Municipal Solid Waste Composting: Issues in Policy & Regulation
Fact Sheet 6 of 7

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The management of municipal solid wastes (MSW) has become increasingly complex and expensive. Communities are moving towards integrated systems involving several management techniques to maximize the recovery of resources from the waste stream. Organic materials comprise the majority of MSW (typically 60-70%), so composting is likely to play a critical role in achieving the 40-60% waste reduction goals set by various states (Table 1).

Table 1. Composting and Recycling Potential of Municipal Solid Waste

Total potentially compostable[*]	70% of MSW
Total composted at 80% capture[***]	56% of MSW
Total potentially recoverable[**]	85% of MSW
Total recovered at 80% capture[***]	68% of MSW

[*]Total potentially compostable = newspaper, cardboard, other paper, food, and yard wastes. Note: This calculation is based on what is potentially composted. It may be more desirable to recycle much of the paper and cardboard rather than compost it.
[**]Total potentially recoverable = total compostable (which includes some papers that may be recycled rather than composted) plus recyclable glass, metal, and plastic packaging.
[***]Total composted/recovered at 80% capture = total potentially compostable/recoverable x 80% because not all this waste will be successfully diverted to recycling and composting due to imperfection of separation and collection.

Composting generally enjoys a favorable public response and there is broad agreement about the need to compost the organic fraction of the waste stream. However, when it comes to specifics, there is debate about the policies and regulations which should govern composting of solid wastes. In the United States, major revisions to federal rules regarding use of sewage sludges have recently been adopted (under section 503 of the Clean Water Act). These apply to any composts containing sludge, but there are no federal laws or rules which specifically apply to solid waste composting. A handful of states and Canadian provinces have adopted rules and many others are currently considering them. A number of European countries have established policies and standards, and several have recently been revised to be more conservative.

Composting as a Component of Integrated Waste Management

Composting provides a means to recover the organic fraction of the waste stream to produce a usable product. Composting should be viewed as a manufacturing process, with a goal of making a product that is safe and that meets consumer needs. An integrated solid waste management strategy which includes source reduction and recycling can help to improve the quality of the finished compost products.

Source reduction includes reducing the amount and toxicity of the waste stream and therefore has positive implications for all other waste management options. Toxicity reduction is particularly important to the production of safe composts. Heavy metals, particularly lead and mercury, can be toxic and may restrict the use of composts. Thus, reduction of the use of the metals in products which find their way into the waste stream will enhance composting.

Removal of recyclables will also enhance composting since glass, metals and plastics are undesirable in composts. Consideration of paper is more complex since some can be either recycled or composted. Composting of soiled and thus non-recyclable paper is recognized as appropriate, but there is some debate about composting potentially recyclable papers. Most states consider composted wastes as "recycled" which is important in meeting state mandates for waste reduction.

There are essentially two approaches to separating recyclables and compostables. They can be source separated by the waste generator (homes and businesses) and collected and processed as separate streams, or they may be collected as part of a mixed waste stream which is then processed at some central facility to separate different components. There are several trade-offs between these approaches (Fact Sheet 3). Source separation is less convenient for generators and education is required to minimize contaminants in the source separated streams. If mixed wastes rather than source separated organics are collected and processed, a greater proportion of the organic fraction will end up in the composts because generators asked to source separate are likely to place some potentially compostable organics into the bin designated as non-compostable. On the other hand, a greater fraction of the heavy metal contaminants will also end up in composts made from centrally processed mixed wastes. Another fact sheet in this series describes the impacts of different collection and processing options on compost quality and concludes that source separation of compostables results in lower concentrations of metals in the composts. (Fact Sheet 3)

Whatever methods are employed, compost facilities will generate some "rejects" or non-compostables that must be disposed of at a landfill or incinerator. Policies must take into consideration the trade-offs between the desire to keep rejects to a minimum (to keep disposal costs lower) and the desire to minimize contaminants in the compost product.

Facility sizing is a critical issue in composting facilities, and it will influence the economics of construction and operation and the amount of incoming waste that is needed to cover costs. The potential for managing appropriate commercial wastes (such as cafeteria or food manufacturing wastes) or for importing wastes from other communities should be considered. Too large a facility may discourage waste reduction or result in the need to "import" wastes while too small a plant will not provide capacity for all appropriate wastes and may not be economic to build and operate. There may also be the challenge of a highly variable quantity of compostable wastes due to seasonal changes in the waste stream or in community population in resort areas.

Compost Quality: How Clean is Clean Enough?

There are several options for regulating compost quality. A risk-based approach, such as that used for regulating land application of sewage sludge, is the most popular approach being used in most states. A risk analysis of the potential environmental and health impacts of the various chemical and pathogenic contaminants is performed and numerical limits are established for each contaminant which would be low enough to achieve a No Observed Adverse Effect Level (NOAEL). Under this approach, products meeting these standards could be applied without restrictions and without causing unacceptable risk to humans or the environment. Such a risk-based approach is predicated on having sufficient information to assess adequately the risks and establish thresholds below which risks are negligible or acceptable.

Based on extensive research, a comprehensive assessment for sewage sludges has been performed to develop Alternative Pollutant Limits (APLs) which meet NOAELs. Much less research and analysis are available on MSW composts and while there are many similarities between sewage sludges and MSW derived composts, there are also some important differences. The bioavailability of metals, ratio between different metals, and higher potential application rate for composts are among the most significant differences. One critical area where research is needed is the acceptable level of lead (Pb).

In contrast to this risk-based approach, other regulations in the U. S. in water and air pollution control have sometimes followed a principal of best achievable technology" The regulations might specify process design and operation requirements. Submission of engineering documents relating to construction and operation are generally required for compost facilities and operational requirements are specified to control pathogenic organisms through elevated temperatures.

A third approach, requiring no net degradation, is currently being used to regulate composts in the Netherlands, Switzerland, selected German states and the Canadian provinces of British

Columbia and Ontario. It is based on the philosophy that in order to ensure the long-term fertility of the soil, the levels of selected contaminants should not be increased over background soil levels. These are very stringent standards which in effect restrict composting to source separated clean organic wastes.

Even if policy makers agree on a particular approach, translating existing scientific information into regulation requires interpretation and is not cut and dried. Within the U. S., risk-based standards for such a key contaminant as lead vary by a factor of two, from 250 parts per million (ppm) for unrestricted use Class I compost in NYS 500 ppm for Class I compost in Florida (Table 2). The differences between risk based and no-net-degradation standards are even greater. For example, the standard for mercury varies by a factor of 66.7 between NYS' risk-based standard (10 ppm) and Ontario's no-net-degradation-based standard (0.15 ppm) (Table 2).

Table 2. Comparison of Risk-Based and No Net Degradation Standards for Metals in Compost

Metal	Risk-based (ppm)		No-net-degradation (ppm)	
	Florida Class I	NYS Class 1	Switzerland	Ontario
Cadmium (Cd)	15	10	3	3
Chromium (Cr)	-	1000	150	50
Copper (Cu)	450	1000	150	60
Mercury (Hg)	-	10	3	0.15
Nickel (Ni)	50	200	100	60
Lead (Pb)	500	250	150	150
Zinc (Zn)	900	2500	500	500

Compost Classification and Regulation of Use

Different classes of composts may be established which are based either on different maximum contaminant levels or on specified input feedstocks. Rules may restrict the use of the different classes of compost to different applications thus allowing a balancing of agronomic benefits against environmental risks. Thus, composts meeting the most stringent standards may be allowed to be used without restriction while composts which meet less strict criteria may be restricted to use in non-food chain crops or to applications where people are unlikely to come into direct contact with the compost.

Current compost regulations are not sophisticated in their consideration of alternative uses for composts of different quality. Most classifications set up a single hierarchy of use and if a single parameter tests outside the standards for a class of composts, that compost is downgraded to the next tier of use. While this is a conservative approach, it may eliminate certain safe and appropriate uses. Ideally, restrictions should reflect the particular risk which the increased contaminant may pose. Thus, with lead, for example, the risk analysis for sewage sludge indicates that direct ingestion by children is the most critical pathway. Therefore, composts not meeting the most stringent lead standard should be restricted to uses where children are unlikely to come in contact with it.

Cumulative Loading

Risk based maximum contaminant levels and sludge APLs are set at concentrations designed to protect plants, animals and people which might come in contact with that compost or sludge. While concentration limits address immediate or short-term effects, repeated application over many years may pose additional long-term risks as metal contaminants are concentrated in the soil. The new federal regulations for land application of sewage sludge consider the APL concentrations low enough that repeated applications would not cause undue risk. However, the use of sludges with metal levels above the APL concentrations but less than a maximum ceiling are restricted by cumulative loading limits. These limits set a maximum total amount of each regulated metal which can be applied to the land. For example, the APL for lead in sludge is 300 ppm and the cumulative load limit is 300 kilograms per hectare (kg/ha) (Table 2). If a sludge compost contained 500 ppm (above the 300 ppm APL rate but below the 840 ppm maximum ceiling) and was applied at the rate of 20,000 kg/ha/year (9 tons/acre/year), the cumulative limit would be reached after 30 annual applications (concentration * annual application rate ÷ cumulative loading = maximum site lifetime, e.g., 500 ppm Pb * 20,000kg/ha ÷ 300 kg Pb/ha = 30 years). To ensure that application programs abide with these cumulative loading restrictions, the federal regulations require that each site using sludge containing metal concentrations above the APL limits receive a site-specific permit.

Several European countries have set restrictions on the rate and duration of compost application even for composts meeting stringent no net degradation standards. Loading rates may be based on predicted contaminant losses from the soil through leaching or plant uptake, or they may be based on nutrient balance calculations. In either case, the goal of such restrictions is to protect the long-term viability and vitality of the soil.

Facility Siting, Design and Operation

Compost regulations may also establish requirements for facility location and design to minimize potential impacts on neighbors from odors, traffic, and potential environmental impacts on water quality. Among the requirements which may be included are set back distances from residences or water courses, availability of on-site utilities, minimum land area per ton of waste accepted, use of bio-filters or other odor control systems and leachate collection.

Summary

Composting can play an important role in an integrated waste management system since a majority of MSW is comprised of organic materials. Source reduction and recycling can help to promote high quality composts by removing undesirable components from the waste stream prior to composting. Input materials to composting facilities can be limited to source separated biowastes, which generally produce composts with the lowest levels of contaminants (Fact Sheet 3) or may be mixed solid waste which is processed centrally to remove non-compostable materials.

Production of high-quality composts that meet consumer needs at a cost that is practical is key and these depend on both the collection system and the design and operation of the composting facility. The trade-offs between compost quality, the percentage of rejects that must be landfilled and total system costs require careful evaluation.

Several approaches have been used to set product quality regulations including risk-based standards, best achievable technologies, and no-net-degradation of background soils. Combining these different underlying regulatory and scientific approaches with the political process of regulatory development results in a wide range of compost quality standards. In the United States, the various states which have addressed compost regulation have generally used a risk-based approach, while several Canadian provinces and European countries have adopted more stringent standards based on existing concentrations of metals in clean soils.

Where risk-based standards are used, maximum contaminant levels are established based on available research. The principle is that composts meeting these standards could be applied without restrictions and would not cause unacceptable risk to human or environmental health. Establishing product use restrictions for composts which do not meet the strictest standards, but which meet a less stringent classification, may provide for the beneficial use of these composts while protecting health and the environment.

Control of the site design and operating criteria of composting facilities through the regulatory process can help to protect the local community and water resources against environmental and nuisance impacts.

Municipal solid waste (MSW) composting is a rapidly evolving technology, and as such is subject to shifting policies and changing regulations. As with other policies and regulations, those related to MSW composting are influenced by a combination of science, economics and philosophy as mediated by the political process.

References

See the fully referenced article in a special issue of *Biomass & Bioenergy* (Vol. 3, Nos 3-4, pp. 163-180, 1992), from which this fact sheet is extracted. A copy of that journal containing 11 articles on MSW composting can be obtained through the Composting Council, 114 S. Pitt St., Alexandria, VA 22314, for $30.

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