or used on-site for composting within two days of receipt. Curbside greenwaste and curbside greenwaste that is used for on-site applications are required to be chipped and ground or removed from the facility within 3 days of receipt. Non-curbside greenwaste, which is mainly composed of tree trimming and landscaping greenwaste, is required to be chipped and ground or removed from the facility within 14 days of receipt. Mixed greenwaste, that contains both curbside and non-curbside greenwaste, is required to be chipped and ground or removed from the facility within seven days of receipt. The requirements for curbside greenwaste are different from non-curbside greenwaste since non-curbside greenwaste tends to decompose at slower rate compared with curbside greenwaste due to the lower moisture content of non-curbside greenwaste.

San Joaquin Valley Unified Air Pollution Control District APCD [Rule 4565](#). Adopted on March 15, 2007, this rule covers “all facilities whose throughput consists entirely or in part of biosolids, animal manure, or poultry litter and the operator who landfills, land applies, composts, or co-composts these materials.”

San Joaquin Valley Unified Air Pollution Control District APCD [Rule 4566](#). In April 2008, the San Joaquin Valley UAPCD introduced its draft version of Rule 4566, covering greenwaste operations, including composters, as well as chip-and-grind and land application operations. On Dec. 18, 2008, the district’s governing board voted unanimously to delay adoption of the rule for 18 months, until the third quarter of 2010. The district is planning to conduct scientific research to determine whether compost pile air emissions might be correlated with compost pile temperature, moisture content, pH or porosity. The district’s goal is to obtain preliminary data by fall 2009 and develop a final report early in 2010. The Rule is still slated to take effect in 2012.

Mojave Desert Air Quality Management District [Rule 1133](#). The Mojave Desert Air Quality Management District (Mojave Desert AQMD) released a draft rule for composting and related operations in June 2008. The District began hearings on the proposed rule in August 2008, and adopted the rule on Oct. 27, 2008. All organics materials handlers were required to register with the District by Dec. 26, 2008. Mojave Desert AQMD Rule 1133 includes a set of raw materials holding-time limitations identical to South Coast AQMD Rule 1133.1, and a series of Best Management Practices for bio-solids co-composters very similar to those found in San Joaquin Valley UAPCD Rule 4565.

The Antelope Valley Air Quality Management District has introduced draft Rule 1133 intended to reduce VOC emissions from chip-and-grind and compost operations. The proposed rule is identical to Mojave Desert AQMD Rule 1133. Both rules impose raw material holding time limitations and require biosolids co-compost operators to perform a Best Management Practices regime which includes testing for carbon-to-nitrogen ratios and closely monitoring moisture and pH. Both bills exempt greenwaste-only composters from those practices.

Attachment 8

Other States Composting Regulations

<p>Connecticut</p>	<p>Leaf composting facilities have a free registration process and must meet minimum siting and operating criteria Large Scale Leaf and Grass Composting page. Grass clipping composting is handled through a general permit and only allowed at registered leaf sites that meet additional siting and operational criteria. GP permit fee is \$500, or \$250 for municipalities. Grinding of clean wood is handled either through a GP or a volume reduction plant (VRP) permit, depending mostly on the size of the operation. The GP is \$500/\$250; the VRP permit is several thousand dollars. Manure is handled through a Comprehensive Nutrient Management Plan (CNMP) if on-farm. Off-farm it depends on a bunch of stuff, but we can usually find a way to permit small (<5,000 cy/yr) through a water permit as opposed to solid waste. Food waste is handled in different ways. On-site (meaning everything from home composting to institutional composting) is not permitted by DEP as long as it is generated and composted on the same site. Composting is considered a volume reduction activity, and so composting facilities taking off-site food scraps are permitted as VRPs. Anaerobic digestion would be considered a VRP.</p> <p>All of these types of facilities (except home composting) may require some kind of storm water or groundwater discharge permit. Case-by-case. See the NERC website for a summary of all northeast states composting regulations (updated in 2005, may have changed by now). We have no specific statutory or regulatory definition of food waste. When needed, we create a definition(s) for a permit which is specific to what the facility is/allowed to take.</p>
<p>Delaware http://regulations.delaware.gov/AdminCode/title7/1000/1300/1301.shtml#TopOfPage</p>	<p>Composting regulations based on EPA CFR Part 503 pollutant, pathogen, and vector reduction requirements. No definition of food waste.</p>
<p>Georgia</p>	<p>Exemptions: agricultural and home/garden composting. Yard waste composting is exempt from solid waste management rules. No definition of food waste. Georgia is currently working with stakeholders to revise composting regulations</p>
<p>Idaho http://deq.idaho.gov/waste-mgmt-remediation/solid-waste.aspx</p>	<p>Idaho’s solid waste rules regulate solid waste facilities including composting operations through Tier classifications based on the types of waste managed and volume of waste at the facility. Our rules provide general site, design, operating, closure/P-C requirements within each tier level and additional facility-specific requirements for landfills, transfer station or processing (composting) facilities. Facilities managing food waste with meats or animal fats would not be eligible for our less-regulated tier classifications regardless of the volume of waste managed.</p> <p>Idaho does not define “food waste” and does not distinguish between pre-consumer/post-consumer food waste</p>
<p>Indiana</p>	<p>We don’t have separate regulations for food waste composting. We do have a registration program for natural vegetation matter only such as: wood, leaves, grass clippings. If the facility proposes to compost other waste that facility will need to apply for processing facility permit under solid waste rule. We are currently working with Land Application program to amend their rules and</p>

	<p>allow composting of such waste under their rule.</p> <p>We do not have a “Food Waste” definition developed as of yet.</p>
<p>Iowa</p> <p>http://www.iowadnr.gov/InsideDNR/RegulatoryLand/SolidWaste.aspx</p>	<p>For food waste composting sites, there is a limit of two tons/week of food waste (this limit does not include bulking agent) that can be accepted from offsite facilities without a permit from the State of Iowa; however – it is regulated on a permit by rule basis and the operating requirements are spelled out in Iowa Administrative Code 567 Chapter 105.3 and 105.5. To accept food waste in a volume more than two tons per week from offsite premises, a permit is required by the State. Food waste generated onsite of the property where it is being composted is not regulated by the State.</p> <p>There is no set definition in Iowa Administrative Code (IAC); however, the section of code that regulates food waste composting sites is referenced in the definition of “small composting facilities” – means facilities meeting the requirements set forth in rule 105.5(455B, 455D). This definition is located under IAC 567 Chapter 105.1(1).</p>
<p>Kansas</p> <p>All of our solid waste statutes and regulations are available at http://www.kdheks.gov/waste/regsstatutes/sw_laws.pdf. The specific regulation for food waste composting is on page 62 of the book.</p>	<p>Five types of composting facility permits; yard waste, livestock manure, livestock (dead animal), source-separated organic waste, and municipal solid waste. Food waste, either pre- or post-consumer, is handled as a source-separated organic waste and must meet those requirements.</p> <p>We do not differentiate the type of food waste because this is a higher level permit that requires engineered drawings, operating plans, contingency plans, and closure plans. The facility pad is required to be built to an equivalent of four inches of concrete (one foot clay compacted to 10-7) and provide good run on and runoff controls.</p> <p>Food waste is defined in K.A.R. 28-29-3 (hhh) “Source-separated organic waste” means organic material that has been separated from noncompostable material at the point of generation and shall include the following wastes: Vegetative food waste, soiled or unrecyclable paper; sewage sludge; other wastes with similar properties, as determined by the department; and yard waste in combination with these materials</p>
<p>Maine</p> <p>http://www.maine.gov/dep/waste/solidwaste/</p>	<p>All composting facilities are regulated under the <i>Maine Solid Waste Management Rules: Composting Facilities</i>, 06-096 CMR 410 unless the composting facility is exempt from licensing. Our composting rules exempt certain agricultural composting operations and also contain exemptions for the composting of small amounts of leaf and yard waste, food waste, and fish waste.</p> <p>No specific definition of “food waste” but different types of wastes/residuals are defined. Type IA residuals have a Carbon:Nitrogen (C:N) ratio greater than or equal to 25:1 – leaf and yard waste falls into this category. Type IB residuals have a C:N ratio of greater than 15:1 but less than 25:1 – most produce and vegetable waste falls into this category. Type IC residuals have a C:N of less than 15:1 – fish waste falls into this category. No distinction is made between pre-consumer and post-consumer food waste.</p>

	<p>On Feb. 18, 2009, Maine adopted a new composting rule (<i>Maine Solid Waste Management Rules: Composting Facilities</i>, 06-096 CMR 410).</p>
<p>Maryland</p>	<p>Does not regulate food waste composting differently than other types. No definition of food waste</p> <p>The composting regs are under the Maryland Department of Agriculture/Office of the State Chemist. COMAR 15.18.04 Compost - see link to the various regulations under this chapter at http://www.dsd.state.md.us/comar/subtitle_chapters/15_Chapters.htm</p>
<p>Minnesota</p> <p>https://www.revisor.leg.state.mn.us/rules/?id=7035.2836</p>	<p>Minnesota regulates yard waste differently than food waste. Food waste is considered solid waste and falls under the solid waste rule (see below). The current rule requires an impermeable pad, storm water collection/treatment which the facility operators say are onerous and create unneeded expenses. They cannot compete with land disposal.</p> <p>The exception to that is Minnesota has a Demonstration Rule that allows for demonstration project. The most recent composting demos involved co-composting yard/food/non-recyclable paper. The Agency has been collecting stormwater runoff data from these facilities and the early results strongly suggest that the runoff from these facilities is drinkable and may allow the removal of the requirement for a pad/pond. However, the sample size is small and would not likely meet the sniff test for being scientifically valid, so the Agency is continuing to collect this data to build a better database of this type of info.</p> <p>Statute 115A.03,</p> <p>We do not define food waste, but rather source separated compostable materials which includes food waste. The definitions are listed below.</p> <p>Subd. 32a.Source-separated compostable materials. “Source-separated compostable materials” means materials that:</p> <ol style="list-style-type: none"> (1) are separated at the source by waste generators for the purpose of preparing them for use as compost; (2) are collected separately from mixed municipal solid waste, and are governed by the licensing provisions of section 115A.93; (3) are comprised of food wastes, fish and animal waste, plant materials, diapers, sanitary products, and paper that is not recyclable because the commissioner has determined that no other person is willing to accept the paper for recycling; (4) are delivered to a facility to undergo controlled microbial degradation to yield a humus-like product meeting the agency’s class I or class II, or equivalent, compost standards and where process residues do not exceed 15 percent by weight of the total material delivered to the facility; and (5) may be delivered to a transfer station, mixed municipal solid waste processing facility, or recycling facility only for the purposes of composting or transfer to a composting facility, unless the commissioner determines that no other person is willing to accept the materials.

	<p>Minnesota calls green waste/yard debris “yard waste”:</p> <p>Subd. 38. Yard waste. “Yard waste” means garden wastes, leaves, lawn cuttings, weeds, shrub and tree waste, and prunings.</p>
Mississippi	<p>Mississippi considers food waste as putrescible waste and the requirements for composting food waste are more stringent than that for composting yard wastes. Listed below are a few of those differences:</p> <ul style="list-style-type: none"> * the receiving area and the composting area for putrescible waste must be covered with a roof; * putrescible waste received for composting must be processed within 72 hours; otherwise, it must be removed and disposed at an appropriate facility; * residuals and recyclables must be stored in a manner to prevent vector attraction; * record-keeping requirements for composting of putrescible waste are more stringent than that for composting yard waste composting <p>The Mississippi Nonhazardous Solid Waste Management Regulations do not either define “food waste” or distinguish between pre-consumer and post-consumer food waste. http://www.deq.state.ms.us/MDEQ.nsf/page/SW_General_Solid_Waste_Guidance?OpenDocument</p> <p>We have recently begun the process of updating the existing solid waste management regulations and will possibly be making some changes to the current requirements for composting putrescible wastes to help promote food waste composting in the state.</p>
Missouri	<p>Operators must obtain a written exemption for anything other than yard waste, paper waste, wood waste, and poultry waste. Any site that accepts anything other than these wastes, such as food waste or drywall from off-site sources, must obtain the written exemption. Municipal solid waste composting requires a full solid waste processing facility permit.</p>
New York http://www.dec.ny.gov/regs/4411.html#14692	<p>New York State regulations are based on waste type and (usually) waste quantity. We don't call it food waste--we use Source Separated Organic Waste (SSOW).</p> <p>Source-separated organic waste means readily degradable organic material that has been separated from non-compostable material at the point of generation including, but not limited to, food waste, soiled or unrecyclable paper, and yard waste in combination with any of the former materials. It does not include biosolids, sludge, or septage.</p> <p>We do have separate definitions for food processing waste (both recognizable and non-recognizable) but all food waste is SSOW.</p>
Ohio http://www.epa.state.oh.us/ocapp/food_scrap/index.html http://www.epa.state.oh.us/dsiwm/pages/3745-27.html	<p>Ohio composting rules identify four classes of facilities based on the feedstocks that can be accepted. The feedstocks determine the stringency of the regulations as follows:</p> <p>(Class IV) Green waste only: permit by rule (notification of registration), runoff/leachate management requirements, no testing of compost product</p> <p>(Class III) Green waste and manure: permit by rule (notification of</p>

	<p>registration), runoff/leachate management requirements, testing of compost product</p> <p>(Class II) Green waste, manure, food wastes and alternative materials: permit by rule (notification of registration), operating license, financial assurance, runoff/leachate management requirements, food waste specific management requirements, testing of compost product. Alternative materials require approval by the director. Examples are dead animals, rendering waste, contaminated soils, industrial sludges, etc.</p> <p>(Class I) All of above plus municipal solid waste: solid waste permit to install, operating license, financial assurance, enclosed structures with impermeable surfaces.</p> <p>Currently, the rules divide food waste in three feedstocks:</p> <ul style="list-style-type: none"> - source-separated raw, harvested vegetables, fruits, and grains, and the paper from packaging that may be commingled with the feedstocks and that are incidental to the load - source-separated vegetables, fruits, and grains processed for human or animal consumption - source-separated dairy products processed for human consumption such as, cheese, butter, milk, yogurt, eggs and cream, and meats processed for human consumption or meats subject to the federal Meat Inspection Act or meats subject to the Poultry Products Inspection Act, excluding meats from non-domestic animals, meats from slaughter houses and retailstores. <p>There is no distinction between pre-consumer and post-consumer. Scientifically there's no difference. Operationally, the concern is that post-consumer food waste is more likely to have non-compostable solid wastes. Our rules already require that any other solid waste found in the incoming feedstock shall be removed prior to incorporation into the process, and operators must inspect the facility each operating day to ensure that any visible solid waste is removed. We consider this approach also serves to address post-consumer food waste. We leave it to the operator to figure out how to comply with the rule.</p> <p>In the upcoming rules review we are proposing to substitute the long definitions above with the following:</p> <p>“Food scraps” means food residuals including but not limited to vegetables, fruits, grains, dairy products, and meats and the biodegradable packaging that may be commingled.</p>
<p>Oregon</p>	<p>Department of Environmental Quality is proposing significant amendments to the existing rules for composting facilities to ensure protection of public health and the environment while allowing Oregon’s composting industry to grow. All facilities, both existing and new, will be screened to evaluate the degree of environmental risk posed by the facility. Low risk facilities will operate under a Registration permit. Higher risk facilities will be required to provide an Operations Plan for DEQ approval that addresses the identified risks.</p> <p>Redefine feedstock types based on physical contaminants and pathogen-carrying properties. Exempt more small facilities from screening and permitting</p>

<p>Rhode Island</p>	<p>Food waste composting facilities are not regulated differently than compost facilities that process non-food feedstocks.</p> <p>No definition of food waste</p> <p>http://www.dem.ri.gov/pubs/regs/regs/waste/swrg05_8.pdf</p>
<p>South Carolina</p>	<p>In South Carolina the composting of biosolids and composting of agricultural animal facility waste is regulated by the Bureau of Water. Composting of yard waste and land clearing debris is regulated by the Bureau of Land & Waste Management. Food waste composting is currently considered an experimental and innovative waste management alternative that would be permitted under Research, Development and Demonstration Regulations (R.61-107.10)</p> <p>Food waste is not defined in our current regulations.</p> <p>Bureau of Water regulations: R.61-43 Standards for Agricultural Animal Facilities http://www.scdhec.net/environment/water/regs/r61-43.pdf</p> <p>Water Pollution Control Permits: R.61-9 Section 503 Standards for the Use and Disposal of Sewage Sludge Section 504 Standards for the Use and Disposal of Industrial Sludge http://www.scdhec.net/environment/water/regs/r61-9.pdf</p> <p>Bureau of Land & Waste Management regulations: R. 61-107.4 Yard Trash and Land Clearing Debris; and Compost http://www.scdhec.net/environment/lwm/regs/R61-107_4.pdf</p> <p>R. 61-107.10 Research, Development and Demonstration Permit Criteria Regulations http://www.scdhec.net/environment/lwm/regs/R61-107_10.pdf</p>
<p>Washington http://apps.leg.wa.gov/WAC/default.aspx?cite=173-350. See section WAC 173-350-220.</p>	<p>Postconsumer food waste is a Type 3 feedstock, as opposed to Type 1 for yard waste and Type 2 for manure. The difference is that the frequency of testing final product increases as the Type # of feedstock increases, Type 1 composters do not have to document pathogen reduction, and Type 1 & 2 do not have to test for Molybdenum or Selenium. Also, we provide some permit exemptions for facilities handling only Type 1 or 2 feedstocks.</p> <p>We do not define “food waste,” but there is a distinction between pre-consumer and post-consumer. Pre-consumer is Type 1 and post-consumer Type 3</p> <p>Although we don't have a specific definition for food waste in our solid waste regulations, pre-consumer food scraps are considered a Type 1 feedstock (“...low level of risk in hazardous substances, human pathogens, and physical contaminants”), and post-consumer food scraps are a Type 3 (“...low level of risk in hazardous substances and physical contaminants, but are likely to have high levels of human pathogens”).</p>
<p>Wisconsin</p>	<p>Wisconsin distinguishes between “vegetable food waste” and other food residuals, and applies a graduated series of regulations depending on the volume of the facility. Facilities for composting less than 50 cy of yard or vegetable food waste are exempt from</p>

	<p>licensing and most regulation. Facilities composting 51 to 500 cy of vegetable food waste must obtain a license and follow some basic operational and design rules, but these facilities do not need department approval of a plan of operation. By contrast, facilities composting up to 20,000 cy of yard waste qualify for this same level of regulation.</p> <p>If a facility wants to compost more than 500 cy of vegetable food waste, they would need to comply with more stringent criteria, including leachate management in a pond or tank, use of a low-permeability pad, and would need to get written approval from the Department. Similarly, composting of non-vegetable (or mixed) food waste requires a processing facility license, with prior plan approval.</p> <p>Note that we are just getting under way with a rewrite of our rules dealing with composting of source separated organic materials - food, yard, non-recyclable paper, possibly manure or digestate. We plan to develop compost quality standards for composts from SSOs, as well as revisit our compost facility regulations to make it easier to compost food residuals.</p> <p>Our rules do not distinguish between pre-consumer and post-consumer food waste, but in most cases we would assume post-consumer food waste would include meat and dairy, which would mean the material does not qualify as “vegetable food waste.”</p> <p>Link to our regulation (see NR 502.08 for processing facilities and NR 502.12 for composting facilities): http://www.legis.state.wi.us/rsb/code/nr/nr502.pdf</p> <p>Link to our web pages on composting: http://dnr.wi.gov/org/aw/wm/recycle/issues/compost.htm</p>
<p>Wyoming http://soswy.state.wy.us/Rules/Rule_Search_Main.asp</p>	<p>We may exempt “green” waste composting from permit requirements or require just a simple “low hazard/low volume” permit. We impose more complex permit requirements and more stringent design and operating plans for facilities that compost food and other putrescible waste or dead animals (aka “animal mortality.”)</p> <p>Food waste isn’t defined in our solid waste rules.</p> <p>Chapter 1 has general permitting requirements. Composting is permitted under our Chapter 6 Transfer, Treatment and Storage facility rules, but there are no rules specific to composting.</p>

Attachment 9

Compost Blanket Specification

Physical/Chemical Requirements		
Property	Test Method	Requirement
pH	*TMECC 04.11-A, Elastometric pH 1:5 Slurry Method, pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A, Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A, Total Solids & Moisture at 70+/- 5 deg C, % Wet Weight Basis	N/A
Organic Matter Content	TMECC 05.07-A, Loss-On-Ignition Organic Matter Method (LOI), % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A, Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	80 or Above 80 or Above
Stability	TMECC 05.08-B, Carbon Dioxide Evolution Rate mg CO ₂ -C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	95% Passing 5/8 inch 70% Passing 3/8 inch
Pathogen	TMECC 07.01-B, Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B, Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C, Man Made Inert Removal and Classification: Plastic, Glass and Metal, % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C, Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles), % > 4mm fraction	None Detected

*TMECC refers to “Test Methods for the Examination of Composting and Compost,” published by the United States Department of Agriculture and the United States Compost Council (USCC).