

Composting

Recommendations provided in this section are developed based on the data collected and analyses conducted in this investigation including nationwide survey results; detailed analyses of state and country Web sites; e-mail and telephone correspondence with state representatives; observations and discussions from site visits in California; discussions with LEAs; and analyses of case histories obtained from literature; as well as the general expertise of the research team.

The analyses conducted for the development of recommendations for composting included identification of best management practices in regulatory schema for protection of the environment and public health and safety; enforceability of regulations (indicating consistency and reproducibility of regulations); and applicability to California, including comparisons to the green material contamination provision. In general, comprehensive and strict regulations were deemed more effective for environmental protection and providing high level of public safety and protection compared to more lenient regulations. The research team observed that other states used comprehensive regulations for composting including regulating compost and composting operations as a function of feedstock type and end uses for finished compost product. These states are ahead of California in promoting best use (i.e., safe practices) for composting activities. The research team believes that advancements in the safe use of compost would have positive impact on composting applications and activities. The research team did not identify a single state with a complete set of regulatory methods and models that represented best management practices in themselves. Therefore, specific relevant and highly applicable features were identified for states analyzed by the research team and recommendations for composting were developed based on this compilation of features.

Recommendations provided for composting were based on the themes used in the analyses of this entire investigation. Specific references are made to the green material contamination criterion when appropriate within the categories analyzed. A list of specific recommendations is provided to summarize the findings of the analyses and interpretation related to the green material contamination criterion. The categories of analyses for composting included:

- Regulatory thresholds.
- Front-end (i.e., incoming material) versus back-end (i.e., outgoing material including product and residual) regulatory enforcement.
- Tiered regulatory structures.
- Entity responsible for regulatory compliance.
- Incentives and public awareness.
- Cradle-to-grave regulatory oversight.

Composting Recommendations

1) Regulatory Thresholds: Various numerical thresholds were used by the states analyzed in this investigation (Sections 5-8). No direct comprehensive scientific bases or risk analyses approaches were used in the development of the numerical thresholds related to facility permitting status

(with the exception of Oregon's new risk-based regulatory structure). The thresholds for scales of operation that qualify for exemption range from backyard operations (defined as 100 yd³ in Colorado, not quantified in Florida), to less than 3,000 yd³ per year of yard waste (New York), to less than 20 to 100 tons depending on compost type and operational details (Oregon), to less than 50 tons (or 500 yd³) per year (Arkansas). The numerical thresholds are highly variable with no foundations provided in the selection of these facility sizes in the respective regulations. Therefore, the research team did not identify and does not recommend at this time the use of highly specific quantitative thresholds for facility size and capacity for exemptions from regulatory compliance.

Various on-site operations including landscaping, farming, and industrial wastes are exempted in other states' regulations. Similarly, various activities are excluded in California as not constituting compostable material handling operations or facilities and are not required to meet requirements set forth in composting regulations. Exclusions are based on composted material type, as well as beneficial use, which constitute specific end use applications. In addition, multiple criteria need to be met for exemption in other states as well as in California. Examples include combined composted material type and total facility capacity criteria, such as the provisions used in Colorado and New York. Examples in California include composted material type and size of operation as well as composted material type and amount of product sold / given away. The investigation of the research team indicated that composite criteria were not developed using scientific bases or risk analyses approaches. The use of composite criteria has potential for better environmental protection than a singular criterion (due to controlling impact of multiple factors), however is relatively complicated for regulatory compliance and enforcement and is not warranted at this time prior to establishing proper scientific basis for ensuring effectiveness of the criteria. The research team recommends a review and refinement of the current exclusions.

Based on the findings of the analyses and observations, the research team recommends that only backyard on-site residential composting operations be considered for exemption. Specifically this refers to materials generated, processed, and applied at a contiguous residential site without any transport of material off site, or financial transactions (i.e., sales of material). The research team recommends that all other types of operations be regulated. The rationale for this recommendation is that compost is derived from a wide variety of material streams, including solid waste components. Proper material handling at facilities is necessary to minimize adverse environmental and health and safety impacts while promoting the environmental benefits of composting.

In California, the only quantitative threshold that is directly related to feedstock quality is the 1 percent contamination criterion applicable to green materials. Quality of feedstock is not assessed for other types of feedstock. A scientific basis for the selection of the 1 percent criterion has not been identified. Nevertheless, the research team believes that this threshold represents a reasonable level regulatory level in the absence of scientific studies. While the 1 percent threshold is deemed acceptable, the determination of the contamination level is problematic. The regulations require that feedstock undergo load checking to ensure that physical contaminants are no greater than 1 percent of total weight using both visual observation of incoming waste loads and load sorting to quantify percentage of contaminants. A minimum of 1 percent of daily incoming feedstock volume or at least one truck per day, whichever is greater, is required to be inspected visually. If a visual load check indicates a contamination level greater than 1 percent, a representative sample is taken, whereby physical contaminants are collected, weighed, and the

percentage of physical contaminants are determined. The research team does not believe that a true assessment of the presence of a maximum of 1 percent contamination by weight can be done visually on a truckload. The research team recommends the development of a detailed test protocol for representative measurement of the amount of contamination level if this requirement is to be maintained in the regulations for incoming materials.

2) Front-End Versus Back-End Regulatory Enforcement: The survey results indicated that front- and back-end regulatory enforcement included determination of amount of incoming and outgoing materials; regulatory criteria developed as a function of incoming feedstock type; and determination of physical characteristics and quality of outgoing product to maintain mature compost that is free of heavy metal contamination, pathogens, and dangerous materials such as man-made contaminants and foreign matter.

Compost regulations for some of the selected states have requirements for only inflow measurements, while some of the selected states have requirements for both inflow and outflow measurements. Weights and/or volumes are required for material flow measurements. Problems arise when conversions are made between weights and volumes without discrete measurements of both quantities or when multiple modes of measurements are conducted. California compost regulations are not consistent in the use of volume (cubic yards) versus weight (tons).

For example, the following sections (Title 14, California Code of Regulations [14 CCR]) include parameters with volumetric requirements (cubic yards):

- Article 2. Regulatory Tiers for Composting Operations and Facilities
 - 14 CCR Section 17855. Excluded Activities
 - 14 CCR Section 17856. Agricultural Material Composting Operations
 - 14 CCR Section 17857.1. Green Material Composting Operations and Facilities
 - 14 CCR Section 17862. Research Composting Operation

Weight measurements are provided in the following section:

- Article 2. Regulatory Tiers for Composting Operations and Facilities
 - 14 CCR Section 17862.1. Chipping and Grinding Operations and Facilities

Both volume and weight are used in the following article:

- Article 7. Environmental Health Standards
 - 14 CCR Section 17868.1. Sampling Requirements. – Volume measurements are specified in the section, except for the case of biosolids for which metric tons are specified

The 1 percent green material contamination rule is based on weight measurements as described in 14 CCR Section 17868.5.

The research team recommends that total inflow, total outflow, and compost outflow quantities be recorded using weight basis to characterize overall site operations in a consistent manner.

Measurement of additional parameters (e.g., other material in, recycling out, other material out as used by other states) are deemed unnecessary as such measurements add to processing and recordkeeping, without adding inherent value to the compost operations or the permitting process.

Classes of composting facilities and grades of compost were defined in regulations based on type of incoming feedstock in some states (e.g., Arkansas, Colorado, Florida, Maryland). In addition, categories of end uses are defined for outgoing compost based on feedstock type in some states (e.g., Arkansas, Florida, Maryland). In California, the only criterion used related to quality of feedstock is the 1 percent green material contamination provision, which defines the amount of residual in green material feedstock and is not broadly applicable to other types of feedstock. Provisions are not available in regulations in California related to end use of compost as a function of incoming feedstock. The types of incoming feedstock and the classification of the feedstock used in Colorado provide a straightforward, yet thorough, system for detailed compost characterization. The research team recommends that consideration be given to adopting a similar system in California. The recommended classification includes:

Type 1—Agricultural crop residues, manure, untreated wood wastes, yard, paper, and green wastes.

Type 2—Animal material, animal mortalities, and source-separated food wastes.

Type 3—Biosolids, solid waste, processed solid waste, and sludges.

The proposed use of this classification system is intended to provide consumers with details of the source of compost and not to classify the composting facility type. It is important to identify feedstock type as essentially no criterion exists for the variable compost feedstocks except for green material contamination criterion. For mixed feedstocks, the research team recommends that all types included in a mixture be monitored for the benefit of the consumer. In addition, the research team recommends developing guidance on intended use for composts derived from different types of feedstock. Currently, California regulations provide criteria related to chemical constituents and pathogens for different uses of compost; however, no consideration is given to type of feedstock in determination of final use. The composting of medical waste; hazardous waste; and unprocessed mammalian tissue, including but not limited to, flesh, organs, hide, blood, bone, and marrow, are prohibited, except when the tissue is from the food service industry, grocery stores, or residential food scrap collection, or as part of a research composting operation. The recommended criteria by the research team for end use as a function of feedstock include non-restricted use for compost derived from Type 1 feedstock; partially restricted use for compost derived from Type 2 feedstock including no agricultural applications and no applications with direct human contact; and highly restricted use for compost derived from Type 3 feedstock allowing for use only in waste containment facilities similar to other states. The research team believes that requiring identification of feedstock type used in compost generation and regulating the end use of compost as a function of feedstock type will provide better environmental and health protection than the current regulatory schema where only a threshold of 1 percent contamination (i.e., residual content) is considered in green material feedstock and no specific criteria or provisions are provided for variable types of feedstock or end uses.

Outgoing compost is regulated according to physical characteristics and quality. Physical characteristics include particle size, which is generally market-driven, and the research team believes does not need to be regulated. For quality, testing requirements for heavy metals,

pathogens, pH, salts, and foreign matter are common in composting regulations. The metal contaminant limits are based on EPA 40 CFR 503. For heavy metals, other states have limits that are equal to or more stringent than those in EPA 40 CFR 503. In some states the heavy metal limits are used specifically as thresholds for characterizing compost grades. Pathogen testing is required in all selected states. The majority of states use limits that are identical to those presented in EPA 40 CFR 503. Other characteristics for outgoing compost that are measured for selected states include: C/N ratio, organic content, stability, dangerous materials/man-made materials/foreign matter, and PCBs.

The research team recommends continued regulation of quality of outflow from composting operations including metal and pathogen characteristics, the amount of residual/foreign matter, and stability. The research team recommends that the sampling rates for outgoing compost quality be reviewed and potentially refined to reflect the feedstock type. Specifically, the research team recommends more stringent sampling requirements (e.g., higher frequency of sampling) for solid waste feedstocks than for green waste feedstocks to ensure that metal and pathogen characteristics (and other potential parameters) are monitored in a manner for maximum environmental and health and safety protection. For the metal and pathogen parameters, the research team recommends that more stringent limits (i.e., lower concentrations) be enforced for outgoing compost similar to requirements in Maine and Washington. In addition, the EU regulations for chemical composition of compost are significantly more stringent in terms of contaminant limits than the criteria used in the U.S. (Appendix E).

A highly detailed testing protocol for determining the quantity of man-made materials is outlined in the Illinois regulations (further described in Section 8). The research team recommends that a similarly detailed approach be adopted for use in California for providing a repeatable test method and for ensuring quality of outgoing compost. For quantity of man-made materials (i.e., contaminants), the research team recommends the use of a maximum upper limit of 1 percent (by weight), used in other states, even though scientific basis has not been established for this specific value.

For stability characterization, the research team recommends that specific numerical results from standardized tests be used instead of qualitative descriptors such as color for assessing regulatory compliance. Compost is classified as “stable” (i.e., mature) or “unstable” (i.e., immature), where the term “stable” is often used to describe compost that has ceased undergoing rapid decomposition and compost with nutrients that are readily available for release into the soil. Unstable compost, in contrast, can detrimentally affect plant growth. The respiration rate test method is considered to be the most accurate and repeatable method for determining stability. The test describes a method to determine the rate of oxygen utilization as an indirect measure of biological activity. For horticultural applications, < 20 mg O₂ / kg compost dry solids per hour is considered stable. For field agricultural applications, < 100 mg O₂ / kg compost dry solids per hour is considered stable. There are several test methods discussed on the CalRecycle Web site for determining stability. However, none of these test methods is required by current regulations.

Guidelines are provided for “Purchasing Compost and Mulch” in the CalRecycle Web site (<http://www.calrecycle.ca.gov/organics/products/Quality/Needs.htm>) for consumers. The CalRecycle Web site provides guidance for “Compost Quality: Performance Requirement Characteristics” and includes guidance for “Quality Standards for Finished Compost.” The guidelines include detailed description of finished product compost parameters as well as include

statements related to the effect of feedstock on the quality of finished compost. The research team believes that consideration should be given to incorporating these recommendations for compost quality into the compost regulations.

In addition, the research team recommends adoption of a highly detailed labeling system for compost, similar to systems available in Rhode Island and Maryland. The label requirements include information on type and/or origin of compost (as described above), physical data, health and safety provisions, suitable applications, and application rates. The data included in the “Compost Quality: Performance Requirements” guidelines in the CalRecycle Web site can be adopted readily for developing labeling criteria.

Overall, the research team observed that other states’ regulations extended beyond the compost facility and included provisions for end product use in the analyses of other states’ regulations as described in Sections 6 and 8. The recommendations provided herein for end product use are outside the direct scope of this agreement. However, based on the presence of similar regulations in other states, the research team recommends that California consider adopting regulations including end use provisions. Composting can be advanced by adopting regulations that recognize the interconnectedness of the entire composting process including feedstock type, facility operations, quality of product, application, environmental protection, and public health and safety. The research team believes that including regulatory provisions for the entire composting process will elevate public confidence in composting and ultimately result in higher compost usage rates.

3) Tiered Regulatory Structures: Type of inflow material (i.e., feedstock) and size of operation are used to designate specific tier of permitting for composting operations. The benefits of a tiered system include increased regulatory oversight of operations that are large and/or contain material streams that pose higher environmental risks. In concept, enforcement agencies can focus on high-risk facilities and use their resources more effectively in a multi-tiered regulatory structure. The drawbacks of a tiered system are that regulatory compliance and enforcement are complicated and that the thresholds used to define divisions between the tiers are inevitably arbitrary due to lack of scientific foundation for such decision making. A low number of tiers provides for a consolidated regulatory structure, yet such a system will tend to treat a broader range of recycling operations similarly. This may be perceived as over-regulating small and clean operations.

Currently, the California regulations include broad exemptions from regulatory oversight (except for yearly inspections by the LEA) for agricultural composting activities selling less than 1,000 cubic yards of compost product per year; include notification status for green material composting operations if less than 12,500 cubic yards of materials are present on-site at any one time (including feedstock and finished compost); and provide three tiered levels for chipping and grinding operations including less than 200 tons/day (no Permit), 200 to 500 tons/day (Registration Permit), and >500 tons/day (Permit). The selection of the particular weight or volume criteria for permit status has not been based on scientific or risk based analyses. The research team recommends that a simple and robust (i.e., applicable to variable conditions) tiered system be employed to ensure proper environmental protection and to minimize public health risks. The research team believes that any business-scale (for profit) operation should be permitted. The recommended tier system includes exemption for backyard composting operations and full permit for all other operations. The research team does not believe that proper scientific

basis is present for the current multipart tiered system and the particular thresholds used for delineating the tier levels employed in California. The research team does not recommend the use of a complicated, multi-provision tier system, at least until sufficient scientific foundation is available for establishing appropriate threshold delineations.

4) Entity Responsible for Regulatory Compliance: The entity responsible for regulatory compliance at state level includes composters (most common—regulated for all selected states), and handlers (in California). The research team believes that these entities should continue to be regulated and does not recommend any changes to the current regulatory schema in regard to the entity responsible for regulatory compliance.

5) Incentives and Public Awareness: Public awareness about composting and overall green waste disposal habits affect waste diversion efforts as well as influence effectiveness of composting operations. Attention should be given to increasing public awareness to improve composting activities. Even though California has a relatively well-developed set of educational programs regarding composting and a dedicated Web site, the research team recommends that more educational information be provided related to backyard composting, the overall composting process, and information for larger-scale operators. In addition, the research team recommends that the State consider expanding collection programs to increase composting rates throughout the state. Specifically, further development of separate green waste collection programs in rural areas would positively impact statewide diversion rates.

6) Cradle-to-Grave Regulatory Oversight: Cradle-to-grave regulatory oversight (i.e., provisions for appropriate siting, design, operation, closure and post-closure of facilities) is present in California to varying degrees. Currently, exempt facilities are not required to provide siting, design, operation, or closure plans. The research team recommends incorporating these aspects into the current exemption regulatory framework. The research team envisions template siting operation, and closure requirements (standard requirements that serve as a master or pattern that can be slightly modified for different facilities) to be in place for all facilities. To streamline the regulatory process for smaller operations, a common set of requirements is envisioned, rather than requiring site-specific plans to be developed. Larger operations should be required to develop site-specific plans. Streamlined permitting for compost facilities will require coordination with local planning agencies and may not be possible in all cases.

For design and operation plans for compost facilities in California, the research team recommends including more specific details in the regulations. Examples from regulatory schema used in New York, Oregon, and Rhode Island (as described in detail in Section 8) include specific distances to property boundaries from composting areas, requirements for geotechnical reports, and requirements for adequate geotechnical liner systems to reduce nuisances including dust and odor and to prevent leakage of leachate from composting operations to surface water and groundwater for better protection of environment and human health.

Site restoration requirements in California regulations (14 CCR Section 17870) provide minimal criteria for closure with no requirements for a post-closure plan. Composting facility operators are required to provide the EA written notice of intent to perform site restoration, at least 30 days prior to beginning site restoration; provide site restoration necessary to protect public health, safety, and the environment; and perform certain site restoration procedures, which include cleaning of all residues from operation and facility grounds, ponds, and drainage areas, cleaning of all machinery, and cleaning of compost materials, dust, particulates, or other residues from all

structures. By comparison Title 27, Subchapter 5, Articles 1, 2, and 3 provide rigorous requirements for the Closure and Post-Closure of Waste Management Units for Solid Waste. Article 4, Standards for Composting Facilities, is reserved and has not yet been published.

Numerous states require that a closure plan be initiated after a period of time over which no material has been received at a composting facility. Colorado and Illinois define this period as 180 days, whereas New York defines this period as one year. It is recommended that California require the implementation of a closure plan based upon a period of no material intake. This period of time should be allowed to be adjusted on a case-by-case basis depending on how a specific operation functions. Implementing a closure plan based upon a period of no material intake will benefit the environment because it can prevent non-operational facilities from harming the environment. Implementing a closure plan based upon a period of no material intake will be readily enforceable using material flows records.

California has no regulatory requirements related to post-closure planning for composting facilities. While composting facilities may have long service lives (as compared to waste containment facilities), requirements for post closure plans are prudent for assuring that operators remain liable in the long-term for any release of contaminants to the environment due to operational activities. The research team recommends that post-closure plans be included in the regulatory structure.

Summary of Composting Recommendations and Impact on California Infrastructure

A summary of recommendations resulting from the composting analysis is presented in Table 24. The table includes specific recommendations, how the recommendations compare to the California regulations, in particular, the green material contamination provision, and the impact on infrastructure.

Table 24. Composting Recommendations and Impact on Infrastructure

Composting Recommendation	Comparison with California Regulations, Green Material Contamination	Impact on Infrastructure
Avoid using composite criteria such as combined composted material type and total facility capacity as criterion for exemption	Currently regulations have exemptions as a function of type of composted material and facility capacity	Medium – The existing capacity thresholds are relatively low, thereby affecting only some operations
Consider review and refinement of excluded activities	Currently exclusions are provided for a variety of composting operations	High – Would require regulatory compliance by additional composting operations
Provide exemptions for only backyard, on-site residential operations	Exemptions are provided for a multitude of operations as described above	High – Would require regulatory compliance by a wide variety of composting operations
Maintain 1 percent green material contamination regulation	Current status	None
Enforce direct measurement of 1 percent green material contamination	Both visual observation and measurement are used	Medium – Facilities already are required to be capable of conducting direct measurements; measurement only requirement would increase test durations
Develop detailed test protocol for determining 1 percent green material contamination criterion	Limited detail is provided for obtaining representative consistent measurements	Medium – Facilities already have capabilities to measure contamination; the new protocol may require longer test durations, but would streamline operations
For measured material quantities, use weight basis to provide a consistent set of values	Currently, both volume and weight are specified in regulations related to exclusions, weight is used for green material contamination	Low – Would simplify material quantity reporting. Would require that all facilities have scales installed (many have this capacity, so minimal impact on operators is envisioned)
Adopt a classification system for feedstock	Currently not required	Low – Modifications are required in regulations, it is expected that composting operations would not be significantly affected as the requirement only refers to identification of feedstock type

Composting Recommendation	Comparison with California Regulations, Green Material Contamination	Impact on Infrastructure
Develop guidance for compost end use as a function of feedstock	Currently not available	Medium – May limit the use of certain types of feedstock for specified applications
Better regulate sampling requirements for outgoing compost as a function of the type of feedstock	Currently sampling requirements for green material feedstock may be less stringent than the requirements for biosolids or municipal solid waste feedstock	Medium – May affect some operations as a function of feedstock type; all operations already conduct some form of sampling
Lower the concentration limits for metals and pathogens in line with other states and Europe	Currently California regulations are less stringent than selected other states and European standards	Medium – The research team believes that lower concentrations can be achieved in California, as they are already used elsewhere; may require modifications to some operations
Adopt/develop testing procedures for determining the quantity of contaminants and stability of outgoing compost	Currently, these parameters are not determined	High – Equipment and personnel or outside testing services would be required for completing the measurements
Implement labeling requirements	Currently outgoing compost does not have labeling requirements	Low – Composters already obtain majority of the data that would be included in a label; the requirement simply ascertains that compost characteristics be made available to the consumers
Avoid the use of multipart tier criteria if not developed using scientific basis or risk analysis approaches	Inconsistent with current composting regulations	Function of level of change considered
Increased regulations be used for design and operation of composting facilities to promote better environmental protection	Specific details regarding distances to property boundaries; requirements for geotechnical reports; requirements for adequate geotechnical liner systems; requirements for minimizing surface water and groundwater impacts are not included	Medium - May limit geographic location for recycling facilities and require construction of liner/drainage systems

Composting Recommendation	Comparison with California Regulations, Green Material Contamination	Impact on Infrastructure
Include regulatory provisions for post-closure plans for permitted facilities	Currently not required by regulations	Medium – minimal impact on the day-to-day operations and enforcement, but potential financial impact for post-closure developments

