



The Regional Municipality of Durham Information Report

From: Commissioner of Works
Report: #2018-INFO-45
Date: March 23, 2018

Subject:

Organics Management Methods

Recommendation:

Receive for information

Report:

1. Purpose

1.1 The purpose of this report is to provide an overview of the three primary organics management methods used in Ontario and the greenhouse gas (GHG) implications of each method. This will form part of the information session identified in Report #2017-COW-180 on the basics of organics management.

2. Background

2.1 The Regional Municipality of Durham (Region) currently provides curbside organics collection to all single-family homes in the Region. Food waste is collected weekly throughout the year, while leaf and yard waste is collected during the growing season on a published schedule.

2.2 All of the collected material is aerobically composted on behalf of the Region by a third party. The final product meets Ontario's strict compost quality guidelines for 'AA' compost. Under this provincial guideline, 'AA' compost cannot contain any foreign matter (plastic, metal, etc.) larger than 25 millimetres (mm).

2.3 The Region does not provide organics collection to multi-residential buildings receiving other Region waste services such as garbage and Blue Box collection.

2.4 In November 2017, the Ministry of Environment and Climate Change (MOECC) published a draft Food and Organic Waste Framework (Framework) for consultation. The Framework includes organic diversion requirements for municipalities and the Industrial, Commercial and Institutional (IC&I) sector and an eventual organics disposal ban. The finalized document is expected to be

published in the spring of 2018.

3. Questions and Answers about Organics Management Methods

3.1 What are household organics?

- a. Household organics typically include food waste such as fruit and vegetable peels, bones, eggshells, coffee grounds and tea leaves; soft paper waste such as tissues and paper towels; dryer lint; and hair. Leaf and yard waste are also considered organic material but are typically collected separately. Some municipal organic programs also collect pet waste, diapers, and sanitary products.

3.2 What is the carbon cycle?

- a. Carbon is an essential element in living organisms and is also the primary component of fossil fuels. The carbon cycle is the exchange of carbon between the organic and inorganic elements in the atmosphere and the earth. Elements that release carbon are referred to as sources while elements that absorb carbon are called sinks. As carbon is used in one form, it cycles through the earth and the atmosphere as illustrated in Figure 1 (Attachment #1).
- b. Carbon sources include human and animal breathing, fossil fuel combustion, decay of dead matter, and volcanic eruptions. The primary carbon sink is plant matter that absorbs carbon dioxide as part of photosynthesis. An imbalance between carbon sources and sinks results in excess carbon in the atmosphere in the form of carbon dioxide. The scientific consensus is that the excess carbon dioxide in the atmosphere is the primary cause of the current climate change patterns.

3.3 How does food waste impact climate change?

- a. When food decomposes, the decay process also releases carbon into the atmosphere.

3.4 What do organics release when they decay?

- a. When organic material decays in the presence of oxygen, carbon dioxide is released. Carbon dioxide is the GHG present in the greatest volume in the atmosphere and is the most common GHG. Organic material that decays without oxygen releases methane. Methane is present in the atmosphere in a much smaller quantity but is a much more potent GHG.
- b. Because of the GHG impact, the MOECC has made food waste avoidance and diversion from disposal a priority for mitigating climate change.

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- c. In a controlled system, the methane that is released when organics decay without oxygen can be captured. Capturing the methane impacts climate change in two ways: the methane is not released into the atmosphere to increase GHG levels and the biogenic methane from food waste decay can be used as a substitute for fossil fuels.
- 3.5 Why is biogenic carbon treated differently than fossil fuel carbon?
- a. Carbon released from the combustion of biomass based fuels is considered carbon neutral because the carbon released is the same carbon that was previously removed from the atmosphere during the growing cycle. There is no net increase in atmospheric carbon. Carbon from combustion of fossil fuels is a new contribution of carbon to the atmosphere.
- 3.6 How are organics in Ontario managed?
- a. Most large urban municipalities in Ontario provide curbside source-separated organics collection for single-family homes. The collected organics are either composted or anaerobically digested. In most medium to small size municipalities, organics are part of the residual waste stream and disposed of with garbage. In multi-residential and other commercial and institutional establishments, organics are also typically disposed of with garbage.
- 3.7 What happens to organic material when it is landfilled?
- a. In the landfill, organic material decomposes in the absence of oxygen and generates methane gas. Methane is a GHG considered 20 to 30 times more potent than carbon dioxide over 100 years.
- 3.8 Is landfill gas captured for energy?
- a. Some landfills are equipped with methane capture systems and the gas is either flared or used to generate heat or electricity. However, these systems are not 100 per cent efficient, and many older or smaller landfills are not equipped with methane capture systems. According to the MOECC's Climate Change Strategy, solid waste disposal on land is the source of the majority of GHGs generated in Ontario from waste disposal activities.
- 3.9 The Region only provides source-separated organics collection for single-family homes. What happens to organics that are not source separated?
- a. In the Region, any organic matter not source separated by the resident, is disposed of at the Durham York Energy Centre (DYEC). Carbon dioxide is the main GHG released when the organics are combusted.
- 3.10 Is Ontario banning the disposal of organics?
- a. Disposal of organics in landfill or energy-from-waste will no longer be an

option in Ontario if the MOECC's organics disposal ban moves forward as proposed in the Food and Organic Waste Framework. The target date for a provincial disposal ban is 2022/2023.

3.11 How does composting organic waste work?

- a. Composting is an aerobic biological process that involves microorganisms decomposing organic matter in the presence of oxygen. Organic matter is converted to a stable product with no toxic effects on plants when used as a soil supplement. Commercial aerobic composting of residential food waste typically occurs indoors with mechanical mixing and aeration. It is monitored and controlled for oxygen and temperature. The elevated temperature, above 55 degrees Celsius, reduces or eliminates pathogens and weed seeds. If not managed properly, aerobic composting can produce significant odours that are offensive to the surrounding community. The composting process typically takes three to four weeks with additional time for curing. Figure 2 (Attachment #2) illustrates the typical steps in a commercial composting system.

3.12 Why does the Region not accept pet and hygiene waste in the current organics diversion program?

- a. Aerobic composting is regulated in Ontario under the General Waste Management Regulation (O. Reg. 347, 1990) and the Ontario Compost Quality Standards. The Standards outline requirements for feedstock, foreign matter and use requirements for finished compost to be considered Grade 'AA', 'A' or 'B'. 'AA' compost has the most stringent standards and is the highest grade of finished compost. Due to the strict quality standards for aerobic composting, difficult to manage materials such as pet waste, diapers, and hygiene products cannot be included in the process. Aerobic composting systems do not include efficient mechanisms to remove plastics.

3.13 Does composting generate any GHGs?

- a. Due to the aeration that occurs during the compost process, carbon dioxide is the dominant GHG produced during composting. The gas is released into the atmosphere.

3.14 What is anaerobic digestion?

- a. Anaerobic digestion is a naturally occurring biological process that uses microorganisms to break down organic material in the absence of oxygen. It is the same type of process that occurs naturally in a landfill to generate methane. However, in a controlled process, the breakdown of organics occurs much more quickly and effectively and the methane gas can be efficiently captured for beneficial reuse. Engineered anaerobic digestion occurs within specially designed reactors where critical conditions such as

moisture, temperature, and pH levels are controlled to maximize biogas generation and waste decomposition rates. Figure 3 (Attachment #3) illustrates the typical steps in a commercial anaerobic digestion process.

- 3.15 How much biogas (methane) is produced in anaerobic digestion?
- a. One tonne of source-separated organics typically produces between 100 and 150 cubic metres (m³) of biogas.
- 3.16 How can the biogas (methane) from an anaerobic digestion facility be used?
- a. Depending on the amount of purification of the biogas, the methane generated in anaerobic digestion can be used in a variety of ways. Low-grade biogas uses include a heat source for the anaerobic digestion process, or boiler and furnace fuels. Medium grade biogas can be used for district heating or in a combined heat and power plant, while high-grade biogas can be injected into the natural gas distribution system or be used as transportation fuel. The higher the grade of biogas use, the more cleaning and purification is required to remove non-methane components of the gas.
- 3.17 What are the benefits of anaerobic digestion compared to aerobic composting?
- a. Benefits of anaerobic digestion include the ability to treat a more contaminated waste stream that contains plastics since the pre-treatment process allows for efficient mechanical removal of non-organic components. During the initial mixing and shredding of organic materials for anaerobic digestion, plastic floats to the top of the tanks and can be easily separated from the digestible organic material. It is this initial step that allows municipalities, such as the City of Toronto, to accept plastic bags, diapers, and hygiene products in their organics stream.
 - b. Anaerobic digestion also generates a renewable natural gas that can be used in a variety of applications to offset fossil fuel use.
- 3.18 Which type of organics diversion system provides the greatest GHG reductions?
- a. Anaerobic digestion offers the largest GHG reduction impact of any organics management strategy since GHGs are not released into the atmosphere and the methane generated is captured and used to offset fossil fuel energy use elsewhere.

4. Conclusion

- 4.1 Decomposition of organic matter is a naturally occurring process that can be enhanced in engineered systems. Both aerobic and anaerobic decomposition release greenhouse gases.
- 4.2 Anaerobic digestion generates methane, which is a more potent greenhouse gas than carbon dioxide which is generated in aerobic composting. However, the

methane generated in an engineered anaerobic digestion system can be captured and used to offset fossil fuel needs, thus providing a significant greenhouse gas reduction.

- 4.3 Further information will be provided to members of Regional Council as part of the Request For Information (#RFI-1158-2017) reporting. At Regional Council's direction, an organics management presentation could be provided to supplement the information available in this report. Additional information on organics management could also be provided by Regional staff, consultants or industry representatives, if requested by Regional Council.

5. Attachments

Attachment #1: Figure 1: The Carbon Cycle

Attachment #2: Figure 2: Typical Commercial Composting Operation

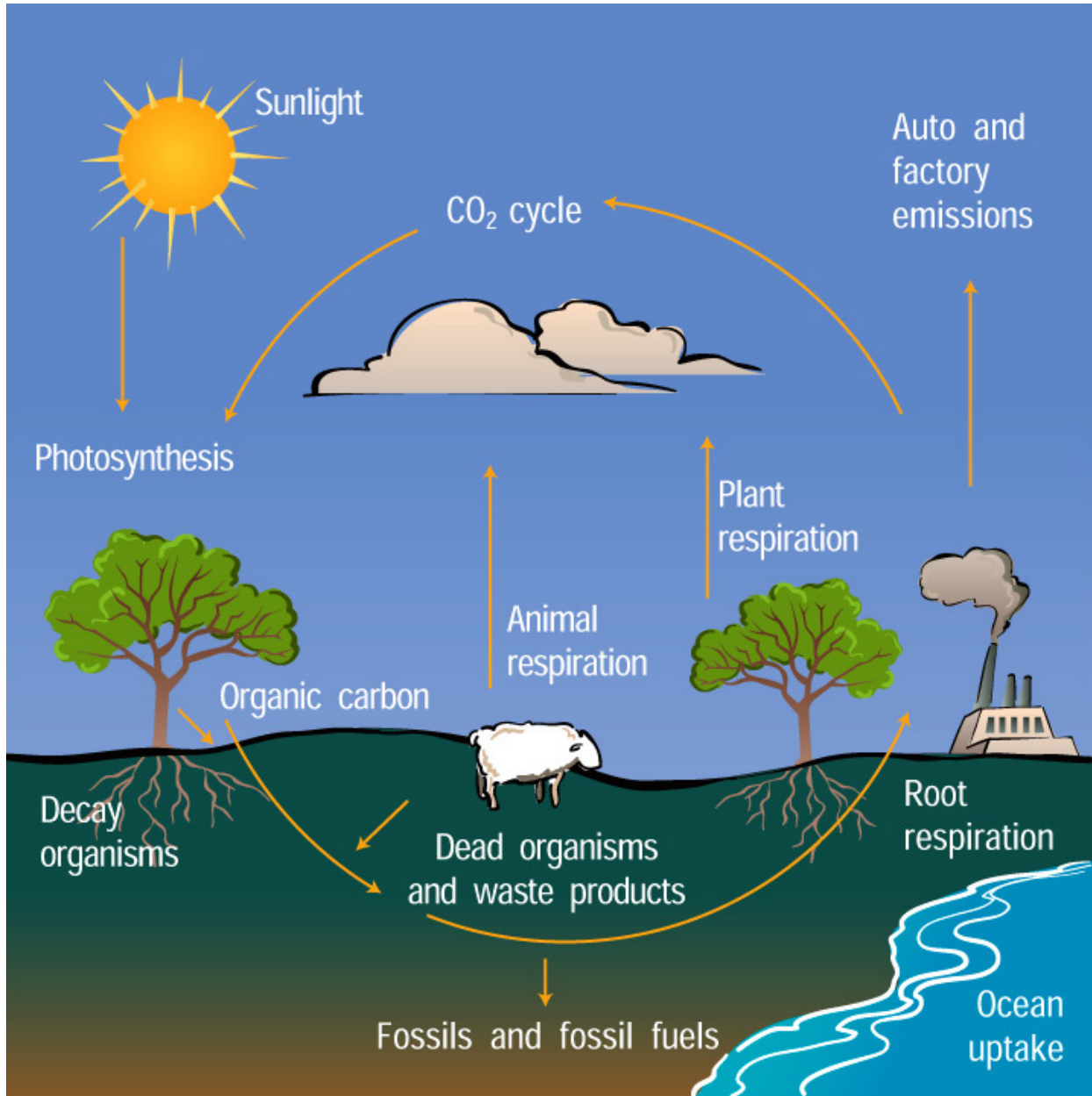
Attachment #3: Figure 3: Typical Anaerobic Digestion Operation

Respectfully submitted,

Original signed by:

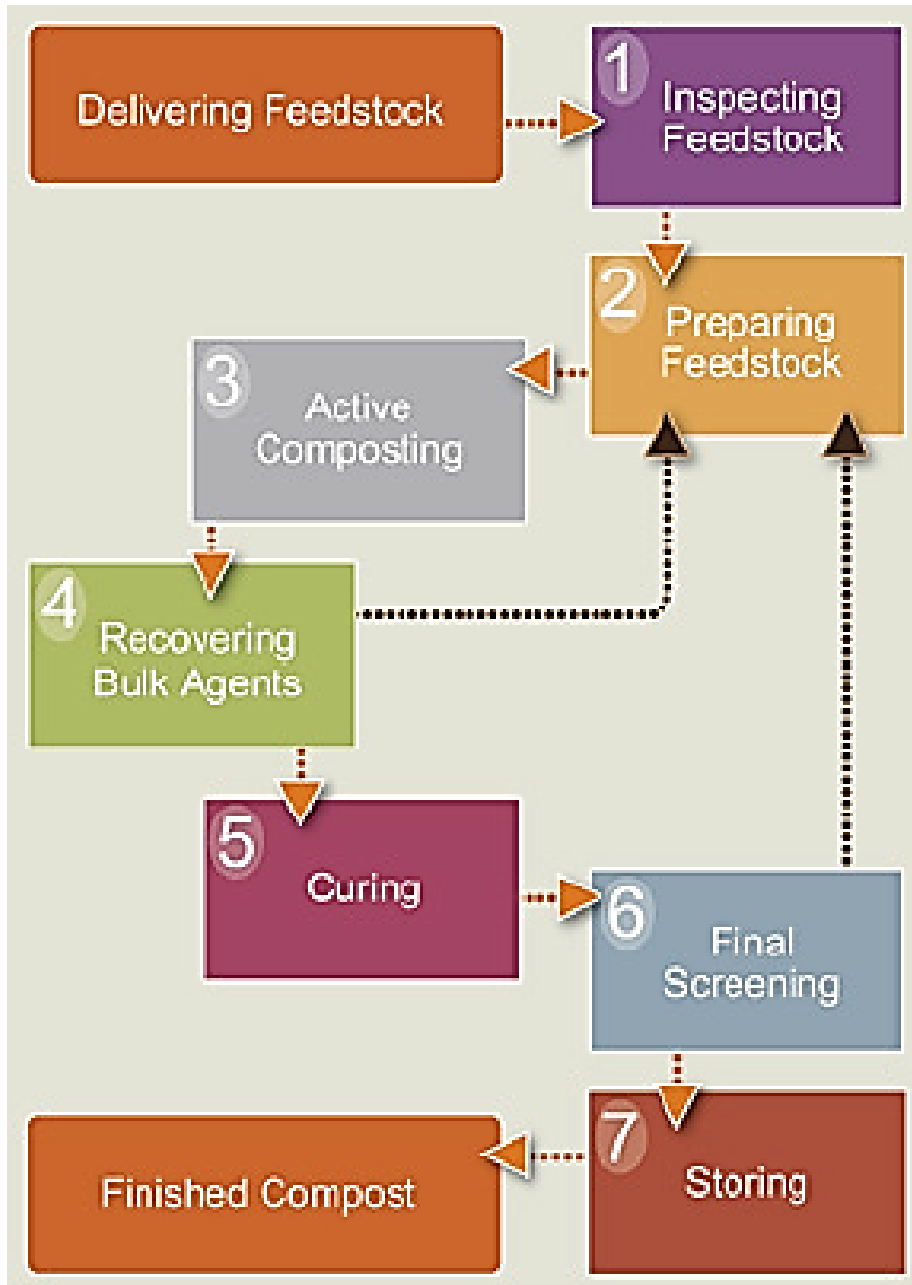
S. Siopis, P.Eng.
Commissioner of Works

Figure 1: The Carbon Cycle



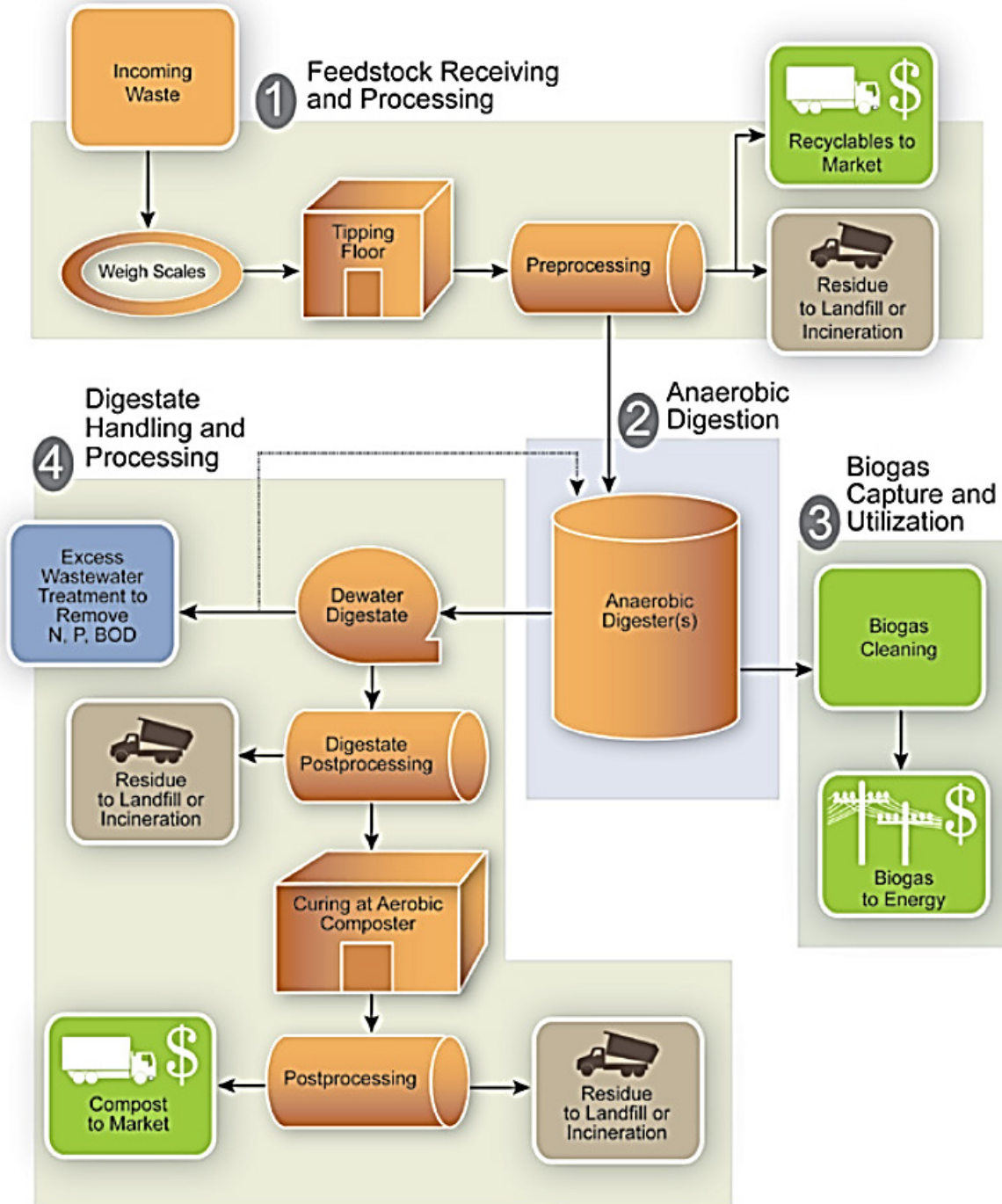
Source: [Kid's Crossing Living the Greenhouse](https://eo.ucar.edu/kids/green/cycles6.htm) (https://eo.ucar.edu/kids/green/cycles6.htm)

Figure 2: Typical Commercial Composting Operation



Source: [Environment Canada Technical Document on Municipal Solid Waste Processing](#)

Figure 3: Typical Anaerobic Digestion Operation



Source: [Environment Canada Technical Document on Municipal Solid Waste Processing](#)