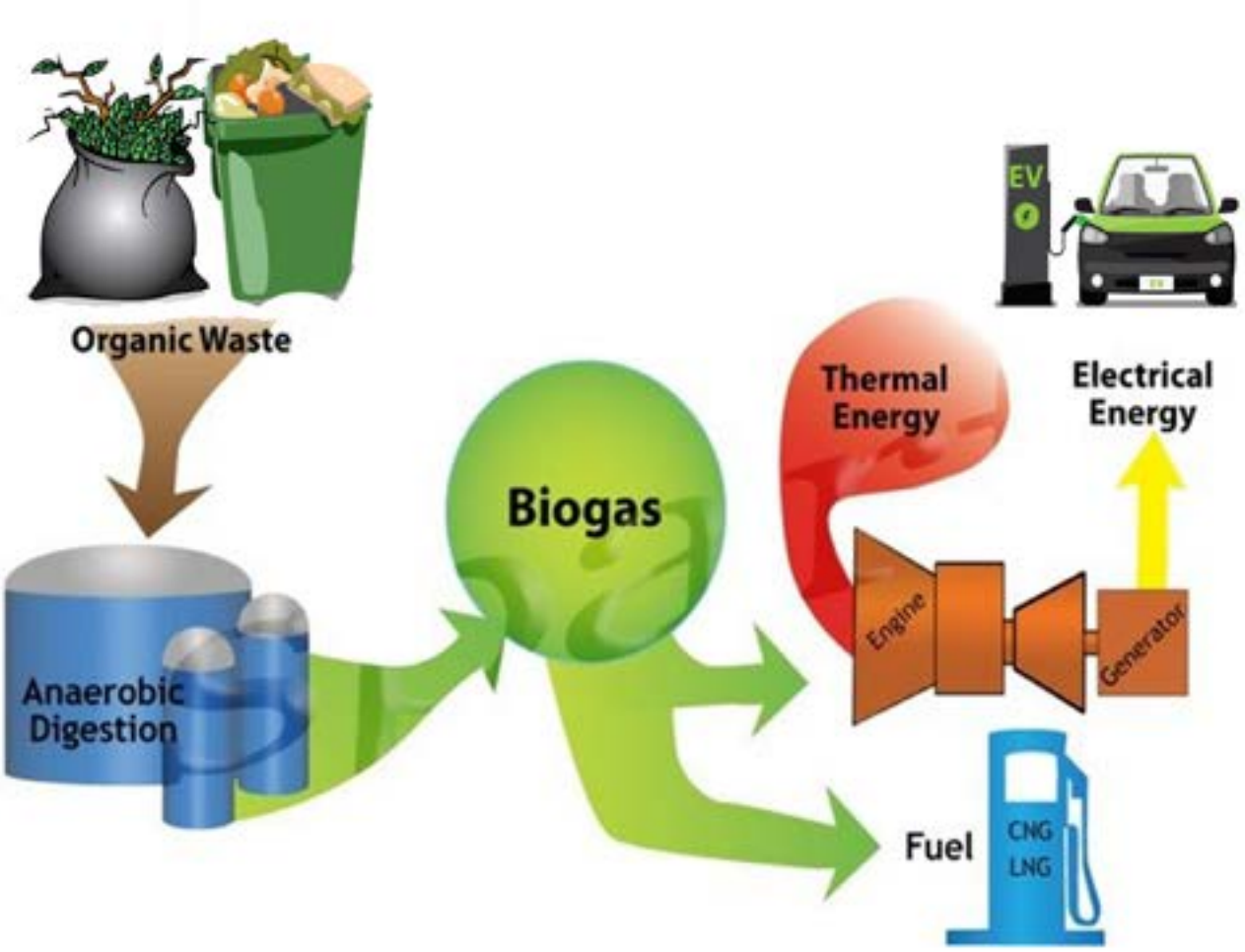

Anaerobic Digestion of City Food and Yard Waste: Answers to 10 Critical Questions

UNIVERSITY OF TEXAS ARLINGTON

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Contents

Introduction

As cities strive to manage their carbon footprint and their contribution to the global climate crisis by reducing the greenhouse gases (GHG) released into the atmosphere, many are turning towards more sustainable options to manage organic waste.

This guidebook is designed to answer common questions that cities may face when considering diversion of food and yard waste from landfills. This will help cities create a win-win-win of saving edible food and producing energy while simultaneously addressing the climate crisis.

Question #1: How much food and yard waste are generated in the U.S.? Why is it a problem?

Nationwide, 22% of the waste that goes to municipal solid waste (MSW) landfills is food waste (US EPA, 2018a). Each person generates an estimated 248 pounds of food waste per year. This equals 82 billion pounds per year nationally and is expected to reach 109 billion pounds by 2050. Large serving "supersized" portions typical of restaurants today, coupled with some consumers' reluctance to store leftover food for later use, contribute to U.S. food waste (Bender, 2017). At the same time, 42 million Americans are food insecure, lacking reliable access to sufficient, affordable, nutritious food (US EPA, 2015). As a consequence the U.S. Environmental Protection Agency (EPA) has set a goal of cutting food waste by 50% by 2030.

Furthermore, 7.8% of waste that goes to landfills is yard waste (US EPA, 2018a). Around 67 pounds of yard waste are generated per person per year, on average. This is approximately 22.3 billion pounds nationally and will reach 29.5 billion pounds by 2050.

"By 2050, the U.S. will generate 7.67 billion tons of methane - enough to fuel 3,741 CNG and 6,897 electric vehicles."

When food and yard waste reach a landfill, they are decomposed by microorganisms, producing carbon dioxide (CO_2) and methane (CH_4), in the absence of oxygen. Methane is a potent greenhouse gas, trapping 28 times more heat than carbon dioxide (CO_2). Landfills are the third largest source of U.S. methane emissions, contributing 23% (US EPA, 2019). Food waste poses a particular problem: since food waste degrades more quickly than most other organics, most methane generated by food waste escapes to the atmosphere before the landfill gas collection and recovery system is installed in a given section of the landfill (typically at the end of two years).

Diverting food and yard waste from landfills can reduce methane emissions, as well as save landfill space, increasing the lifespan.

Question #2: Why should my city consider collection of food and yard waste? What can be done with food and yard waste once it is collected?

There is no way to stop food waste completely; however, collection of food and yard waste allows it to be used beneficially, rather than consuming space in the landfill. The United States Environmental Protection Agency (EPA) has developed a Food Recovery Hierarchy as a means to prioritize management strategies for food waste. Preference is given to the top tiers of the hierarchy, which create the most benefits for the environment, society, and the economy. "Source reduction" programs aim to reduce food waste from being generated in the first place by growers (commercial farms and ranches), the producers (grocery stores and restaurants), and consumers. Strategies for "feeding the hungry" include regulations that allow for gleaning of fields and donation of food before the expiration date. This donation is typically made to the food banks and shelters within the city.

"Industrial uses" include anaerobic digestion (AD), which provides a wide range of benefits: reducing greenhouse gas emissions, production of renewable energy, and production of fertilizer (by-product). According to the hierarchy, preference is given to AD over composting. Both AD and composting produce a fertilizer/soil amendment as an end product, but AD produces renewable energy as well.

Following the EPA's recommendations, the least preferred options for food waste are landfilling and incineration. Although incineration can recover energy, it is not a good option for food waste due to its high moisture content; much of the recovered energy is lost in evaporating moisture.

Question #3: Are there examples of successful food/yard waste collection programs in the U.S.?

There are several successful food diversion programs across the U.S. A few examples are provided here.

1. San Francisco, California

San Francisco, California enacted an ordinance in 2009 which bans landfills from accepting food waste. By 2012, San Francisco had seen 81% diversion of food waste from the landfill, according to Alex Demitrew, Commercial Zero Waste Coordinator, San Francisco Department of the Environment. San Francisco's program provides 3-stream service recycling, composting, and trash

for all sectors: residential, multi-family, and commercial. In 2020, this program was diverting approximately 700 tons of organics per day from landfills. The entire program is funded by ratepayers (generators). Because of this, the department is not supported through the general fund and receives no tax the general fund and receives no tax funds.

> *"If we knew then what we know now, we would have implemented our Mandatory Recycling and Composting Ordinance a lot sooner." - Alex Dimitrew, Commercial Zero Waste Coordinator, San Francisco Department of the Environment*

2. Austin, Texas

Since its inception in 2018, the City of Austin's Zero Waste goal aims to divert at least 90% of discarded materials from area landfills by 2040 (City of Austin, 2020). A study released by Austin Resource Recovery found that nearly 20% of what ends up in landfills from private waste streams is food that could have been recovered to feed people, converted to animal feed, or composted. Eliminating food waste will also help to meet the City's goal of net-zero community-wide greenhouse gas emissions by 2050, since landfilled food waste generates methane, this program unfortunately does not utilize anaerobic digestion for methane capture. AD is preferable to composting from an environmental perspective because it produces

a renewable source of energy in the form of biogas, and composting wastes this energy as heat.

Austin's organics diversion program is directed at both residential and commercial customers, and maintained by a contracted company. Although the city encourages donation of food prior to the use-by date, no city tax incentives are available for food donation, only those available from the federal government. As a means of vector/vermin control, residents are provided outside storage bins with covers for organic materials, which are picked up weekly.

Yard trimmings collected curbside are composted to create mulch. The mulch is made available to the public for free.

3. Washington State

Washington State's food diversion program was enacted in 2019, in conjunction with the Departments of Health, Agriculture, and the Office of Public Instruction, in order to divert 50% of organic waste by 2030 (Washington State, 2020). This program is regulatory; therefore no incentives are provided for compliance. The Department of Ecology program under Washington States' House Bill 114 requires the rescue and diversion of edible food to anti-hunger agencies. Additionally, food-generating businesses (grocery stores, restaurants and institutions) are advocating adoption of enhanced legislation to the Good Samaritan Food Donation Act (RCW 69.80.031) as a means to alleviate safety concerns.

As of January 1, 2019 single-family residences, multi-family residences, and businesses are prohibited from putting significant amounts of food waste, as well as compostable food-soiled paper towels, paper napkins, and pizza boxes, in their garbage containers; recyclables (paper, cardboard, glass and plastic bottles and jars, aluminum and tin cans) are also banned. Details of the ban include the following:

Single-family residences: Single-family residence' garbage carts should not contain recyclables or food waste. Recyclables and food waste should be put in separate carts.

Multi-family residences: Apartments and condos must provide convenient food/yard waste service and recycling service for their residents. Seattle Public Utilities (SPU) gives warning notices for multi-family garbage containers that contain recyclables and food waste. For each warning, the property will receive a tag on the container and a notice will be mailed to the account. After two warnings, properties may receive a $50 fee on their waste bill for recyclables in the garbage.

Commercial businesses: The ordinances specify that a fee may be applied to a solid waste account when more than 10% of the garbage container (by volume) contains prohibited materials, food waste, food-soiled paper, and/or recyclables. All commercial establishments that generate food waste or compostable paper are required to subscribe to food/yard waste service, compost their food waste on site, or self-haul their food waste to a transfer station for processing.

4. Vermont State

Vermont has a total ban on the disposal of food scraps in the trash or landfills, which took effect July 1, 2020. Due to the rural nature of the state, Vermont focuses on residential composting as an alternative method of food waste disposal, according to Emma Stuhl of Vermont's Solid Waste Management program. Vermont residents are encouraged to conduct at-home composting; those residents who do so may continue to dispose of meat and bones in the trash. For residents that choose not to participate in at-home composting, food waste drop off facilities are available to receive organic waste. The Vermont ban provides unique solutions for business/institutions; if the businesses have edible food, they are encouraged to donate edible food to food banks. Due to the focus on residential composting, food waste is not used in the generation of energy in Vermont; however, wood chips are used for energy production. Due to the regulatory nature of the program, no incentives are provided for participation.

Question #4: What obstacles have cities encountered in separate collection of food and yard waste, and how have the obstacles been overcome?

Segregating food waste is not without its issues. There are odor, vector, and vermin control to consider. San Francisco provides a 1.5-gal ventilated in-house container to deter mold and other odor issues. Additionally, the city also provides biodegradable plastic bags for purchase at $5.00 per 25 bags as a means to address odor issues. According to Alex Dimitrew, Commercial Zero Waste Coordinator, San Francisco Department of the Environment, San Francisco uses enzymatic to control the vector and vermin and schedules pickup times every three days to control the odor.

In Vermont's program, which focuses on residential composting, Stuhl states that small screens are used to control the vermin, and "if done properly, composting does not have a smell; therefore, it does not attract any large animals such as bears."

Question #5: What incentives/penalties could my city use to encourage public participation in a separate collection of food and yard waste?

Posted green waste tipping fees at disposal and diversion facilities that accept green waste in California.

Facility	Median Green Waste	Average Green Waste	Range Green Waste
Landfill	$39	$40	$9-$126
Transfer Station	$41	$49	$0-$178
Compost	$30	$30	$0-$127
Chipping and Grinding	$36	$40	$0-$128
Biomass	$13	$16	$0-$47

Table 1 courtesy of the Department of Resources Recycling and Recovery (Cal Recycle, 2015)

Encouraging participation requires the right balance between penalties and incentives, or sticks and carrots. Massachusetts mandates food waste diversion for growers/producers. In 2014, 1350 businesses signed on and diverted 100,000 tons of biomass; by 2018, 2300 additional businesses were signed on and diverted 280,000 tons. No incentives are provided to encourage participation.

While most programs, like Massachusetts, have taken the route of mandatory participation for commercial growers/producers, a few have mandatory residential programs. San Francisco has a total ban on food waste in garbage, enforced through fines: $100 for small businesses and single occupancy homes, and up to $1,000 for large businesses or multi-unit

Median posted tipping fees for green waste. The green line is the landfill median. All landfills were surveyed in this study; other facilities have a portion of facilities sampled.

Chart courtesy of the Department of Resources Recycling and Resources (CalRecycle 2015)

buildings.

Although most of the programs are mandatory due to regulation, other solutions for encouraging participation are tax incentives for donating food before it becomes waste. The federal government's tax incentives for businesses have been extraordinarily successful in motivating food donations. Food donations across the country rose by 137% in 2006, the year in which Congress provided liability protection to food donors via an enhanced good Samaritan law (NRDC, 2017). With the passage of the Protecting Americans from Tax Hikes (PATH) Act in December 2015, all businesses — including C-corporations, S-corporations, limited liability corporations (LLCs), partnerships, and sole proprietorships — are eligible for an enhanced tax deduction for food donations. A model ordinance requiring food waste separation is included on page 21.

Question #6: What is anaerobic digestion? Why should food and yard waste be digested rather than composted?

Anaerobic digestion (AD) converts organic material, in the absence of oxygen and under controlled conditions, to biogas. Biogas (60-70% methane, 30-40% CO_2 and trace amounts of other gases) can be used as a source of renewable energy. After removing impurities (e.g. hydrogen sulfide and water vapor), biogas can be compressed to form compressed natural gas (CNG), or burned to generate electricity or can be directly used for heating. Anaerobic digestion also produces digestate as a by-product, a stabilized residual that can be used as a fertilizer.

In both AD and composting, microorganisms decompose organic wastes to produce fertilizer as an end product. Composting occurs in the presence of oxygen; AD occurs without oxygen. Composting dissipates the energy of microbial reactions as heat, whereas AD stores this energy in the form of biogas (methane). Thus, AD is preferable to composting from an environmental perspective because it produces a renewable

source of energy in the form of biogas, and composting wastes this energy as heat.

Question #7: Are any cities in the U.S. successfully digesting food and yard waste?

Los Angeles is utilizing anaerobic digestion (AD) and is increasing their food-to-biogas program through a facility owned by Kompogas, which takes in about 100,000 pounds of waste a day. The facility produces enough energy to fuel itself and 600 homes a year. The city mitigated odor issues from food waste and complied with California's food waste diversion requirements when it switched to the anaerobic digester (Dawson, 2019).

Newtown Creek Waste Water Treatment Plant - Photo courtesy of Insider.com

One of the country's largest facilities is in Brooklyn, New York, which in 2016 began using its own Newtown Creek Wastewater

Treatment Plant to process 130 tons of liquefied food waste, roughly 3% of the city's daily food waste.
Food waste is just a fraction of the sewage that the plant handles in its eight gleaming egg-shaped silver tanks. Officials expect that Newtown will produce approximately 190 to 275 million cubic feet of natural gas for local electricity generation by this year (Blesener, 2019).

City population	Number of fleet vehicles powered by food waste		Number of fleet vehicles powered by yard waste		Total fleet vehicles powered	
	Electric	CNG	Electric	CNG	Electric	CNG
100,000	142	77	401	218	543	294
500,000	709	384	2005	1088	2714	1472
1,000,000	1417	768	4011	2176	5428	2944

Question #8: How many vehicles can be fueled from digesting food and yard waste?

Digesting the food waste generated by the average American in one year - around 248 pounds (US EPA, 2018a) - could provide enough energy for an electric vehicle (E.V.) to travel about 41 miles, or a CNG vehicle to travel around 22 miles. Fleets are attractive targets for alternative fuels like biogas because they mean many vehicles will be able to take advantage of installing a refueling station, which is typically costly. The table below shows the number of fleet vehicles that could be fueled from the food and yard waste of cities of various sizes, assuming that an average fleet vehicle

travels 29,000 miles/year (NCTCOG, 2019). [1]

Question #9: How much would anaerobic digestion of food and yard waste cost for my city?

The up-front cost of building an anaerobic digestion facility can be higher than that for starting a composting facility. However, many cities already have anaerobic digesters that convert sewage sludge at wastewater treatment plants (WWTPs) to biogas. Food and yard waste can be added to these digesters at little cost. According to EPA, 78 digesters at WWTPs across the U.S. were co-digesting food waste in 2015 (US EPA, 2018b). Of these, 25 used the biogas to generate electricity, and one generated compressed natural gas (CNG) as vehicle fuel. With 14,748 WWTPs across the U.S. (University of Michigan, 2018), the substantial potential exists for expanding the co-digestion of food and yard waste at WWTPs.

Developed in a US DOT-funded project, the Food & Flora Waste to Fleet Fuel (F^4) Tool can be used to assess the economic feasibility of anaerobic digestion of food/yard waste. The F^4 Tool offers a choice between using digester biogas to generate electricity or upgrading it to compressed natural gas, either of which can be used as a fleet fuel. As shown in the figure below, the F^4 Basic Tool requires only five numerical and three multiple-choice inputs. F^4 can accept additional optional user inputs, for a more refined cost-benefit analysis. Although the F^4 Tool was developed to evaluate the use of existing wastewater treatment plant (WWTP) digesters for food/yard waste co-digestion, it can also be used to assess the economic feasibility of new or existing concrete digesters not associated with WWTPs.

1 These calculations assume mid-range biogas yields of 0.017 m^3/lb wet food waste and 0.055 m^3/lb wet yard waste (Deublin and Steinhauser, 2008), and biogas with a mid-range methane content of 60%, with a heating value of 600 Btu/ft^3 (Swedish Gas Technology Centre, 2012). The E.V. calculation also assumes a mid-range steam turbine efficiency of 42.5% for electricity generation (range 40-45%, Webber, 2007) and electricity consumption of a 2011 Nissan Leaf (3.7 mi/kWh). The CNG calculation assumes that the CNG vehicle gets about the same fuel economy as a conventional gasoline vehicle on a gasoline-gallon-equivalent basis (US DOE, 2019). The fuel economy of a 2015 CNG Honda Civic (31 MPGe, Compare.com, 2018) is used. Miles traveled for the E.V. exceeds the CNG vehicle because of the low efficiency (15-25%, Webber, 2007) of the CNG vehicle's internal combustion engine (ICE). Although the steam turbine used to generate electricity has only a 40-45% efficiency, the efficiency of the electric motor in the E.V.is 60-75%, which gives an overall efficiency of around 29%, which is greater than the 15-25% range for the ICE.

Question #10: Where Can I Find Out More Information?

For a complete list of food diversion programs in the US, visit the US Environmental Protection Agency website at https://www.epa.gov/sustainable-management-food/wasted-food-programs-and-resources-across-united-states .

For more information about anaerobic digestion, visit the US EPA website at https://www.epa.gov/anaerobic-digestion .

Please also visit the F^4 Framework website: https://www.uta.edu/academics/schools-colleges/engineering/research/centers-and-labs/seer

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The following food diversion regulations are an amalgamation of several programs currently active in several states and in the United Kingdom. Due to the nature of the legal language, certain similiaries can not be avoided.

Sample Food Waste and Yard Waste Ban policy

SAMPLE FOOD WASTE/YARD WASTE
ENVIRONMENTAL REGULATION
2020 No. 001

ENVIRONMENTAL PROTECTION, SAMPLE REGULATION

Applicability

(1) shall apply to all solid waste management activities and facilities including, without limitation, landfills, dumping grounds, transfer stations, solid waste combustion facilities, solid waste processing and handling facilities, recycling facilities, refuse composting facilities and other works or sites for the storage, transfer, treatment, processing or disposal of solid waste and the beneficial use of solid waste.

(2) also shall apply to any person disposing or contracting for disposal or transport of solid waste or restricted materials (restricted materials to be determined by the municipality).

Definitions

[Add the following definitions for commercial organic material]

Commercial Organic Material means food material and yard waste material from any entity that generates more than one ton of those materials for solid waste disposal per week, but excludes material from a residence.

[Add the following definitions for combustion facility]

Food Material means material produced from human or animal food production, preparation and consumption activities and which consists of, but is not limited to, fruits, vegetables, grains, and fish and animal products and byproducts.

Residence or Residential means a single, multi-family, or group home, or apartment complex. For purposes (to your Environmental Regulation), a group home means an establishment, usually resembling a private home, for providing a small group of persons with special needs, such as handicapped or elderly persons or children, with lodging and supervised care. Residence does not include any centralized dining facility.

Restricted Material means any material subject to a waste restriction at a solid waste management facility pursuant to (your Environmental Regulation. See table 2 for restricted material definitations.)

Vegetative Material means plant material.

Exemptions

(1) Facilities and Operations Not Subject to Environmental Regulations - Facilities and operations exempted from site assignment by the Site Assignment for Solid Waste Facilities Regulations,

Applicability, are exempted from the requirements of your Environmental Regulation with the exception of which applies to

any person disposing or contracting for disposal or transport of solid waste or restricted materials listed in (your Environmental Regulation)

Final Amendments to your Environmental Regulations

Waste Bans

(1) Purpose. The Department may restrict or prohibit the disposal, or transfer for disposal, of
certain components of the solid waste stream when it determines that:

(a) disposal of the material presents a potential adverse impact to public health, safety or the environment;
(b) a restriction or prohibition will result in the extension of the useful life or capacity of a facility or class of facilities or reduce its environmental impact; or
(c) a restriction or prohibition will promote reuse, waste reduction, or recycling.

(2) General and Specific Restrictions. Where the Department makes a determination to restrict
or prohibit the disposal, or transfer for disposal, of a particular material it may:

(a) require as a condition of issuance of a permit that a facility prohibit or limit the disposal, or transfer for disposal, of particular types of material;
(b) require as a condition of continued operation under an existing plan approval or permit that a facility or a class of facilities prohibit or limit the disposal, or transfer for disposal, of particular types of material; or
(c) determine that a specific facility or class of facilities are

not approved for the disposal of particular types of material and may not contract for the disposal of particular types
of material. For the purpose of (your environmental regulation) disposal or contract for disposal shall include, but not be limited to:

1. entering into an agreement to dispose or transport for disposal of materials restricted from disposal in violation of (your Environmental Regulation)
2. depositing restricted materials for collection, contracting for the collection of such materials or collecting or transporting such materials in a manner which results in the disposal of materials in violation of Environmental Regulation ___; or
3. intentionally contaminating or co-mingling with solid waste pre-sorted material restricted from disposal which would result in the need to dispose of said material in violation of Environmental Regulation ____

(3) Compliance with Waste Restrictions.

(a) Effective on the dates specified in (your Environmental Regulation) restrictions on the disposal or transfer for disposal of the materials listed therein shall apply as specified.
(b) No person shall dispose, transfer for disposal, or contract for disposal or transport of the restricted material, except in accordance with the restriction established in the Table 2. Any person who disposes, transfers for disposal or contracts for disposal transport of restricted material may be subject to enforcement by the Department

pursuant to (your Environmental Regulation)
(c) No landfill, transfer facility or combustion facility shall accept the restricted material except to handle, recycle or compost the material in accordance with a plan submitted pursuant to (your Environmental Regulation) and approved by the Department.

The following table is a suggested guide

Restricted Material	Effective Date for Landfills or Combustion Facilities	Effective Date of Restriction for Transfer Facility	Restriction
Yard Waste	(Date Enacted)	Date Effective	Ban on disposal or incineration or transfer for disposal at a solid waste disposal facility
Recyclable paper,			Ban on disposal or incineration or transfer for disposal at a solid waste disposal facility
Organic Materials (Pre-line Food)			Edible food to be distributed to shelters prior to active spoilage or at the end of each dinning shift (breakfast/lunch/dinner)
Organic Materials (Post-line Food)			To be diverted to Compost/Livestock feed or AD if available
Organic Materials Grocery			To be donated to shelters no later than 1 week prior to the sell by date
Organic Materials post-culled produce			Post-culled produce to be made available for collection from food banks, shelters, and community food suppliers (non-profit).
Organic Materials post-harvest			Farms to allow for non-commercial gleaning of the fields (post-harvest)

Table 2 - Restricted Material

STATUTORY INSTRUMENTS
September 2020
ENVIRONMENTAL PROTECTION
FOOD WASTE REGULATION

Coming into force per Environmental Regulation (your environmental regulation), The Department of Environmental Protection, or other agency in charge of waste collection

(a) the Environment Agency;
(b) such bodies or persons appearing to them to be a representative of the interests of local government, industry, agriculture, and small business respectively as they consider appropriate; and
(c) such other bodies or persons as they consider appropriate.

This Act's purposes are for the prevention, reduction, and management of organic (Food and Yard) waste.

The Department of Environmental Protection, concerning State or municipality, make these Regulations in exercise of the powers conferred by said State under the Environmental Protection Regulation (Enter your Regulation here).

PART 1 General

Citation, commencement, and extent

(1) These Regulations may be cited as the Waste Regulations 2020.
(2) Subject to paragraph (enter a regulatory paragraph of the Environmental Protection Regulation of your Municipality, they come into force on the day after the day on which they are made.
(3) Regulation comes into force at the end of 6 months, beginning with the day on which these regulations are made.
(4) These Regulations extend to (City or State)

Application

2. Subject to regulation (Environmental Regulation), these Regulations do not apply concerning waste, which is excluded from the Waste Framework's scope.

Interpretation

3. (1) In these Regulations, "appropriate authority" means concerning the Secretary of State; (or city authority)
(a) "waste management plan" means a waste management plan prepared by an appropriate authority;
(b) "waste collection authority" means an authority that is a waste collection authority for the purposes of the Environmental Protection Act (or regulation).

(2) Terms which are used but not defined in these Regulations and are used in the Waste Framework Directive have the same meaning as in that Directive.

PART 2. Waste prevention program
Establishment of a waste prevention program

4. (1) The appropriate authority must, not later than (Enter Date):

(a)evaluate the usefulness of the waste prevention measures set out as examples of the Waste Framework Directive and any other such standards the authority thinks fit; and

(b)establish one or more programs of waste prevention measures (each a "waste prevention program").

(2) A program established before the coming into force of these Regulations may be a waste prevention program.
(3) In this regulation, "waste prevention measures" means measures taken before a substance, material, or product has become waste that reduces:
(a)the quantity of waste, including through the re-use of products or the extension of the life span of products;
(b)the adverse impacts of generated waste on the environment and human health; or
(c)the content of harmful substances in materials and products.

Purposes etc. of the waste prevention program.
5. The appropriate authority must ensure that a waste prevention program.
(a)is compatible with the objectives in paragraphs (enter paragraphs of the regulation that are appropriate)
(b)has as its purpose a contribution towards breaking the

link between economic growth and the environmental impacts associated with the generation of waste;
(c)is expressed in writing and—
(i)sets out the objectives of the program and a description of existing waste prevention measures; and
(ii)It identifies the program's waste prevention measures if integrated into a waste management plan or other programs.

Monitoring and evaluation of waste prevention program
6. (1) An appropriate authority;
(a)must establish qualitative or quantitative benchmarks;
(b)may establish qualitative or quantitative targets and indicators against which to assess the value of waste prevention programs.
(2) An appropriate authority must publish the benchmarks and any targets or indicators it establishes.

PART 3. Waste management plans
A requirement for waste management plans
7. (1) The appropriate authority must ensure that there are one or more plans containing policies concerning waste management as the case may be (each a "waste management plan").
(2) A waste management plan may form part of a document and, where this is the case, any requirement of law concerning the program applies only to that part.
Content of waste management plans
8. (1) The appropriate authority must ensure that the waste management plans (taken together) cover the whole (County/City/State) as the case may be.

(2) The appropriate authority must ensure that the waste management plans (taken together)—
(3) The relevant authority must consider, in particular, whether the matters should be included in the waste management plans.
(4) An appropriate authority must ensure that the waste management plans conform to the strategy to reduce biodegradable waste going to landfill.
(5) A statement of policy made before the coming into force of these Regulations may be or form part of a waste management plan.

PART 4. Waste prevention program and waste management plans: general provision.

Directions to the Environment Agency
9. (1) The appropriate authority may give directions to the Environment Agency requiring it;
(a)to advise the authority on the measures or policies which are to be included in a waste prevention program or waste management plan;
(b)to carry out a survey or investigation into any other matter connected with the preparation of such a program or strategy or any modification of it, and report its findings to the authority.
(2) A direction is given under paragraph (1)(b)
(a)must specify or describe the matters which are to be the subject of the survey or investigation;
(b)may identify bodies or persons to be consulted before carrying out the survey or investigation; and
(c)may make provision concerning the manner in which:
(i)the survey or study is to be carried out; or

(ii)the findings are to be reported and made available.
(3) The Environment Agency must comply with a direction given under paragraph (1).
(4) Where a direction is given under section (1)(b), the Environment Agency must also consult anybody or person that it considers appropriate but is not specified in the direction.
(5) The Environment Agency must make its findings available to the bodies and persons it consults.
Review and modification of program and plans
10. (1) The appropriate authority;
(a)must review each waste prevention program and municipal waste management plan at least every sixth year; (audit date to be determined by the agency)
(b)may, from time to time, modify a program or plan.
(2) The appropriate authority must ensure that the Environment Agency and the bodies or persons consulted during the preparation of;
(a)proposals for a waste prevention program or municipal waste management plan; or
(b)proposals to modify such a program or plan.
(3) They are such bodies or persons appearing to be representative of;
(a)the interests of local government; and
(b)the interests of industry, as the authority considers appropriate.
(4) This regulation does not apply to a waste management plan containing only provisions relating to the disposal of organic waste (Food/Yard waste)
(5) Steps taken before the coming into force of these regulations concerning a waste prevention program or waste management plan may be steps for this regulation.

Public participation in program and plans

11. Public involvement in the preparation or modification of a waste prevention program or waste management plan affects, but does not apply to a program or plan

(a)designed for the sole purpose of serving national defense or taken in case of civil emergencies;

(b)for which a public participation procedure is carried out under;

(i)Part 3 of the Environmental Assessment of Plans and Program Regulations (number and date of regulation), or

(ii)Part 3 of the Environmental Assessment of Plans and Program Regulations (number and date of regulation); or

(2) The appropriate authority must ensure that waste prevention programs and municipal waste management plans are available on a publicly accessible website.

(3) Steps taken before the coming into force of these Regulations concerning a waste prevention program or waste management plan may be steps for evaluating waste reduction and diversion programs.

PART 5 Duties concerning waste management and improved use of waste as a resource.

Duty concerning the waste hierarchy

12. (1) An establishment or undertaking which imports, produces, collects, transports, recovers, or disposes of waste, or which as a dealer or broker has control of waste must, on the transfer of waste, take all such measures available to it as are reasonable in the circumstances to apply the following waste hierarchy as a priority order;

(a)prevention;

(b) diversion

(c)preparing for re-use;

(d)recycling;

(e)other recovery (for example, energy recovery);

(f)disposal.

(2) However, an establishment or undertaking may depart from the priority to achieve the best overall environmental outcome. This is justified by life-cycle thinking on the widespread impacts of the generation and management of waste.

(3) When considering the overall impacts, the following considerations must be taken into account;

(a)the general environmental protection principles of precaution and sustainability;

(b)technical feasibility and economic viability;

(c)protection of resources;

(d)the overall environmental, human health, economic and social impacts.

Duties concerning the collection of waste

13. (1) An establishment or undertaking which collects waste paper, metal, plastic, or glass must, from (Date of enaction), take all such measures to ensure separate collection of that waste as are available to the establishment or undertaking in that capacity and are:

(a)technically, environmentally and economically practicable; and

(b)appropriate to meet the relevant recycling sectors' necessary quality standards.

(2) For the avoidance of doubt, co-mingled collection (being the collection together with each other but separately from

other waste of waste streams intended for recycling with a view to subsequent separation by type and nature) is a form of separate collection.
(3) Every waste collection authority must, when making arrangements for the supply of waste paper, metal, plastic, or glass, ensure that those arrangements are by way of separate collection.

Duty concerning collected waste

14.(1) An establishment or undertaking which collects, transports or receives the waste paper, metal, plastic, or glass must, from (date of enaction), take all such measures available to it in that capacity as are reasonable in the circumstances to ensure that where that waste has been separately collected it is not mixed with other waste or other material with different properties.
(2) This duty applies only where keeping waste separate facilitates or improves recovery.