Organic Waste Diversion (Composting)

Overview

Organic (waste) refer to a broad range of materials, often derived from plants and living things. In traditional, municipal solid waste (MSW) management and for purposes of this paper the term organic waste will refer to the following materials: yard trimmings, food scraps, wood waste, and paper/fibers, including paperboard products. Organic wastes biologically decompose (resulting in air emissions) and as a category of waste, organic waste is typically the largest component of the solid waste stream. For these reasons, it is also a major target for diversion in solid waste management planning efforts. Lincoln Municipal Code (LMC) 5.41.010 defines organic materials as any biodegradable material: "lawn clippings and leaves; raw sewage or treated sewage sludge; animal or paunch manure; any other plant or food residue; or a mixture of any of the above."

Much of the current recycling efforts in the Lincoln and Lancaster County planning area (Planning Area) have focused on recovery and recycling paper/fiber, aerobically composting yard waste, and chipping wood waste for re-use. Most of the readily putrescible (organic) waste, with the exception of yard waste, is disposed of at the Bluff Road Landfill or exported. Food waste, which represents approximately 16 percent of the MSW stream, is disposed of by landfilling (principally at the Bluff Road Landfill). Separate technical papers address yard waste and dry paper/fibers recycling (residential and commercial). The primary focus of this paper will be food waste, managed alone or with other organic materials.

Food waste is part of the definition of garbage in LMC 8.32.010; "garbage" includes "all animal, fruit, or vegetable wastes resulting from the handling, preparation, cooking, or consumption of food." Garbage is a subset of "refuse" in the LMC definitions. Refuse haulers that collect, haul, or convey garbage are required to be licensed (as required by LMC 8.32.110) and follow the conditions of LMC 8.32.

Commercial composting operations in the City, or within three miles, are also required to obtain a permit to operate in accordance with the requirements of LMC 5.41.150. Commercial composting operations include composting of yard waste and any other organic materials as defined in the LMC that originate from off the premises.

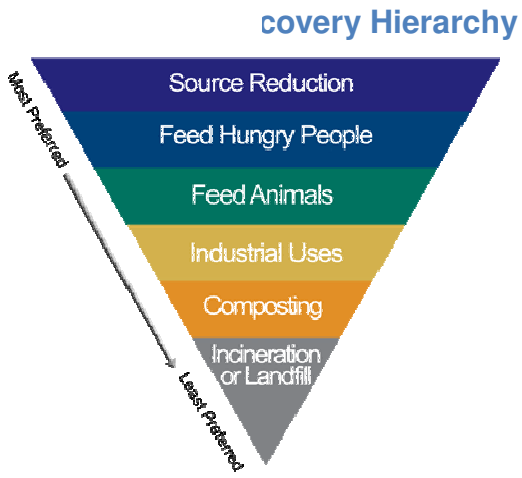
Food waste is generated from many sources including but not limited to:

- households
- restaurants and eating establishments
- food manufacturing and processing facilities
- supermarkets
- institutions such as schools, prisons and hospitals

Food waste can further be categorized as either pre-consumer (i.e., food prep waste) or post-consumer waste (e.g., leftover food or plate scrapings). Food service providers (e.g., restaurants, supermarkets, institutions) produce a significant amount of food waste that needs to be managed each day. Individuals, households and other small scale generators can also generate a significant amount of food waste but in a more dispersed setting and may only require weekly management. According to a 2006 study "Food Loss and the American Household", households threw away 14 percent of the food they purchase. A more recent study "Wasted: How America is Losing Up to 40 Percent of its Food from Farm to Fork to Landfill", estimates that food waste comprises about 40 percent of all food generated in the United States.

In managing food waste, both the United States Environmental Protection Agency (USEPA) and United States Department of Agriculture (USDA) recommend following the "food recovery hierarchy", as shown in Figure 1. This mimics USEPA's hierarchy for integrated solid waste management (Source: http://www.epa.gov/osw/conserve/materials/organics/food/, retrieved on 08/23/2012)

- **Source Reduction** – Reduce the amount of food waste being generated;
- **Feed People** – Donate excess food to food banks, soup kitchens and shelters;
- **Feed Animals** – Provide food scraps to farmers;
- **Industrial Uses** – Provide fats for rendering; oil for fuel; food discards for animal feed production; or anaerobic digestion combined with soil amendment production or composting of the residuals;
- **Composting** – Recycle food scraps into a nutrient rich soil amendment.



Current Programs

Current programs for organic waste diversion in the Planning Area generally focus on dry papers/fiber recycling, yard waste composting, and wood waste chipping. Food waste diversion (source reduction) in the Planning Area includes non-profit food distribution programs and possible on-site management of food scraps by some generators. Within the City of Lincoln, the Food Bank of Lincoln and numerous non-profit food pantries accept donations of food from residents and businesses for distribution for those in need. (Source: http://www.foodpantries.org/ci/ne-lincoln, retrieved on 08/24/2012). Other villages in the Planning Area may also operate food pantries.

There are also two private livestock composting operations and a private yard waste composting facility near Lincoln. One of the livestock waste composting operations is reported to accept a small amount of lawn waste and other organic wastes. Permit requirements for these facilities do not allow them to accept more than 1,000 cubic yards of other organic wastes. Livestock waste is not a waste type addressed in the Solid Waste Plan 2040 and as such is not discussed further in this paper.

The City supports and promotes paper/fiber recycling and yard and wood waste management, through its website http://lincoln.ne.gov/city/pworks/waste/sldwaste/ and in the *Lincoln-Lancaster County's Official 2012 Waste Reduction & Recycling Guide*. See separate papers on Yard Waste, Residential Recycling and Diversion and Commercial Recycling and Diversion for more information on programs to manage yard waste and paper/fibers. The City also provides Christmas tree grinding and mulching for approximately 3 weeks following the Christmas holiday.

NDEQ Title 132 – Integrated Solid Waste Management Regulations define solid waste processing facilities to "mean any facility where solid wastes are processed, and shall include, but not be limited to solid waste compost sites, materials recovery facilities, recycling centers and solid waste transfer stations." The regulations require that "No person shall construct or operate a solid waste management facility without a permit issued by the Department [NDEQ] pursuant to this Section unless otherwise provided in these regulations."

Partial exemptions from permit requirements exist for solid waste processing facilities when:

- a solid waste compost site receives between 20,000 and 100,000 cubic yards per year of lawn wastes only (this currently applies to the City's Bluff Road site);
- a solid waste compost sites receives less than 1000 cubic yards per year of material; or
- a solid waste compost sites receives between 20,000 and 100,000 cubic yards per year of material that consists of lawn waste in combination with less than 1000 cubic yards of other materials.

Organic wastes not diverted through source reduction or recycling are generally disposed of at a landfill.

While the focus of this paper is on options for diversion of organic waste it is noted that the Bluff Road Landfill and possibly one of the landfills accepting exported wastes are equipped with landfill gas recovery systems. These systems attempt to capture the methane emissions resulting from anaerobic digestion of organic materials that occur within the landfill. The City has entered into an agreement with Lincoln Electric System (LES) to buy the majority of landfill gas collected and convert it to electrical energy. Collected gas, which is not used by LES will be combusted in a flare system (to destroy the methane gas) located at the Bluff Road Landfill. This is considered the status quo; as the landfill grows the gas collection system will be expanded and LES has agreed to expand its electrical generation system when enough landfill gas is available to support an additional electrical generation unit.

Generation and Diversion

The NDEQ's 2008 Nebraska Waste Characterization Study included a waste sort and characterization at the Bluff Road Landfill. This study estimated that approximately 63.3 percent of the MSW disposed was organic materials (includes all papers (44.1 percent), food (16.0 percent), yard waste (2.9 percent), and wood (0.3 percent)). Based on fiscal year 2011 disposal tonnages (Bluff Road and exported), the food waste component (16 percent) is equivalent to 49,000 tons per year. The study did not characterize the quantity of the paper/fibers or the extent to which they were contaminated and might limit post-disposal recovery for recycling. Soiled papers (as well as clean papers not recycled) are also a candidate for composting, provided they can be cost effectively segregated from the waste stream.

Program (Facility/System) Options

Organics diversion programs vary from community to community across the U.S. Recycling is used to target paper/fibers (organics); composting of source separated yard waste and processing of wood waste are also key organics diversion programs. Source reduction targets reducing the quantities of these and other materials that require diversion and post-generation management programs. Although many communities already have some level of food waste diversion through source reduction (education and food donations/food pantries), more recent efforts have focused on collection and composting of food waste in order to significantly increase landfill diversion. These food waste composting programs often look to combine food with yard waste and other organic materials as part of the composting operations. In examining food/organics waste composting there are three distinct but related elements that need to be addressed:

- Marketing
- Collection and recovery
- Composting or digestion

This paper deals with large scale organics management. While "backyard" composting is a viable option for certain vegetative wastes it is considered a source reduction option (composted and used at the generation site) and is not addressed further in this paper.

Markets

While a separate paper deals with markets for recovered/recycled materials, it is important to note that absent a use for the material resulting from composting operation, the costs increase significantly; lack of markets has been one of the major contributors to failed organics composting programs in the US. A major factor in marketing is product purity, which includes aesthetic considerations as well as physical and chemical contaminants. These matters all need to be carefully understood and addressed to ensure a marketable product. Because of the potential threat for contamination, a program of careful monitoring and testing will be required. Composted products that do not meet market criteria will need to be managed by an alternate strategy or disposed. In concept, organic waste compost, derived from MSW would be subject to criteria similar to what is currently required for materials derived from biosolids. A synopsis of the criteria is summarized in Appendix 1.

For compost produced from food or other organic waste it should be anticipated that testing for similar pathogens, vector attraction reduction (VAR) and chemical composition will be necessary. Without markets, the composting process may result in a more expensive method of volume reduction and stabilization prior to landfill disposal.

These factors impact market demand for the finished compost. Over the last five fiscal years the City has distributed an average of about 6,200 cubic yards of LinGro compost per year. As mentioned in the paper on Recycling Incentives it will be essential to establish viable and sustainable markets before undertaking a large-scale organics composting program; additional research and market development may be necessary to ensure the long-term availability of such markets.

Collection and Recovery

Assuming adequate markets and processing facilities are (or will be available) to support organic waste composting, the next key elements is implementation of the collection infrastructure. Collection and recovery methods may vary significantly depending upon the targeted source of the organic material. In general, options include pre-and post disposal and sanitary sewer disposal systems; there are also differing options that might be applied to residential sources versus commercial, industrial and institutional sources. In all instances extensive education may be a key component in establishing and implementing the program. Education will be needed to address simply what can and can not go into a composting operation, and how to prepare and manage the material prior to collection.

There have been several MSW composting operations attempted in the US; these largely take post-disposal, mixed municipal waste (organic and non-organic) and compost them all together. While some success has been demonstrated with these methods, many of these projects have shut-down and operational facilities (e.g., Rapid City, South Dakota) have had difficulty with marketing the materials. Operational problems and lack of markets has significantly increased the cost of such mixed waste composting operations. As such, this paper focuses principally on source separated organic material options.

Wet/Dry Systems. Collection operations can generally be separated into: 1) residential; and 2) business (commercial, industrial, institutional) options. Common among both options is what is described as "wet/dry" collection. Wet/dry collection systems involve the source separation (prior to collection) of organics into: 1) "wet" wastes (food, yard waste, and soiled papers); and,

2) other "dry" municipal solid waste (MSW). The "dry" fraction can be further separated into "dry" recyclables (paper/fibers, plastics, metals) and refuse for disposal.

For many communities looking to implement organics diversion the first step is to determine whether to target residential or commercial sources. Another important factor to consider is frequency of collection due to odors and vector attraction in hot summer months.

For residential wet/dry collection systems the first step is to implement or optimize residential (single-stream) curbside recycling then later add another cart for targeted organics (yard waste, food scraps and food-soiled papers). Also, pilot programs are often developed through public/private partnerships to evaluate and incorporate food waste and food-soiled paper into the residential organics collection system. Some programs provide small pails or buckets to the residents for use in the kitchen which can then be used to fill larger containers. See discussion in the paper on Residential Recycling and Diversion for additional information on collection of recyclables. Collection of residential food waste has been widespread in parts of Canada for many years; however, programs in the United States are more limited. Some examples of residential organics collection in the U.S. include:

- Since August 2008, the City of Boulder, Colorado has required haulers to offer organics collection to single-family residences, bundled at one rate with trash and recyclables collection. Organics are collected every other week, alternating with recyclables. The programs estimate diversion of over 50 percent from the residential waste stream (Source: "U.S. Residential Food Waste Collection and Composting", *BioCycle*, December 2009, Vol. 50, No. 12, p. 35). Some haulers also offer organics/food waste collection services to businesses and multi-family units.

- The City of Dubuque, Iowa currently provides curbside organics collection to approximately 300 subscribers (households, businesses and institutions). The City provides 12-gallon wheeled containers with snap-locking lids, plus 2-gallon kitchen pails/buckets to residents. Subscription cost is $0.60 per month for residents; larger 48-gallon and 64-gallon carts for businesses are $5.50 and $8.50 per month, respectively. A summary of Dubuque's food scrap recycling program is in Appendix 2 of this paper. Food waste is collected weekly, commingled with yard waste in the packer truck. Dubuque's compost facility is limited to processing a maximum 2 tons per week of food waste under Iowa rules. Expanding food waste collection would require a MSW composting facility permit and facility capital improvements to meet those requirements. (Source: http://www.cityofdubuque.org/index.aspx?NID=483, retrieved 08/27/2012)

- City of Seattle, Washington provides weekly food and yard waste collection to residential households. In early 2009, the mandatory food waste participation program went into effect for single-family households; households must participate in the curbside organics collection or backyard composting. This requirement expands to all households up to four-plexes by September 15, 2012. Current organic collection rates vary from $4.65 to $8.95 per month based on can/cart size. (Source: http://www.seattle.gov/util/Services/Yard/Yard_Waste_Collection/index.asp, retrieved on 08/27/2012)

For programs targeting commercial food waste generators and food service providers (e.g. supermarkets, institutions/cafeterias, and restaurants) consideration needs to be given to the following:

- Types of organic waste (produced)
- Convenience

- Participation and diversion levels
- Costs of services and funding

Similar to residential wet/dry collection, the legal considerations and collection infrastructure will need to be investigated and developed in order to encourage or require businesses and institutions to recycle food waste and food-soiled paper and for private haulers to establish the needed infrastructure to properly manage those materials. See the technical paper on Commercial Recycling and Diversion for additional discussion on collection infrastructure. By initially focusing on large volume generators it may be easier to implement a two or three container separation system (organics, dry recyclables and waste). Collection of food waste (organics) may present additional challenges for the commercial sector. Key issues that will need to be addressed with generators and haulers are expected to include:

- Containers
- Container maintenance
- Collection frequency

An organics waste diversions program will need to be implemented in conjunction with a compost facility permitted (at state and local levels) to accept food and other organic wastes. Once a food waste composting facility(s) is available, pilot programs are typically used to begin the collection and processing of the material. Properly structured, the source separation of organic wastes will minimize residuals and rejects from the composting process.

Sanitary Sewer Collection Systems. Another food waste processing alternative gaining support over the past few years is the use of in-sink food waste disposals or other pre-processing prior to direct piping or trucking to anaerobic digester, typically part of the local wastewater treatment plant. Food waste grinders or pulpers have been around for many decades and in the early years for garbage disposal they were promoted at a tool for clean and effective management of household food waste. Based on certain prerequisites, this approach can be implemented on-site for kitchen facilities at targeted establishments (institutions, cafeterias/food services, and restaurants) or at a centralized center. The processed food waste would then be piped to sanitary sewer system or trucked to the digester facility. Considerations for implementing this method include:

- On-site equipment requirements at residential and commercial establishments.
- Adequate piping system to handle quantity and/or modifications required for direct sewer routing.
- Increased water consumption to properly flush solids and keep pipes clean.
- Added costs to industries for increased organic loading in their waste water. Large businesses or industries are typically charged based on such factors as volume and organic loading placed in the sanitary sewer.
- Wastewater treatment plant must have the capacity to handle the increased volumes, solid, and organics loading.

The University of Nebraska at Lincoln (UNL) recently commissioned a study to investigate diverting food waste from the UNL cafeterias to the City of Lincoln's anaerobic digestion facilities at the Theresa Street Wastewater Treatment Facilities (WWTF). The study evaluated on-site pre-processing modifications along with re-piping to sanitary sewer system or trucking food waste from centralized slurry tank to the treatment plant. The study concluded that the least cost alternative was the direct sanitary sewer disposal option, provided that UNL could resolve pipe plugging problems through re-plumbing the grinder units. Otherwise a centralized slurry tank with sanitary sewer discharge was the next cost-effective alternative. The study indicated that the Theresa Street WWTF would have to be upgraded to include additional

screening and storage capacity, if this approach resulted in significant increases in volume of materials disposed in this manner. UNL has decided not to pursue this option at the present time. (Bio-Waste Anaerobic Digestion Study for UNL, Draft February 2012, HDR).

Composting or Digestion

Once organic waste is collected it would be delivered to a processing and composting facility. In developing such a facility the primary questions will be the type of wastes to be handled and the type of composting process to be used. There are two primary means of decomposing the organic material – aerobically or anaerobically. Aerobic processes refer to decomposition in the presence or oxygen and anaerobic processes refers to decomposition in the absence of oxygen.

Aerobic Organic Waste Composting. Aerobic composting of organic waste collected in commercial and residential programs can occur through one or more of the following methods:

- Windrow composting – organic materials (i.e. yard waste, wood waste, and vegetative food/paper waste) mixed into turned windrows or aerated static piles at a permitted composting facility. If an enclosed facility were used, with frequent turning and good temperature control, this could also incorporate meat and greases.
- In-vessel composting – uses an enclosed reactor with temperature and moisture-control to contain and expedite composting; especially suited for processing food wastes, biosolids and sludges. Initial reactor holding time would be 7 to 10 days, followed by secondary digestion.
- Vermicomposting – uses red worms to break down organic materials into compost; not suited for animal products or grease and best used for small-scale on-site composting systems.

All anaerobic digestion processes produce a digestate (compost) material, carbon dioxide (CO_2) and water vapor.

The City's current yard waste composting facility, adjacent to the Bluff Road Landfill, is operated using windrows. Yard waste compost is periodically turned and the final product is screened prior to use or marketing as LinGro Compost. This facility is currently close to capacity; expanded City composting operations to include food waste would likely require not only expansion of the composting area, but also modification to the current facility and operations including pre-grinding incoming materials, construction of forced aeration system, increasing operation staff and other features. Operated as a large scale organic waste composting operation would require a permit to comply with NDEQ Title 132 permitting requirements. Alternatively, other sites could be identified for organics composting in the County.

Issues with outdoor composting of food waste include vectors, odors and storage of waste. Wet food waste has less air voids than yard waste alone, which can result in anaerobic conditions and produce odors. To help minimize anaerobic conditions a forced aeration system is usually necessary for composting wet organic waste, with yard waste, in windrows. Grinding and mixing with yard waste along with frequent monitoring and turning would aid in effective aerobic decomposition. Storage can be a significant issue since standard operations of the existing facility does not provide a steady stream of yard waste (grass in summer; leaves in fall) and as such the City often needs to store yard wastes for extended periods of time before mixing and composting can begin (yard waste often stored through the winter, with composting beginning when grass supply increases and warm temperatures are available). Storage of large volumes of food waste is problematic and could lead to anaerobic conditions (odors) and vector issues with this technology.

In-vessel composters come in a variety of sizes and retention times, but generally have some type of mechanical mixing or aeration system. In-vessel composting can process larger quantities in a relatively small area more quickly than windrow composting and can better accommodate animal waste products (i.e. full range of readily digestible food waste). This technology is capital-intensive, but is well-adapted for processes that are likely to require odor control and reduced buffer space requirements to be acceptable to neighbors. There are three basic configurations with several subcategories in each configuration:

- Vertical flow reactors (anaerobic digesters) - agitated bed (multiple hearths or multiple floors), packed bed or silo
- Horizontal or inclined flow reactors - rotating drums or kilns, agitated beds (channels or bins, circular or rectangular shape) or static beds (tunnel reactors, ram or conveyor type)
- Batch reactors – enclosures, bags or boxes

In-vessel systems have a relatively high cost of construction and operation as compared to windrow systems, with a distinct advantage on digestion time and space requirements. The resulting compost is typically only partially digested and a secondary "curing" time, under aerobic conditions is necessary. This can be done with static piles or windrow systems. Aeration is often necessary for secondary curing to prevent undigested materials from becoming anaerobic; enclosed curing facilities may also be necessary to control odors. A thorough assessment of these in-vessel systems is beyond the scope of this paper. Ultimate selection of a composting technology will be dependent on the final feedstock mix, market, regulatory restrictions and adjacent land uses. Typical in-vessel requirements can include:

- Processing equipment - include aerated bins, bags, channels or agitated beds
- Buildings - needed to house in-vessel technology and windrow curing (typically aerated)
- Bunkers - covered and paved units to store cured compost prior to distribution
- Mobile equipment - front-end loaders, trucks and conveyance systems required to move materials between buildings
- Trommel screen - to remove oversized objects from end-product and prepare for market.

Anaerobic Organic Waste Digestion/Composting. Anaerobic digestion can be used to digest food and green waste, agricultural waste, wastewater treatment plant sludge or other similar waste streams. The anaerobic digestion process may either be a wet or semi-dry process depending on the total liquids and solids content of the waste being digested in the reaction vessel. Both types of anaerobic digestion processes involve an enclosed vessel where biological processes are used to decompose the organic waste to produce a semi-solid digestate (compost) material and a biogas. The biogas typically consists of methane, CO2 and water vapor. The resulting methane gas can be used as a fuel for boilers or an internal combustion engine or, in sufficient quantities, in a gas turbine to produce electricity. In many cases the volume of digester gas is insufficient, by itself to justify and energy recovery project and is therefore burned in a flare. If there is a market for the use of the gas, it may have to be treated to remove moisture or other contaminants. Odor is one characteristic of anaerobic digestion. As such, site location can be a major factor in siting a facility and odor control would be a necessary component of the selected implementation technology.

The remaining digestate (compost) material is typically between 10-30% (by weight) of the waste input depending on the type of anaerobic digestion process used. Anaerobic digestion is a less energy intensive process and typically results in a more thorough breakdown of readily digestible solid than is achieved by aerobic composting means. The digestate can be treated further (e.g. dried and cured aerobically) to produce a compost that can be marketed as a soil amendment (see discussion above on marketing).

This anaerobic digestion approach can be used to stabilize organic waste in the waste stream through one of the following methods:

- Anaerobic composting – stand-alone facility for food and other source separated organic wastes from the MSW stream.
- Co-composted – mixed with sewage sludge and digested at the City's wastewater treatment plant. This approach, would apply to a strategy that used garbage disposals (grinders) at the generation source and sanitary sewer system for conveyance of sink/food waste to the wastewater treatment facility. This approach might also be applicable if the City were to construct a pre-processing facility at the wastewater plant – the feasibility of this option on a large scale would require further evaluation.

Anaerobic digestion is widely used on a commercial-scale for industrial and agricultural wastes, as well as wastewater sludge. Anaerobic digestion technology has been applied on a larger scale in Europe on mixed MSW and source separated organics, but there is only limited commercial-scale experience in North America. The Greater Toronto Area is home to two of the only commercial-scale plants in North America that are designed specifically for processing source separated organic wastes.

Options Evaluation

The general issues that will need to be addressed in implementing an organic waste diversion/composting programs are:

- types of organic waste (produced and to be managed)
- markets for compost, digestate and biogas
- implementation considerations, especially the collection program
    - convenience
- participation and diversion levels
- costs of services and funding
- available processing capacity (new facility requirements)
- odors and emissions
- policy and ordinance changes
    - enforcement

Organics waste collection and management programs will vary depending upon the targeted waste generators (residential, commercial, both). Any programs implemented will need to be flexible, recognize the differences between generators, and obtain hauler, residents, business community and institutional support to be successful.

Based on NDEQ Title 132 criteria for solid waste processing facilities, current yard waste and commercial compost operations in the Planning Area may be able to take up to 1000 cubic yards per year of other materials (such as food waste) and still maintain partial exemption status. However, significant diversion of non-yard waste organics (food waste and soiled papers) will likely require special permits.

When organic waste is disposed in a landfill it decomposes under anaerobic conditions and produces landfill gas (methane and CO_2) which must be captured and destroyed to reduce emissions of methane. Methane and CO_2 are both greenhouse gases, but methane is considered 21 times more potent based a CO_2 equivalency.

To significantly increase diversion of organic waste, and more specifically food waste within the Planning Area, some form of targeted, source separated collection program will be necessary. Consistent with the guiding evaluation criteria developed for use in the Solid Waste Plan 2040,

the organic waste diversion options have been further evaluated based on the following considerations.

- **Waste Reduction/Diversion**: Removal of food and other organic waste from the MSW stream for management through composting would be considered a form of recycling, assuming markets are available for the compost/digestate. To be successful long-term financially sustainable markets will be necessary; sustainable local markets are not known to currently exist in the Planning Area and would need to be further researched or developed in conjunction with any program that added differing types of organics to the current yard waste composting operation or City biosolids production. Organics waste diversion would not necessarily reduce waste exports, but significant diversion efforts will extend the life of the landfill.
- **Technical Requirements:** New or expanded facilities would be required to undertake both collection and composting of additional organic waste streams. Changes will be required with the current MSW collection programs to implement organic or wet/dry collection programs. The most significant areas of risk may be associated with markets and as a result costs; related risks include contamination (product purity) and odor control. Markets for compost from a mixed stream of residentially and commercially generated food waste have not been established nationally. The techniques that produce compost (aerobic and anaerobic) from organic matter are well known and technically proven. Systems can be designed to effectively compost food and other organic matter and control odors, but the costs of these systems are higher than the cost of systems that compost only yard waste.
- **Environmental Impacts:** Both aerobic and anaerobic digestion produce CO2, which is a greenhouse gas; anaerobic digestion (which can also occur in uncontrolled aerobic processes) generates methane, which is a more potent greenhouse gas. Anaerobic operations are typically characterized by much more pronounced odors. Any system that relies on anaerobic processes will need to be contained (e.g., in a digester) and the methane captured. Captured methane can be a fuel source, if a market exists, or will need to be burned to reduce methane to CO_2 and water. Storage, handling, and management of food waste on a large scale will require additional health and safety practices, because as it reaches the management facility it is a biologically active waste (rotting and decaying). All composting and management processes will need to be designed to limit environmental emissions (air and water).
- **Economic Impacts:** Implementation of an expanded organics management program (beyond current voluntary yard waste collection and City provided receiving, processing and composting) will require added capital expenditures for the collection, storage and processing (composting), as well as post processing storage. Unless economically advantageous markets are identified, the cost to residents and businesses will be higher than the status quo. If an expanded organics collection and composting program were to be undertaken decisions would be required on the role of public and private entities in funding additional systems, facilities, and programs. The economic development potential associated with this management option may be limited to employment opportunities (haulers and composting facility), marketing and distribution of the compost/digestate product.
- **Implementation Viability**: Implementation will require legislative and regulatory changes. Because food waste is generally putrescible the changes required in collection, storage, and management at the source of generation (household or business) should be anticipated to result in some level of social/political discontent. Until

a more defined strategy is developed it can not be clearly determined how such a strategy will affect the parties responsible for generation of this waste type. Additional land and siting is generally anticipated to be necessary with a large scale program; some minimization of land and facilities may be possible if anaerobic digestion can be accommodated within the City's existing WWTF. Any facility handling more than 1000 tons per year of organic material (not yard waste) will require additional state and local permits.

Relationship to Guiding Principles and Goals

As it relates to the Guiding Principles and Goals of the Solid Waste Plan 2040, organics waste diversion (composting) is directly applicable, as further noted below.

- **Emphasize the waste management hierarchy**: management of organic materials (yard waste, food waste, and (soiled) papers) is directly related to the waste management hierarchy in that it places maximum emphasis on reduce, reuse, and recycle (composting) to avoid or minimize disposal in the City's landfill. Current programs for diversion of collected yard waste from disposal are compatible with this hierarchy. To significantly increase diversion, above the status quo, food waste (and possibly other organics) from commercial and residential sectors will need to be actively targeted.
- **Encourage public/private partnerships**: current curbside collection of yard waste is voluntary (subscription based) through private haulers and relies significantly on City provided receiving, storage, composting and marketing of the end products. Expanding collection to include food waste (e.g., wet/dry collection programs) would likely be provided by private haulers but the structure of such programs and the party responsible for the additional composting facilities would require further evaluation, in conjunction with the implementation of this type of program.
- **Ensure sufficient system capacity:** increased source reduction programs for yard wastes could help delay the need for additional infrastructure during the planning period. The Planning Area currently does not have a compost facility permitted with NDEQ to accept large volumes of food waste or similar organic wastes. Development of an expanded organics collection and composting is anticipated to require added infrastructure for storage and collection at the generator's level, and additional facilities for composting. Additional system changes would also be anticipated with the hauler collection system to provide for handling of source separated, putrescible, organic materials. Many commercial establishments may not have sufficient space for separate food waste/organics bins in addition to existing containers and possible recyclables containers; each will need to evaluate their space requirements. Private haulers may need to procure additional collection equipment to specifically serve organics collection customers.
- **Engage the community:** increased source reduction of food waste (e.g., food pantry programs or onsite composting) will require an engaged community because it ultimately seeks to enhance the current practices. Development of an organic materials diversion program and related ordinances (for collection) will need to engage the residential and business community, private haulers, and potential processors to develop a viable and enforceable program. Some opposition to change can be anticipated. Public education to engage the community will be important to facilitate change, and to increase and sustain participation in any source reduction program and organics collection/composting program.

- **Embrace sustainable principles:** Reduction in the quantity of organic wastes generated (source reduction) and reuse of the products resulting from composting operations are consistent with sustainability principles. Composting emphasizes minimizing environmental and social impacts. Recovery of organic materials and recycling/composting, possibly with energy recovery (anaerobic digestion) will reduce the quantities of waste disposed and further recognizes that waste is not inevitable and discarded materials are potentially valuable resources.

Summary

Organic (waste) refer to a broad range of materials, often derived from plants and living things. In traditional, municipal solid waste (MSW) management and for purposes of this paper the term organic waste will be used to refers to the following materials: yard trimmings, food scraps, wood waste, and paper/fibers, including paperboard products. Organic wastes biologically decompose (resulting in air emissions) and as a category of waste, organic waste is typically the largest component of the solid waste stream.

Current curbside collection of yard waste is voluntary, subscription based through private haulers and relies significantly on the City provided receiving, storage, composting and marketing of the end products. Implementation of expanded organics diversion programs (e.g., food waste composting) will likely require laws/ordinances to mandate a basic program and define levels of service. While the technologies to undertake composting are well known the most significant risk may lie in long-term, viable and economically sustainable markets for the compost/digestate. Large scale, source separated, organics (food and soiled papers) is an emerging strategy in the US, with a somewhat tainted history of unsuccessful (MSW composting projects/programs.

If increased organics diversion and composting are selected as part of the strategies for inclusion in the Solid Waste Plan 2040, if may be appropriate to begin with a pilot program and target select waste streams. In all instances markets for the resulting compost will likely be the key to economic viability and success of any such program.

Appendices

Appendix 1 – Biosolids Classifications

To ensure that biosolids applied to the land do not threaten public health, the U.S. Environmental Protection Agency (USEPA) created the 40 CFR Part 503 Rule. It categorizes biosolids as Class A or B, depending on the level of pathogenic organisms in the material, and describes specific processes to reduce pathogens to these levels.

The rule also requires "vector attraction reduction" (VAR) – reducing the potential for spreading of infectious disease agents by vectors (i.e., flies, rodents and birds) – and spells out specific management practices, monitoring frequencies, record keeping and reporting requirements.

Class A Biosolids - contain minute levels of pathogens. To achieve Class A certification, biosolids must undergo heating, composting, digestion or increased pH that reduces pathogens to below detectable levels. Class A biosolids can be land applied without any pathogen-related restrictions at the site. Class A biosolids can be bagged and marketed to the public for application to lawns and gardens.

Class B biosolids have less stringent standards for treatment and contain small but compliant amounts of bacteria. Class B requirements ensure that pathogens in biosolids have been reduced to levels that protect public health and the environment and include certain restrictions for crop harvesting, grazing animals and public contact for all forms of Class B biosolids. Class B biosolids are treated in a wastewater treatment facility and undergo heating, composting, digestion or increased pH processes before leaving the plant. This semi-solid material can receive further treatment when exposed to the natural environment as a fertilizer, where heat, wind and soil microbes naturally stabilize the biosolids.

APPENDIX 2

Dubuque's GreenCart Program – Food Scrap and Organics Recycling 7-1-10

Dubuque is the **first city in Iowa** to offer a curbside food scrap recycling program. Currently up to 300 households, businesses and institutions are encouraged to subscribe to this fee-based program. Subscribers will be provided **a 2-gallon KitchenCatcher and a 12-gallon, wheeled, GreenCart**. The subscription for each GreenCart is only **$0.60 per month**. It is billed on the City Utility Bill. Larger container options are available to our business and institutional customers: 48 gal carts @ $5.50 per month, and 64 gallon carts @ $8.50 per month.

The food scrap recycling program has helped us 1.) Extend our landfill life, 2.) Reduce pollution (especially methane - a powerful greenhouse gas), 3.) Maintain Dubuque County's recycling rate above 25 percent, and 4.) Create a beneficial compost product for gardens and landscaping. According to the 2005 IDNR Waste analysis, more than 25% of the current refuse materials set out from the average Dubuque household could be processed into compost.

Weekly Curbside Set out

The GreenCart is **co-collected every week** with yard waste on your regularly scheduled collection day from the first full week in April through the last full week in November. Weekly setouts are recommended to reduce neighborhood sanitation concerns. Place your GreenCart at the curb or alley setout point by 6 a.m. The GreenCart has a weight limit of 40 pounds. Do not set out the smaller indoor container (your KitchenCatcher) – it might get blown away if placed at the curb.

Feed your GreenCart over the Holidays

Use your GreenCart to reduce the compostables that you or your neighbours might have thrown out during the holidays. Instead, feed your GreenCart. Watermelon rinds, bones and all food leftovers from entertaining can be disposed of in your GreenCart. If you have too much material to fit in your larger GreenCart, your extra compostables, weighing less than 40 pounds, could be placed in a paper yard waste bag for collection with an attached single-use yard waste sticker.

Compostable Paper and Landscape Materials

Add paper! Non-recyclable paper, tissues, paper towels, paper cups, paper plates, paper take-out containers and messy pizza boxes are great additions to the GreenCart. Not only are they compostable, but they reduce pests by decreasing the moisture content in the cart. The drier the material, the easier it is to handle. Discarded potted plants (pots removed) and other plant material are also great additions.

GreenCart Storage

Store your 12-gallon GreenCart where you currently store your regular trash container (in the garage or at the side of your home.). Keep out of direct sunlight.

Kitchen Catcher

Store your Kitchen Catcher in a convenient location (on the counter, under the sink or mounted to the inside of a cupboard door). We recommend emptying the contents every two days or so.

More Tips

- **<u>PLASTIC BAGS ARE NEVER ALLOWED IN THE GREENCART</u>**. Plastic does not degrade and results in an undesirable compost product.
- Wash your GreenCart and Kitchen Catcher (dishwasher safe) with mild detergent as required. It helps reduce odors.
- To reduce odor and minimize mess, you can line your bins or wrap / cover loose scraps in newspaper or a paper bag. Placing compostable paper in the bottom of the cart helps absorb liquids.
- If you have a bad odor forming, you can sprinkle a small amount of baking soda onto the materials in the GreenCart to absorb liquids and help reduce odor.
- The smell from a little concentrated household cleaner applied to the outside of the GreenCart has worked as a deterrent to critters trying to investigate the contents of your GreenCart.

For further information or to subscribe, call the Public Works Department at 589-4250.

Food Scrap Recycling - What can go into the GreenCart?

Total weight of contents not to exceed 40 pounds

Acceptable Items

Baked goods & dough
Bread, toast
Butter & margarine
Cake, cookies & candy
Cereal & oatmeal
Cheese & dairy products
Coffee filters & grounds
Corncobs & husks
Eggs & eggshells
Fish & fish parts, shellfish
Fruits & vegetables
Flour, grains & rice
Gravy & sauces
Grease, lards & fats
Herbs & spices
Jams & jelly
Mustard & mayonnaise
Meat, bones & meat products
Muffins & muffin papers
Nuts & nutshells
Pasta & pizza
Peanut butter
Plate scrapings
Popcorn
Salads & salad dressing
Sour cream & yogurt
Sugar & syrup
Tea bags

Greasy pizza boxes
Microwave popcorn bags
Paper napkins, plates & cups
Paper take-out trays
Paper towels & facial tissues
Popsicle sticks & toothpicks

Cut flowers

Houseplants (soil ok but no pots)

Yard Waste: grass, leaves, trimmings, small prunings, culled garden produce, weeds, sod

Unacceptable Items

Animal waste & bedding, including droppings and litter
Cigarette butts and ashes
Dead animals
Diapers
Disposable mop sheets
Feminine hygiene products
Hair/pet fur, feathers
Hazardous waste
Medical waste
Plastic films, straws and bags, tubs & lids
Textiles, clothing, shoes, etc.
Wood & treated wood
Vacuum bags/dust
Waxed paper & waxed cardboard
Wood ashes (cold)
Wood chips & sawdust
Wine corks

Into your yellow recycling bin

Paper: clean cardboard, newspapers, magazines, catalogs, junk mail, cereal boxes, egg cartons, paper towel rolls, toilet paper rolls, paper bags, etc.

Metal: cans, foil

Glass: jars, beverage containers

Plastics: #1 thru #5

Question about something that is not on the list? Contact us at 589-4250