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1.0 GUIDANCE

The purpose of the Protocol is to quantify the Emissions Reduction associated with the diversion of organic waste from landfills in B.C. See Appendix A for an illustration of possible configurations of Local Government Areas, landfills, and waste management facilities.

This Protocol has the effect of a regulation.

The Project Proponent is responsible to ensure the Validation Body selected for a Project using this Protocol is accredited by the Standards Council of Canada to Technical Sector F: Decomposition of Waste Material, Handling and Disposal or by the American National Standards Institute to Sector Group 6: GHG Waste Handling and Disposal.

For a Project that involves both organic waste diversion and fuel switching, the Project Plan may be prepared in accordance with this Protocol and the B.C. Fuel Switch GHG Offset Protocol.

The Project Proponent is responsible to provide justification where any assumptions or estimates used in the Project Plan.

The Project Proponent is responsible to ensure the requirements of the Protocol, the Act and Regulations are met and required forms are complete.
2.0 DEFINITIONS

In the Protocol, the capitalization of terms where the capitalization is not solely performing a grammatical function indicates a defined term in the Act, Regulation or this section.


“Aerobic Composting” means the controlled biological oxidation and decomposition of organic matter which meets the requirements of section 7(d) of Schedule 1 of the Organic Matter Recycling Regulation, B.C. Reg. 18/2002 (OMRR).

“Anaerobic Digestion” means the controlled biological conversion of solid, liquid and dissolved organic matter to biogas in the absence of oxygen.

“Biogas” means the mixture of different gases produced by the breakdown of organic matter in the absence of oxygen.

“Eligible Waste” means degradable non-hazardous organic material that originates from residential, industrial, commercial or institutional sources and falls within the following categories:

a) brewery waste / winery waste, fish waste, food waste, hatchery waste, milk processing waste, plant matter derived from processing plants, poultry carcasses, red-meat waste or whey, as those terms are defined in Schedule 12 of the Organic Matter Recycling Regulation, B.C. Reg. 18/2002 (OMRR),

b) Food-soiled paper waste.

“Final Diversion Investment Decision” means a final decision

a) to contract for, purchase, lease or construct a substantial portion of the capital or services necessary to implement a new program to manage Eligible Waste that would otherwise have gone to a landfill, or to increase the scope and capacity of an existing Eligible Waste management program,

b) made for the purposes of managing waste and increasing diversion rates of waste from landfills, and

c) that involves a substantial financial commitment of the relevant Local Government to deliver such services;

“Fuel” includes electricity and material that is combusted or transformed to generate usable energy or do work.

“Functional Equivalence” means quantification of Baseline Emissions and Project Emissions in a manner that ensures that function and quality of products or services provided under the Baseline Scenario, as compared to those provided with the Project, are sufficiently equivalent to avoid significant Leakage.

“Historic Activities Diversion Rate” means, in relation to the Baseline Scenario, the highest annual rate of diversion of Eligible Waste that Local Government achieved in the three years prior to the Project Start Date, but not before 2011.
“Incremental” means, in relation to diversion of Eligible Waste, a diversion rate beyond the baseline diversion rate as established under sections 5 and 8.

“Ineligible Waste” means organic waste that is not Eligible Waste.

“Integrated Grid” means an electrical distribution system that is connected to a transmission system operated by BC Hydro or FortisBC.

“Local Government” has the same meaning as in the Local Government Act.

“Local Government Area” means the geographic area of the municipal corporation of a Local Government.

“Organic Waste Management Facility” (OWMF) means a facility that processes organic waste in order to generate reusable resources such as a compost, fertilizer product, or energy, and includes organic waste processing on open land.

“Performance Standard” means a technical, activity or performance measure used to calculate Baseline Emissions or a component of Baseline Emissions, determined in accordance with Section 5.1.

“Primary Activity” means the main activity or set of activities in the Project Scenario that result in the majority of Emissions Reduction from the Functionally Equivalent Baseline Scenario.

“Program of Activities” means a type of Project that is not Stand-Alone where a group of similar Project Instances are covered by a single Project Plan and additional Project Instances may be added to the Project over the course of the Project Crediting Period.

“Project Instance”, in relation to a Program of Activities, means a single instance of a Project Scenario that, in combination with other similar Project Instances, is covered by the same Project Plan.

“Project Scenario” means the activities that have an effect on greenhouse gas emissions and constitute the estimation of the Project Emissions.


“Qualified Organic Waste Management Facility” means an OWMF which meets the criteria specified in Section 3.2.

“Regulation” means the Greenhouse Gas Emission Control Regulation.

“Regulatory Requirement” means the rate of waste diversion resulting from laws, bans, by-laws, licensing requirements, and waste management plans approved under section 24 of the Environmental Management Act, and other similar rules that, within the jurisdiction of a Local Government:

a) require implementation of measures that are intended to or can be demonstrably expected to achieve a certain level of diversion, or

b) create disincentives for the disposal of Eligible Waste in a landfill.

“Residual Waste” means organic waste disposed at a landfill from an Organic Waste Management Facility, including waste in the form of digestate, effluent, or any other post-treatment form of organic waste, as well as Ineligible Waste and untreated Eligible Waste.
“Stand-Alone” means a type of Project where all instances of the Primary Activities of the Project Scenario are identified in the validated Project Plan.

“Unqualified Organic Waste Management Facility” means an OWMF which is not a Qualified OWMF.
3.0 APPLICABILITY

3.1 General Criteria

These Criteria apply to both Stand-Alone and Program of Activities project types.

1. The Project must:
   a) Involve both the Incremental diversion of Eligible Waste from a landfill to an Organic Waste Management Facility and the processing of that waste at that facility, and
   b) Meet the Organic Waste Management Facility qualification criteria specified in Section 3.2.

2. Project Reductions must not result from:
   a) Waste recovered from a landfill;
   b) Composting of Eligible Waste using non-aerated static or passive pile composting;
   c) Reductions in GHGs other than CO₂, CH₄ and N₂O.

3. The Primary Activities of the Project Scenario are:
   a) Diversion of Eligible Waste from a landfill to a Qualified Organic Waste Management Facility for treatment, and
   b) Treatment of Eligible Waste at a Qualified Organic Waste Management Facility.

3.2 Qualified Organic Waste Management Facility Criteria

A Qualified Organic Waste Management Facility must be operated in accordance with applicable legislation and regulations and must satisfy the following requirements:

The Organic Waste Management Facility must process Eligible Waste by one or both of Aerobic Composting and Anaerobic Digestion processes as the Primary Activity in the Project Scenario. Where an Organic Waste Management Facility uses both Aerobic Composting and Anaerobic Digestion processes, the Project Proponent must assess Project eligibility against both the requirements for Aerobic Composting in Section 3.2.1 and the requirements for Anaerobic Digestion in Section 3.2.2.

3.2.1 Aerobic Composting

Acceptable composting technologies include, but are not limited to:

- Windrow with mechanical turning
- Aerated static pile
- Aerated and covered static pile
- In-vessel systems

All Eligible Waste must be:

- Mixed and incorporated into the composting process no more than 24 hours after delivery to the Organic Waste Management Facility; or,
• Covered with a layer of high-carbon materials or finished compost no more than 24 hours after
delivery, and mixed and incorporated into the composting process no more than 72 hours
after delivery; or,
• Placed in a building under negative air pressure with exhaust gas vented through a biofilter or
otherwise placed in an enclosed environment with emissions controls that are equivalent to
the control of methane and nitrous oxide by a biofilter no more than 24 hours after delivery,
and,
• Processed in accordance with the requirements of Canadian Council of Ministers of the
Environment (CCME) Compost Quality Guidelines.

3.2.2 Anaerobic Digestion

For Projects where methane production processes are enhanced, the Organic Waste Management
Facility must manage the risk of fugitive emissions in accordance with the guidance provided in the
Canadian Standards Association (CSA) Code for Digester Gas, Landfill Gas, and Biogas Generation and
Utilization (ANSI/CSA B149.6-15).

In cases where Residual Waste from the anaerobic digestion is aerobically composted, it must be
processed in accordance with the requirements of the CCME Compost Quality Guidelines.

All biogas captured from the Anaerobic Digestion technology must either be used at the Organic
Waste Management Facility, sold or transferred to other parties off-site, or flared. All venting or fugitive
release of biogas that occurs from time to time at the Organic Waste Management Facility must be
quantified according to the methodologies included in the Protocol.

3.3 Start Date

The Start Date is asserted by the Project Proponent in accordance with the Regulation (section 14 (3)
(n) (i)). The Start Date is when the Project Proponent first began implementing Incremental diversion
activities, but after January 1, 2014.

3.4 Crediting Period

The Crediting Period is up to 10 years in accordance with the Regulation section 18 (1) (b) (ii) (B).
The Project Proponent must provide justification for the length of the Crediting Period based on the
analysis used to establish Baseline and Project Scenarios.

3.5 Project Report Period

The first Project Report Period begins on the Project Start Date. The Project Report Period must be a
12-consecutive-month period (e.g. October 16, 2018 – Oct 15, 2019) except for the first and last Project
Report Periods.
The first Project Report Period may be from six to eighteen months in length to align the Project Report Period with business requirements (e.g. October 16, 2018 – December 31, 2019 for alignment with a calendar year). If the first Project Report Period is not twelve consecutive months, then the last Project Report Period must be less than twelve consecutive months so the total length of all Project Report Periods corresponds with the length of the Crediting Period.

Project Proponents may choose not to submit a report on an annual basis; however, the information in a report covering multiple years must be organized and separated by calendar year.

### 3.6 Materiality

For the purpose of this Protocol any errors, omissions or misrepresentations are considered material as per sections 15 (3) (c) and 21 (4) (c) of the Regulation if the individual or aggregate effects may result in an overestimation of the Project Reductions of more than 5%.
4.0 PROJECT BOUNDARY

4.1 Description of the Project

The Project Proponent must provide a detailed technical description of the Project including where
the Project will be carried out and where the Emissions Reduction will occur.

The Project Plan must indicate whether the Project type is Stand-Alone or Program of Activities.

4.2 Identification of the Project Location

For Stand-Alone Project type and for each Project Instance determined at the time of validation
if Program of Activities Project type, Project Plans must include global positioning system (GPS)
coordinates (latitude and longitude) for the locations where the Primary Activities of the Project
Scenario will be carried out and any other information allowing for the unique identification of the
Primary Activities of the Project Scenario.

This includes providing information on the following,

1. Locations for all sources of Eligible Wastes, for which the following must be specified:
   - Local Government Areas from which the Eligible Wastes are sourced.
   - The types of operations from which the Eligible Wastes are sourced in sufficient detail to
     allow confirmation by validation and verification bodies that the waste in the Project is
     Eligible Waste diverted from a landfill.
   - A map showing the location from where the Eligible Waste is sourced at an appropriate
     scale to determine its location within the Local Government area.

2. Locations of Organic Waste Management Facilities included in the Project:
   - GPS coordinates (latitude and longitude). Street address and postal code must be
     provided, if available.
   - If there is more than one Organic Waste Management Facility at the given location, a
     written description of the Project Site that clearly identifies at which Organic Waste
     Management Facility the Primary Activities will occur.
   - A map at a scale of sufficient level of detail (e.g., 1:2500) to identify the location of the
     applicable Organic Waste Management Facility operation.

Project Plans for Projects involving a Program of Activities must identify the geographic boundary
within which the Primary Activities of the Project Scenario will be occurring, and how each Project
Instance will be uniquely identified in Project Reports.

Project Plans of Program of Activities must describe how the approach that will be used for
identification of Project Instances that are not determinable when the Project Plan is validated
will meet the requirements of the Regulation. Project Plans must include a description of how this
approach will enable future audits and inspections to identify individual Project Instances and source
locations for all Eligible Wastes.
5.0 ESTABLISHMENT OF BASELINE SCENARIO

The Baseline Scenario must be determined using the Performance Standard approach described below.

5.1 Performance Standard Approach

In The Project Plan, the Project Proponent must assert, for each Project Instance, the baseline diversion rate for each year of the Project Crediting Period and provide justification for this assertion.

The following conditions are to be applied for each Project Instance:

1. If, as of the implementation of the Primary Activities as approved by the Final Diversion Investment Decision, in the Local Government Area from which Eligible Waste is being diverted there are no applicable Regulatory Requirements in place and no Regulatory Requirements have been announced, the Project Proponent may use the Historic Activities Diversion Rate as a Baseline for the entire Project Crediting Period.

2. If, as of the implementation of the Primary Activities as approved by the Final Diversion Investment Decision, in the Local Government Area from which Eligible Waste is being diverted there are applicable Regulatory Requirements in place or announced, and the Local Government can demonstrate in the Project Plan that it voluntarily imposed Regulatory Requirements on itself by bylaw or by the submission of a waste management plan applicable to it to the minister under section 24 of the Environmental Management Act, or by an endorsement of such a submission, and that the Local Government can demonstrate that the decision to impose the Regulatory Requirements was at least partially based on the assumption that financial benefits from generating Offset Units from Eligible Waste diversion would help reduce obstacles to successful implementation of, or compliance with, the Regulatory Requirements, the Project Proponent may use the Historic Activities Diversion Rate as a Baseline for the entire Project Crediting Period.

3. If, as of the implementation of the Primary Activities as approved by the Final Diversion Investment Decision, there are Regulatory Requirements in place or announced and none of the above conditions are satisfied or there is insufficient evidence to demonstrate in the Project Plan that one of the conditions is satisfied, then the baseline is the Historic Activities Diversion Rate up to the date when the Regulatory Requirements come into force, and afterwards the baseline is the Regulatory Requirements diversion rate or the Historic Activities Diversion Rate, whichever is higher.

If target waste diversion rates are provided only for a specified future date in a Waste Management Plan or other applicable governing document, the Project Proponent in the Project Plan will calculate annual baseline diversion rates by assuming a linear increase each year in diversion to the specified future date and assume a constant baseline diversion rate for years after the specified future date.
5.2 Adjusting the Baseline during Project Implementation

If new Regulatory Requirements come into effect that the Project Proponent was unaware of at the
time of Final Diversion Investment Decision, but those Regulatory Requirements cause the Project
Proponent to increase the actual diversion rates beyond what was planned as part of the Final
Diversion Investment Decision, the baseline diversion rate asserted in the Project Plan according to
section 5.1 must be adjusted as described in section 8.0.
6.0 CATEGORIZATION AND DESCRIPTION OF SELECTED PROJECT AND BASELINE SOURCES, SINKS AND RESERVOIRS

The Project Plan must include baseline and Project sources listed in Figure 1 and Table 1. There are no Reservoirs or Sinks associated with this Protocol. GHGs included for each emission source are specified in Table 1.

Emission sources are denoted as:

- P – for Project emission source
- B – for Baseline emission source
- D – for Project waste treatment that is a digestive process
- C – for Project waste treatment that is a composting process
**Baseline Sources, Sinks and Reservoirs in scope**

<table>
<thead>
<tr>
<th>Source/Sink/Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel delivery</td>
</tr>
<tr>
<td>Fuel consumption</td>
</tr>
<tr>
<td>Aerobic composting at OWMF</td>
</tr>
<tr>
<td>Digestate treatment at OWMF</td>
</tr>
<tr>
<td>Effluent storage pond at OWMF</td>
</tr>
<tr>
<td>Venting effluent storage pond at OWMF</td>
</tr>
<tr>
<td>Flaring biogas at OWMF</td>
</tr>
<tr>
<td>Flaring at OWMF</td>
</tr>
<tr>
<td>Waste decomposition at Landfill</td>
</tr>
<tr>
<td>Energy generation from biogas at OWMF</td>
</tr>
</tbody>
</table>

**Project sources, sinks and reservoirs in scope**

- Combustion of fuel on-site (for operation of OWMF)
- Digestate treatment at OWMF
- Effluent storage pond at OWMF
- Venting at OWMF
- Flaring at OWMF
- Waste decomposition at OWMF
- Energy generation from biogas at OWMF

**Figure 1 – Sources, Sinks and Reservoirs (SSRs)**
### Table 1: Selected SSRs for Baseline and Project Scenarios

<table>
<thead>
<tr>
<th>SSR</th>
<th>GHGs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source P1</td>
<td>CO₂, CH₄, N₂O</td>
<td>GHG emissions in B.C. caused by the transportation of the Fuel used in the Project.</td>
</tr>
<tr>
<td>Source P2</td>
<td>CO₂, CH₄, N₂O</td>
<td>GHG emissions from the combustion of all fuel(s) and / or the use of electricity at the Organic Waste Management Facility, including the use of biogas. Combustion of Fuel on-site is a Controlled SSR. Consumption of electricity generated off-site is a Related SSR.</td>
</tr>
<tr>
<td>Source P3C</td>
<td>CH₄, N₂O</td>
<td>GHG emissions resulting from the composting process.*</td>
</tr>
<tr>
<td>Source P4D</td>
<td>CH₄, N₂O</td>
<td>GHG emissions from the Digestate treatment process. Digestate from the anaerobic digester may be converted to fertilizer through mechanical or Aerobic Composting processes, which may require energy inputs such as natural gas, diesel and / or electricity. GHG emissions arising from this fuel and / or electricity consumption are included under source P2. GHG emissions from the composting process are included under source P3C.</td>
</tr>
<tr>
<td>Source P5D</td>
<td>CH₄</td>
<td>GHG emissions from the open storage of the liquid component of anaerobic digester effluent as the remaining organic carbon content is degraded.</td>
</tr>
<tr>
<td>Source P6D</td>
<td>CH₄</td>
<td>Venting of biogas produced by the anaerobic digester may occur during upset conditions or maintenance events, resulting in GHG emissions.</td>
</tr>
<tr>
<td>Source P7D</td>
<td>CH₄, N₂O</td>
<td>Flaring of biogas produced by the anaerobic digester may occur during upset conditions or maintenance events, or as part of normal operating conditions, resulting in GHG emissions.</td>
</tr>
<tr>
<td>Source B8, Source P8</td>
<td>CH₄, N₂O</td>
<td>GHG emissions from Eligible Waste decomposition at a landfill resulting in the production of methane</td>
</tr>
<tr>
<td>Source P9D</td>
<td>CH₄, N₂O</td>
<td>GHG emissions from biogas produced at an Anaerobic Digestion Organic Waste Management Facility and combusted to produce thermal energy or electricity. GHG emissions from flaring biogas are included under Source P7D.</td>
</tr>
</tbody>
</table>

(*) CO₂ emissions from biomass are not included since these emissions are considered biogenic.
7.0 PROJECT JUSTIFICATION

The Project Proponent must identify in the Project Plan the obstacles to the Project in the same manner as required for Baseline Scenario candidates in section 5.

The Project Proponent must assert and justify in the Project Plan that there are financial, technological or other obstacles to carrying out the Project that are overcome or partially overcome by having the Project Reductions recognized as Offset Units. The justification in the Project Plan must include:

- financial analysis including the impact of carbon finance on investment hurdle rates and decision-making,
- how the economic business case and values used in the financial analysis compare to those commonly used by the Project Proponent and industry-specific standards,
- the anticipated rate of adoption of the Primary Activity over the Crediting Period.
8.0 QUANTIFICATION OF EMISSIONS REDUCTION AND REMOVALS ENHANCEMENT

The Project Proponent must use section 8 to quantify Baseline Emissions, Project Emissions and Project Reductions, for each Project Instance of a Program of Activities Project. In the case of a Stand-Alone Project, quantification is identical to that for a Program of Activities Project with a single Project Instance.

Each emission source in Table 1 of section 6 is calculated using quantification methods specified in this section.

Equation references to ‘i’ refer to a source type in the SSR column of Table 1 in section 6. Equation references to ‘j’ refer to a GHG type in the GHG column of Table 1 in Section 6. Equation references to ‘m’ refer to a Project Report Period; to ‘h’ refer to a Fuel type; to ‘PI’ refer to a Project Instance; to ‘f’ refer to an Organic Waste Management Facility; to ‘LF’ refer to a Landfill.

References to quantification of ‘annual’ GHG emissions and to ‘year m’ are to be adapted, if applicable, to reflect the actual length of Project Report Period m.

References to WCI (20, 23, or 24) refer to the most current version of the Western Climate Initiative Final Essential Requirements of Mandatory Reporting - amended for Canadian Harmonization as published on the Ministry of Environment and Climate Change Strategy’s website. For each SSR, only specific calculation methods within WCI.20 are permitted. If more than one option exists, the Project Proponent must select the most accurate quantification method unless an alternative method in the Protocol provides a result that is materially the same and the selection is justified.

For each Project Instance PI, for year m, convert individual GHG totals into total GHG emissions in units of tonnes of CO2 equivalent (tCO2e) using Equation 1:

**Equation 1: Conversion to tCO2e**

\[ T_{i,PI,m} = \sum_j \left( T_{i,j,PI,m} \times GWP_j \right) \]

Where,

- \( T_{i,PI,m} \) = Total GHG emissions for source type i for Project Instance PI for Project Report Period m (tonnes of CO2e).
- \( T_{i,j,PI,m} \) = Total emissions of GHG j for source type i for Project Instance PI for Project Report Period m (tonnes of CO2, tonnes of CH4, tonnes of N2O).
- \( GWP_j \) = 100-year global warming potential for GHG j relative to CO2.

Global warming potentials for GHG j must use the latest values set out in Column 4 of the Schedule to the Carbon Neutral Government Regulation.
Eligible Waste Quantification

The steps for quantifying eligible waste described below must be performed for each Project Instance \( PI \) for each year \( m \) in a Project Crediting Period.

**Step 1 – Assert total Eligible Waste diverted**

The total amount of Eligible Waste \( M_{TotalDiversion,PI,m} \) diverted in Project Instance \( PI \) in year \( m \) must include all diversion of Eligible Waste - to both Qualified and Unqualified Organic Waste Management Facilities.

**Step 2 – Assert total Eligible Waste diverted to qualified and to unqualified facilities**

The total amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) to Qualified Organic Waste Management Facilities \( M_{ToQualifiedOWMFs,PI,m} \) and to Unqualified Organic Waste Management Facilities \( M_{ToUnqualifiedOWMFs,PI,m} \) must sum up to \( M_{TotalDiversion,PI,m} \).

**Step 3 - Assert baseline diversion rate**

Assert baseline diversion rate \( M_{BaselineDR,PI,m} \) from section 5.1.

**Step 4 - Adjust baseline diversion rate for new requirements**

The adjusted baseline diversion rate \( M_{Baseline,PI,m} \) is determined using Equation M1:

\[
M_{Baseline,PI,m} = M_{BaselineDR,PI,m} + \max \left((M_{NewReg,PI,m} - M_{Plan,PI,m}), 0\right)
\]

Where,

- \( M_{Baseline,PI,m} \) = Adjusted baseline diversion rate of eligible waste in Project Instance \( PI \) for year \( m \) (tonnes);
- \( M_{Baseline,PI,m} \) = Baseline diversion rate for Project Instance \( PI \) in year \( m \) as in Section 5.1 (tonnes);
- \( M_{Baseline,PI,m} \) = Total amount of Eligible Waste that is required to be diverted in Project Instance \( PI \) in year \( m \) to meet new Regulatory Requirements not known at the time of Final Diversion Investment Decision (tonnes). If no new Regulatory Requirements are in effect, this value is zero.
- \( M_{Baseline,PI,m} \) = Total amount of Eligible Waste in Project Instance \( PI \) planned to be diverted in year \( m \) resulting from a Final Diversion Investment Decision and stated in the Project Plan (tonnes).
Step 5 – Determine total incremental diversion of Eligible Waste

The increase, relative to the baseline, in Eligible Waste \( M_{\text{IncrDiversion},PI,m} \) is determined using Equation M2:

**Equation M2: Total incremental diversion of Eligible Waste**

\[
M_{\text{IncrDiversion},PI,m} = M_{\text{TotalDiversion},PI,m} - M_{\text{Baseline},PI,m}
\]

Where,

- \( M_{\text{IncrDiversion},PI,m} = \) Increase in Eligible Waste diversion, relative to the baseline, achieved in Project Instance \( PI \) in year \( m \) (tonnes);
- \( M_{\text{TotalDiversion},PI,m} = \) Total amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) (tonnes);
- \( M_{\text{Baseline},PI,m} = \) Baseline amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) (tonnes).

Step 6 – Determine the total diverted Eligible Waste that is available for Offset Units

The total amount of diverted Eligible Waste that is available for Offset Units \( M_{\text{TotalOffsetAvailable},PI,m} \) is determined using Equation M3:

**Equation M3: Eligible Waste available for Offsets**

\[
M_{\text{TotalOffsetAvailable},PI,m} = \min\left\{ M_{\text{IncrDiversion},PI,m}, \left( M_{\text{ToQualifiedOWMFs},PI,m} - \Delta M_{\text{ToUnqualifiedOWMFs},PI,m} \right) \right\}
\]

Where,

- \( M_{\text{TotalOffsetAvailable},PI,m} = \) Total amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) that is available for Offset Units (tonnes);
- \( M_{\text{IncrDiversion},PI,m} = \) Increase in Eligible Waste diversion, relative to the baseline, achieved in Project Instance \( PI \) in year \( m \) (tonnes);
- \( M_{\text{ToQualifiedOWMFs},PI,m} = \) Total amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) to Qualified Organic Waste Management Facilities (tonnes);
- \( \Delta M_{\text{ToUnqualifiedOWMFs},PI,m} = \) Decrease from the year before the first Project Crediting Period to year \( m \), in amount of Eligible Waste diverted in Project Instance \( PI \) to Unqualified Organic Waste Management Facilities (tonnes), determined using Equation M4:

**Equation M4: Eligible Waste leakage**

\[
\Delta M_{\text{ToUnqualifiedOWMFs},PI,m} = \max\left\{ (M_{\text{ToUnqualifiedOWMFs},PI,0} - M_{\text{ToUnqualifiedOWMFs},PI,m}), 0 \right\}
\]

Where,

- \( M_{\text{ToUnqualifiedOWMFs},PI,0} = \) Total amount of Eligible Waste diverted in Project Instance \( PI \) to Unqualified Organic Waste Management Facilities (tonnes) in the year before the first Project Crediting Period;
- \( M_{\text{ToUnqualifiedOWMFs},PI,m} = \) Total amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) to Unqualified Organic Waste Management Facilities (tonnes).
Step 7 – Determine the fraction of Eligible Waste available for Offsets out of total diverted

The fraction of diverted Eligible Waste available for Offset Units as a portion of all Eligible Waste diverted to Organic Waste Management Facilities is determined using Equation M5:

**Equation M5: Fraction of Eligible Waste available for Offsets**

\[
\frac{r_{OffsetAvailable,PI,m}}{M_{TotalDiversion,PI,m}} = \frac{M_{TotalOffsetAvailable,PI,m}}{M_{TotalDiversion,PI,m}}
\]

Where,

- \( r_{OffsetAvailable,PI,m} \) = Fraction of diverted Eligible Waste available for Offset Units out of all Eligible Waste diverted to Organic Waste Management Facilities in Project Instance \( PI \) in year \( m \);
- \( M_{TotalOffsetAvailable,PI,m} \) = Total amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) that is available for Offset Units (tonnes);
- \( M_{TotalDiversion,PI,m} \) = Total amount of Eligible Waste diverted in Project Instance \( PI \) in year \( m \) to Organic Waste Management Facilities (tonnes).

Step 8 – Determine the fraction of Eligible Waste available for Offset Units out of total waste at facility

\( R_{Available,f,PI,m} \) is determined using Equation M6. Where an Organic Waste Management Facility \( f \) only processes waste available for Offset Units, \( R_{Available,f,PI,m} = 1 \); where some of the waste processed at OWMF \( f \) is Eligible Waste not available for Offset Units or is Ineligible Waste, \( R_{Available,f,PI,m} < 1 \).

**Equation M6: Fraction of Eligible Waste available for Offsets out of total waste at facility**

\[
R_{Available,f,PI,m} = r_{OffsetAvailable,PI,m} \times \frac{M_{Eligible,f,PI,m}}{M_{Total,f,m}}
\]

Where,

- \( R_{Available,f,PI,m} \) = Fraction of diverted Eligible Waste available for Offset Units in Project Instance \( PI \) out of all organic waste processed at Organic Waste Management Facility \( f \) in year \( m \);
- \( r_{OffsetAvailable,PI,m} \) = Fraction of diverted Eligible Waste available for Offset Units out of all Eligible Waste diverted to Organic Waste Management Facilities in Project Instance \( PI \) in year \( m \).
- \( M_{Eligible,f,PI,m} \) = Amount of Eligible Waste in Project Instance \( PI \) processed at Organic Waste Management Facility \( f \) in year \( m \) (tonnes);
- \( M_{Total,f,m} \) = Amount of organic waste, including Ineligible Waste, processed at Organic Waste Management Facility \( f \) in year \( m \) (tonnes).
8.1 Project Emissions and Removals

8.1.1 P1 Fuel Delivery to Organic Waste Management Facility

This emission source \( T_{P1,Pl,m} \) consists of GHG emissions from all non-electricity Fuel consumption associated with the transportation of Fuel used at all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \).

Equation P1 must be used to calculate non-electricity Fuel delivery emissions.

**Equation P1: Fuel Delivery**

\[
T_{P1,j,Pl,m} = \sum_{f} R_{Available,f,Pl,m} \times \left\{ \sum_{h} EF_{P1,j,h} \times AL_{P1,h,f,m} \right\}
\]

Where,

- \( T_{P1,j,Pl,m} \) = Total Fuel delivery emissions of GHG \( j \) in Project Instance \( PI \) in year \( m \) from all Project OWMFs (tonnes of GHG \( j \));
- \( R_{Available,f,Pl,m} \) = Fraction of diverted Eligible Waste in Project Instance \( PI \) available for Offset Units out of all organic waste at Organic Waste Management Facility \( f \) in year \( m \);
- \( EF_{P1,j,h} \) = Non-electricity Fuel transportation emission factor for GHG \( j \) for non-electricity Fuel type \( h \) (tonnes of GHG \( j / \) litres of Fuel \( h \));
- \( AL_{P1,h,f,m} \) = Amount of non-electricity Fuel type \( h \) combusted to transport Fuel to Organic Waste Management Facility \( f \) for Project Report Period \( m \) (litres of Fuel \( h \)).

Results from this equation must be converted to tCO\(_2\)e using Equation 1.

**Emission factor \( EF_{P1,j,h} \)**

Quantification must use a mobile combustion emission factor for GHG \( j \) for Fuel type \( h \) from Canada’s most recent National Inventory Report: Greenhouse Gas Sources and Sinks in Canada.

If it is demonstrated to be a more accurate quantification method, then GHG emissions for CO\(_2\) may be determined using WCI.23 and GHG emissions for CH\(_4\) and N\(_2\)O emissions may be determined using WCI.24.

**Activity level \( AL_{P1,h,f,m} \)**

Non-electricity Fuel consumption for transport vehicles must be measured for each Fuel type \( h \) used in transporting Fuel delivered for use in the operation of each OWMF \( f \).
8.1.2 P2 Fuel Consumption for Operation of Organic Waste Management Facility

This emission source \( T_{P2,Pl,m} \) consists of GHG emissions from all Project Organic Waste Management Facilities in year \( m \) involving the combustion of non-electricity fuel, other than flaring, and involving the use of electricity, in Project Instance \( PI \). CO₂ emissions from the combustion of biogas are not included in the calculation of \( T_{P2,Pl,m} \) since these emissions are considered biogenic.

Quantification of non-electricity Fuel combustion emissions \( T_{P2,Elec,f,m} \) at OWMF \( f \), for each Fuel type \( h \), must use WCI.23(b), (c) or (e), and if applicable WCI.23(f) for CO₂ emissions, and WCI.24 for CH₄ and N₂O emissions. Then is the sum of emissions for all non-electricity Fuels:

\[
\text{Equation P2.1: Fuel Combustion at OWMF } f \\
T_{P2,FossilF,j,f,m} = \sum_h T_{P2,FossilF,j,h,f,m}
\]

Quantification of electricity Fuel consumption emissions \( T_{P2,Elec,f,m} \) associated with electricity supplied by the Integrated Grid to OWMF \( f \) must use Equation P2.2. Since the electricity emission factor in Equation P2.2 accounts for all GHGs, it is not necessary to use Equation 1 to convert the results into tCO₂e.

\[
\text{Equation P2.2: Integrated Grid Electricity Use at OWMF } f \\
T_{P2,Elec,f,m} = EF_{P2,Elec,f,m} \times AL_{P2,Elec,f,m}
\]

Where,

\( T_{P2,Elec,f,m} \) = Total GHG emissions in tCO₂e due to consumption of electricity supplied to OWMF \( f \) in year \( m \) (tCO₂e);

\( EF_{P2,Elec,f,m} \) = Emission factor for electricity supplied by the Integrated Grid in year \( m \) (tCO₂e / MWh);

\( AL_{P2,Elec,f,m} \) = Total electricity consumed by OWMF \( f \) in year \( m \) (MWh).

Project Proponents must use the appropriate electricity emission factor for year \( m \) published on the B.C. Ministry of Environment’s website in accordance with Schedule E of the Greenhouse Gas Emission Reporting Regulation.

Electricity consumption for each OWMF \( f \) must be calculated based on Project data for year \( m \).

Total GHG emissions for source P2, for Project Instance \( PI \) for year \( m \), are the sum of emissions from combustion of all non-electricity Fuels and emissions from the use of electricity, for all OWMFs, scaled by:

\[
\text{Equation P2.3: Fuel Consumption Emissions attributed to Local Government LG} \\
T_{P2,Pl,m} = \sum_f R_{Available,f,Pl,m} \times \left( T_{P2,Elec,f,m} + \sum_j \left( T_{P2,FossilF,j,f,m} \times GWF_j \right) \right)
\]
### 8.1.3 P3C Aerobic Composting

This emission source \( T_{P3C,j,PI,m} \) consists of GHG emissions from Aerobic Composting at all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \). Aerobic Composting emissions are calculated using Equation P3C. CO₂ emissions from composting are not included in the calculation of these emissions are considered biogenic.

**Equation P3C: Aerobic Composting**

\[
T_{P3C,j,PI,m} = r_{OffsetAvailable,PI,m} \times \sum_f (EF_{compost,j,f} \times M_{Eligible,f,PI,m})
\]

Where,

- \( T_{P3C,j,PI,m} \) = Emissions of GHG \( j \) from Aerobic Composting, where \( j \) is CH₄ or N₂O (tonnes of CH₄ or N₂O);
- \( r_{OffsetAvailable,PI,m} \) = Fraction of diverted Eligible Waste available for Offset Units out of all Eligible Waste diverted to Organic Waste Management Facilities in Project Instance \( PI \) in year \( m \);
- \( EF_{compost,j,f} \) = Emission factor from Table 2 for GHG \( j \) for the applicable composting technology type at Organic Waste Management Facility \( f \) (tonnes CH₄ or N₂O / tonne Eligible Waste);
- \( M_{Eligible,f,PI,m} \) = Amount of Eligible Waste in Project Instance \( PI \) processed at Organic Waste Management Facility \( f \) in year \( m \) (tonnes).

Results from this equation must be converted to tCO₂e using Equation 1.

**Emission Factor \( EF_{compost,j,f} \)**

The CH₄ and N₂O emission factors applicable to the composting technology at the Organic Waste Management Facility are shown below in Table 2.

**Table 2: CH₄ and N₂O Emission Factors for Aerobic Composting**

<table>
<thead>
<tr>
<th>Composting Technology</th>
<th>CH₄ Emission Factor (tonne CH₄ / tonne waste)</th>
<th>N₂O Emission Factor (tonne N₂O / tonne waste)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turned System (e.g. Windrow with Mechanical Turning, etc.)</td>
<td>Covered with ≥15cm finished compost or other carbonaceous material for first 3 weeks of composting cycle</td>
<td>0.0026</td>
</tr>
<tr>
<td></td>
<td>Uncovered</td>
<td>0.0039</td>
</tr>
<tr>
<td>Forced Aeration System (e.g. Positive or Negative Aerated Static Pile, etc.)</td>
<td>Uncovered and no biofilter</td>
<td>0.0026</td>
</tr>
<tr>
<td></td>
<td>Covered with: ≥15cm finished compost or other carbonaceous material for first 2 weeks of composting cycle, synthetic covers, or biofilter</td>
<td>0.0013</td>
</tr>
</tbody>
</table>
### 8.1.4 P4D Digestate Treatment

This emission source ($T_{P4D,PI,m}$) consists of GHG emissions from the treatment of digestate at all Project Organic Waste Management Facilities in year $m$, in Project Instance $PI$.

Emissions associated with the treatment of digestate are calculated using Equation P4D. CO$_2$ emissions from digestate treatment are not included in the calculation of since these emissions are considered biogenic.

**Equation P4D: Digestate Treatment**

$$T_{P4D,j,PI,m} = \sum_f R_{Available,f,PI,m} \times (EF_{digestate,j,f} \times M_{digestate,f,m})$$

Where,

- $T_{P4D,j,PI,m}$ = Emissions of GHG $j$ from digestate treatment, where $j$ is CH$_4$ or N$_2$O (tonnes of CH$_4$ or N$_2$O);
- $R_{Available,f,PI,m}$ = Fraction of diverted Eligible Waste in Project Instance $PI$ available for Offset Units out of all organic waste at Organic Waste Management Facility $f$ in year $m$;
- $EF_{digestate,j,f}$ = Emission factor from Table 3 for GHG $j$ for the applicable digestate treatment process at Organic Waste Management Facility $f$ (tonne CH$_4$ or N$_2$O / tonne wet digestate);
- $M_{digestate,f,m}$ = Amount of digestate produced at Organic Waste Management Facility $f$ with the applicable digestate treatment process (tonnes wet digestate).

Results from this equation must be converted to tCO$_2$e using Equation 1.

If digestate from an Organic Waste Management Facility is not treated before being sent to a landfill or is treated in non-aerated static piles, all emissions associated with that digestate are to be calculated as waste decomposition emissions under source P8 instead of this SSR emission source.

**Emission Factor $EF_{digestate,j,f}$**

The CH$_4$ and N$_2$O emission factors applicable to the aerobic digestate treatment technology at the Organic Waste Management Facility are shown below in Table 3.

The emission factors are applicable whether the digestate is treated at the Organic Waste Management Facility or at another facility.
### Table 3: CH\textsubscript{4} and N\textsubscript{2}O Emission Factors for Digestate Treatment

<table>
<thead>
<tr>
<th>Digestate Technology by GHG Emission Risk Level</th>
<th>CH\textsubscript{4} Emission Factor (tonne CH\textsubscript{4} / tonne wet digestate)</th>
<th>N\textsubscript{2}O Emission Factor (tonne N\textsubscript{2}O / tonne wet digestate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High:</td>
<td>0.0044</td>
<td>0.00034</td>
</tr>
<tr>
<td>· Material treated at an undocumented composting facility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium:</td>
<td>0.026</td>
<td>0.0002</td>
</tr>
<tr>
<td>· Digestate treated at the Organic Waste Management Facility in aerated systems (turned windrows or aerated static piles).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>· Material treated at a centralized composting facility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low:</td>
<td>0.0009</td>
<td>0.00007</td>
</tr>
<tr>
<td>· Digestate treated at the Organic Waste Management Facility in an enclosed system (in-vessel) utilizing a bio-filter or biogas scrubber.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>· Digestate thermally dried upon separation from liquid effluent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>· Digestate used directly as animal bedding material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>· Digestate immediately blended as soil amendment.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.1.5 P5D Effluent Storage Pond

This emission source \((T_{P5D,PI,m})\) consists of \(\text{CH}_4\) emissions from digester effluent discharged to an open storage pond from all Project Organic Waste Management Facilities in year \(m\), in Project Instance \(PI\).

Emissions of \(\text{CH}_4\) from digester effluent discharged to an open storage pond are calculated using Equation P5D. \(\text{CO}_2\) emissions from the effluent storage pond are not included in the calculation of \(T_{P5D,PI,m}\) since these emissions are considered biogenic. \(\text{N}_2\text{O}\) emissions are not included in the calculation of \(T_{P5D,PI,m}\) since these emissions are expected to be negligible.

Equation P5D: Effluent Storage Pond

\[
T_{P5D,\text{CH}_4,PI,m} = \sum_f R_{\text{Available},f,PI,m} \times \left\{ B_{0,\text{eff}} \times MCF_{\text{eff}} \times \sum_{q=1}^{12} \left( V_{\text{eff},q,f} \times COD_{\text{eff},q,f} \right) \right\}
\]

Where,

\(T_{P5D,\text{CH}_4,PI,m}\) = Emissions of \(\text{CH}_4\) from the effluent storage pond (tonnes \(\text{CH}_4\));

\(R_{\text{Available},f,PI,m}\) = Fraction of diverted Eligible Waste in Project Instance \(PI\) available for Offset Units out of all organic waste at Organic Waste Management Facility \(f\) in year \(m\);

\(B_{0,\text{eff}}\) = Maximum methane producing capacity of the effluent per tonne chemical oxygen demand from Table 5 in Appendix C (tonne \(\text{CH}_4\) / tonne COD);

\(MCF_{\text{eff}}\) = Default methane correction factor for digester effluent, from Table 5 in Appendix C;

\(q\) = Month number during year \(m\);

\(V_{\text{eff},q,f}\) = Volume of effluent discharged into the storage pond in month \(q\) at Organic Waste Management Facility \(f\) (m\(^3\));

\(COD_{\text{eff},q,f}\) = Chemical oxygen demand of the effluent discharged into the storage pond in month \(q\) at Organic Waste Management Facility \(f\) (tonne COD / m\(^3\)).

Results from this equation must be converted to t\(\text{CO}_2\)e using Equation 1.
### 8.1.6 P6D Venting

This emission source \(T_{P6D,CH_4,PI,m}\) consists of \(CH_4\) emissions from venting biogas during upset events from all Project Organic Waste Management Facilities in year \(m\), in Project Instance \(PI\).

Emissions of \(CH_4\) from venting biogas during upset events are calculated using Equation P6D.

\(CO_2\) contained in the biogas is not included in the calculation of \(T_{P6D,CH_4,PI,m}\), since these emissions are considered biogenic. \(N_2O\) emissions are not included in the calculation of \(T_{P6D,PI,m}\) since the percentage of \(N_2O\) in biogas is typically negligible.

#### Equation P6D: Venting

\[
T_{P6D,CH_4,PI,m} = \frac{\rho_{CH_4}}{1000} \times \sum_f R_{Available,f,PI,m} \times \left\{ (V_{vessel,f} + Q_{biogas,f,m} \times t_{f,m}) \times r_{CH_4,vent,f,m} \right\}
\]

Where,

- \(T_{P6D,CH_4,PI,m}\) = Emissions of \(CH_4\) from biogas venting (tonnes of \(CH_4\));
- \(\rho_{CH_4}\) = Density of \(CH_4\) at standard temperature and pressure (15°C and 1 atm) from Table 5 in Appendix C (kg/m³ \(CH_4\));
- 1000 = Factor to convert \(\rho_{CH_4}\) to units of tonnes/m³ \(CH_4\);
- \(R_{Available,f,PI,m}\) = Fraction of diverted Eligible Waste in Project Instance \(PI\) available for Offset Units out of all organic waste at Organic Waste Management Facility \(f\) in year \(m\);
- \(V_{vessel,f}\) = Maximum volume of biogas in storage vessel at steady state at standard temperature and pressure (15°C and 1 atm) at Organic Waste Management Facility \(f\) (m³);
- \(Q_{biogas,f,m}\) = Flow rate of biogas at steady state at standard temperature and pressure (15°C and 1 atm) at Organic Waste Management Facility \(f\) in year \(m\) (m³/hr);
- \(t_{f,m}\) = Amount of time in year \(m\) that vessel is venting at facility \(f\) (hr);
- \(r_{CH_4,vent,f,m}\) = Volume fraction of \(CH_4\) in the vented biogas at Organic Waste Management Facility \(f\) in year \(m\).

Results from this equation must be converted to t\(CO_2\)e using Equation 1.
8.1.7 P7D Flaring

This emission source \( T_{P7D,PI,m} \) consists of GHG emissions from flaring supplementary Fuels and biogas from all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \).

Quantification of supplementary Fuel flaring combustion emissions \( T_{P7D,SupplF,j,f,m} \) at OWMF \( f \), for each Fuel type \( h \), must use WCI.23(b), (c) or (e), and if applicable WCI.23(f) for CO\(_2\) emissions, and WCI.24 for CH\(_4\) and N\(_2\)O emissions. Then \( T_{P7D,SupplF,j,f,m} \) is the sum of emissions for all flared supplementary Fuels:

**Equation P7D.1: Supplementary Fuel flaring at OWMF \( f \)**

\[
T_{P7D,SupplF,j,f,m} = \sum_{h} T_{P7D,SupplF,j,h,f,m}
\]

Quantification of biogas flaring combustion emissions \( T_{P7D,Biogas,j,f,m} \) at OWMF \( f \) must use WCI.24 for CH\(_4\) and N\(_2\)O emissions, using the volume of CH\(_4\) in the biogas as the Fuel volume.

CO\(_2\) emissions from the combustion of biogas are not included in the calculation of \( T_{P7D,PI,m} \) since these emissions are considered biogenic.

Total GHG emissions for source P7D, in Project Instance \( PI \) for year \( m \), are the sum of emissions from the flaring of all supplementary Fuels and biogas, for all OWMFs, scaled by \( R_{Available,f,PI,m} \):

**Equation P7D.2: Flaring**

\[
T_{P7D,j,PI,m} = \sum_{f} R_{Available,f,PI,m} \times \left( T_{P7D,SupplF,j,f,m} + T_{P7D,Biogas,j,f,m} \right)
\]

Where,

\( T_{P7D,j,PI,m} \) = Emissions of GHG \( j \) from flaring (tonnes of GHG \( j \));

\( R_{Available,f,PI,m} \) = Fraction of diverted Eligible Waste in Project Instance \( PI \) available for Offset Units out of all organic waste at Organic Waste Management Facility \( f \) in year \( m \);

\( T_{P7D,SupplF,j,f,m} \) = Total emissions of GHG \( j \) for all flared supplementary Fuels at Organic Waste Management Facility \( f \) in year \( m \) (tonnes of GHG \( j \));

\( T_{P7D,Biogas,j,f,m} \) = Total emissions of CH\(_4\) or N\(_2\)O from biogas flaring at Organic Waste Management Facility \( f \) in year \( m \) (tonnes of CH\(_4\) or N\(_2\)O).

Results from Equation P7D.2 must be converted to tCO\(_2\)e using Equation 1.
8.1.8 P8 Residual Waste Decomposition at Landfill

This emission source \( T_{P8,CH4,PI,m} \) consists of GHG emissions from anaerobic decomposition of Residual Waste disposed at all landfills from all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \).

Emissions of \( \text{CH}_4 \) from anaerobic decomposition of Residual Waste are calculated using Equation P8.1.

**Equation P8.1: Residual Waste Decomposition at Landfill**

\[
T_{P8,CH4,PI,m} = \sum_{f} R_{Available,f,PI,m} \times \sum_{LF} (EF_{RW,Decomp,CH4,LF,m} \times M_{ResidualWaste,f,LF,m})
\]

Where,

- \( T_{P8,CH4,PI,m} \) = Emissions of \( \text{CH}_4 \) from Residual Waste decomposition (tonnes of \( \text{CH}_4 \));
- \( R_{Available,f,PI,m} \) = Fraction of diverted Eligible Waste in Project Instance \( PI \) available for Offset Units out of all organic waste at Organic Waste Management Facility \( f \) in year \( m \);
- \( EF_{RW,Decomp,CH4,LF} \) = Integrated emission factor for Residual Waste decomposition at landfill \( LF \), calculated using Equation P8.2, for Residual Waste sent to landfill \( LF \) in year \( m \) (tonne \( \text{CH}_4 \)/tonne waste);
- \( M_{ResidualWaste,f,LF,m} \) = Amount of Residual Waste sent to landfill \( LF \) from Organic Waste Management Facility \( f \) in year \( m \) (tonnes waste).

If Residual Waste is being sent to multiple landfills and the partitioning of waste between these landfills cannot be verifiably determined, the highest landfill decay date \( k_{LF} \) for organic waste of all applicable landfills is to be used for calculation of emissions from Residual Waste decomposition at all these landfills.

Results from Equation P8.1 must be converted to tCO\(_2\)e using Equation 1.
Equation P8.2: Integrated Emission Factor for Residual Waste Decomposition at a Landfill

\[
EF_{RW,\text{Decomp,CH}_4,LF,m} = A \times T\text{DOC} \times k_{LF} \times \sum_{x=1}^{n_{\text{max}}} \left(1 - LCE_{LF,m,x}\right) \left(e^{-k_{LF}x}\right)
\]

Where,

- \(EF_{RW,\text{Decomp,CH}_4,LF,m}\) = Integrated emission factor for decomposition of Residual Waste disposed at landfill LF in year \(m\) (tonne CH\(_4\) / tonne waste);
- \(A\) = Methane production capacity of organic waste, calculated using Equation B8.4 (tonne CH\(_4\) / tonne carbon);
- \(T\text{DOC}\) = Default fraction of total degradable organic carbon in organic waste, from Table 5 in Appendix C (tonne carbon / tonne waste);
- \(k_{LF}\) = Decay rate for organic waste at landfill LF, from Table 4 in Appendix B (years\(^{-1}\));
- \(x\) = Number of years after waste disposal in year \(m\) at landfill LF;
- \(n_{\text{max}}\) = Maximum number of years it would take for waste disposed at a B.C. landfill to reach 95% decomposition, from Table 5 in Appendix C (years);
- \(LCE_{LF,m,x}\) = Fraction of methane, for each year \(x\) after waste disposal in year \(m\), assumed to be captured or destroyed by landfill gas collection system at landfill LF, calculated using Equation B8.5;
- \(e\) = Mathematical constant that is the base of the natural logarithm, from Table 5 in Appendix C, rounded to five decimal places;
8.1.9 P9D Energy Generation

This emission source ($T_{P9D,P1,m}$) consists of GHG emissions from biogas combustion for energy generation from all Project Organic Waste Management Facilities in year $m$, in Project Instance $PI$.

Quantification of emissions from biogas combustion for energy generation at OWMF $f$ ($T_{P9D,Biogas,j,f,m}$) must use WCI.24 for CH$_4$ and N$_2$O emissions, using the volume of CH$_4$ in the biogas as the Fuel volume.

CO$_2$ emissions from the combustion of biogas are not included in the calculation of $T_{P9D,P1,m}$ since these emissions are considered biogenic.

Total GHG emissions for source P9D, in Project Instance $PI$ in year $m$, are calculated using Equation P9D:

Equation P9D: Energy Generation from Biogas

$$T_{P9D,j,P1,m} = \sum_f R_{Available,f,P1,m} \times T_{P9D,Biogas,j,f,m}$$

Where,

- $T_{P9D,j,P1,m}$ = Emissions of GHG $j$ from biogas combustion for energy generation (tonnes of GHG $j$);
- $R_{Available,f,P1,m}$ = Fraction of diverted Eligible Waste in Project Instance $PI$ available for Offset Units out of all organic waste at Organic Waste Management Facility $f$ in year $m$;
- $T_{P9D,Biogas,j,f,m}$ = Emissions of CH$_4$ or N$_2$O from biogas combustion for energy generation at Organic Waste Management Facility $f$ in year $m$ (tonnes of CH$_4$ or N$_2$O).

Results from this equation must be converted to tCO$_2$e using Equation 1.
8.2 Baseline Emissions and Removals

8.2.1 B8 Baseline Waste Decomposition at Landfill

This emission source \( T_{PB,Pl_m} \) consists of GHG emissions from anaerobic decomposition of baseline Eligible Waste that would have been disposed at landfills in year \( m \) in Project Instance \( Pl \).

In order to maintain functional equivalence, the amount of organic waste that would have been disposed at landfills is assumed to be equivalent to the amount of diverted Eligible Waste treated at Organic Waste Management Facilities:

\[
M_{TotalDiversion,Pl,m} = \sum_{LF} M_{Eligible,LF,Pl,m} = \sum_{f} M_{Eligible,f,Pl,m} = \sum_{LF,f} M_{Eligible,LF,f,Pl,m}
\]

Where,

- \( M_{TotalDiversion,Pl,m} \) = Total amount of Eligible Waste diverted in Project Instance \( Pl \) in year \( m \) (tonnes);
- \( M_{Eligible,LF,Pl,m} \) = Amount of Eligible Waste that would have been disposed at landfill \( LF \) but was diverted to Organic Waste Management Facilities in Project Instance \( Pl \) in year \( m \) (tonnes waste);
- \( M_{Eligible,f,Pl,m} \) = Amount of Eligible Waste that would have been disposed at landfills but was diverted to Organic Waste Management Facility \( f \) in Project Instance \( Pl \) in year \( m \) (tonnes waste);
- \( M_{Eligible,LF,f,Pl,m} \) = Amount of Eligible Waste that would have been disposed at landfill \( LF \) but was diverted to Organic Waste Management Facility \( f \) in Project Instance \( Pl \) in year \( m \) (tonnes waste).

Methane emissions resulting from anaerobic decomposition of Eligible Waste that would have been disposed at landfills are to be calculated using Equation B8.2:

\[
T_{B8,CH_4,Pl,m} = r_{OffsetAvailable,Pl,m} \times \left( \sum_{LF} E_{Decomp.CH_4,LF,m} \times \left( \sum_{f} M_{Eligible,LF,f,Pl,m} \right) \right)
\]

Where,

- \( T_{B8,CH_4,Pl,m} \) = Emissions of \( \text{CH}_4 \) from anaerobic decomposition of baseline Eligible Waste that would have been disposed at landfills in Project Instance \( Pl \) in year \( m \) (tonnes of \( \text{CH}_4 \));
- \( r_{OffsetAvailable,Pl,m} \) = Fraction of diverted Eligible Waste available for Offset Units out of all Eligible Waste diverted to Organic Waste Management Facilities in Project Instance \( Pl \) in year \( m \);
- \( E_{Decomp.CH_4,LF,m} \) = Integrated emission factor for Eligible Waste decomposition at landfill \( LF \), calculated using Equation B8.3, for Eligible Waste that would have been disposed at landfill \( LF \) in year \( m \) (tonne \( \text{CH}_4 \) / tonne waste);
Results from Equation B8.2 must be converted to tCO₂e using Equation 1. Where,

\[ E_{\text{EF, LF, m}} = A \times TDOC \times k_{LF} \times \left( \sum_{x=1}^{n_{\text{max}}} (1 - LCE_{LF, m, x})(e^{-k_{LF}x}) \right) \]

\( EF_{\text{Decomp, CH₄, LF, m}} \) = Integrated emission factor for decomposition of Eligible Waste at landfill \( LF \), for Eligible Waste that would have been disposed at landfill \( LF \) in year \( m \) (tonne CH₄ / tonne waste);

\( r_{\text{max CH}_4} \) = Maximum fraction of methane assumed to be generated at a landfill out of the theoretical maximum methane generation \( A \times TDOC \), from Table 5 in Appendix C; \( A \) = Methane production capacity of organic waste, calculated using Equation B8.4 (tonne CH₄ / tonne carbon);

\( TDOC \) = Default fraction of total degradable organic carbon in organic waste, from Table 5 in Appendix C (tonne carbon / tonne waste);

\( k_{LF} \) = Decay rate for organic waste at landfill \( LF \), from Table 4 in Appendix B (years⁻¹);

\( x \) = Number of years after waste disposal in year \( m \) at landfill \( LF \);

\( n_{\text{max}} \) = Maximum number of years it would take for waste disposed at a B.C. landfill to reach 95% decomposition, from Table 5 in Appendix C (years);

\( LCE_{LF, m, x} \) = Fraction of methane, for each year \( x \) after waste disposal in year \( m \), assumed to be captured or destroyed by landfill gas collection system at landfill \( LF \), calculated using Equation B8.5;

\( e \) = Mathematical constant that is the base of the natural logarithm, from Table 5 in Appendix C, rounded to five decimal places;

If baseline Eligible Waste would have been disposed at multiple landfills in Project Instance \( PI \) and the partitioning of waste between these landfills cannot be verifiably determined, the lowest landfill decay date \( k_{LF} \) for organic waste of all applicable landfills is to be used for calculation of emissions from baseline Eligible Waste decomposition at all these landfills.
\[ A = DOC \times MCF_{LF} \times (1 - OX) \times \frac{16}{12} \times F_{CH_4} \]

Where,

\( A \) = Methane production capacity of organic waste (tonne CH\(_4\) / tonne carbon);

\( DOC \) = Default fraction of organic waste that decomposes under anaerobic conditions, from Table 5 in Appendix C;

\( MCF_{LF} \) = Default methane correction factor for a landfill, from Table 5 in Appendix C;

\( OX \) = Default factor for the oxidation of methane by cover soil bacteria, from Table 5 in Appendix C;

\( 16/12 \) = Molar mass ratio of methane to carbon (tonne CH\(_4\) / tonne C);

\( F_{CH_4} \) = Default fraction of methane in gas produced at a landfill, from Table 5 in Appendix C.

**Equation B8.5: Fraction of Methane captured by landfill gas collection system**

\[ LCE_{LF,m,x} = \begin{cases} 
0, & 1 \leq x \leq \max(yr_{LGCS,LF} - m, 0) \\
0.75, & \max(yr_{LGCS,LF} - m, 0) + 1 \leq x \leq \max(2026 - m, 0) \\
0.85, & \max(2026 - m, 0) + 1 \leq x \leq n_{max}
\end{cases} \]

Where,

\( LCE_{LF,m,x} \) = Fraction of methane, for each year \( x \) after waste disposal in year \( m \), assumed to be captured or destroyed by landfill gas collection system at landfill LF;

\( yr_{LGCS,LF} \) = year of installation (actual if before Project start or planned if after) of landfill gas collection system (LGCS) at landfill LF;

\( m \) = Year of Project Report period;

\( 2026 \) = starting year of assuming LGCS is present at landfill LF and has collection efficiency of 0.85;

\( n_{max} \) = Maximum time it would take for waste disposed at a B.C. landfill to reach 95% decomposition, from Table 5 in Appendix C (years).
8.3 Leakage

The GHG sources commonly expected to be material to projects using this Protocol are identified in Figure 1. The Project Plan must confirm that there are no other GHG sources that are material to the Project.

If the Project has an emission source that is potentially material and not included in Figure 1 the Project Proponent must conduct a Leakage assessment as set out in the Regulation section 14(3)(k).

Use Equation 1 to convert to tCO₂e.

The primary source of Leakage is the shifting of waste diversion from Unqualified Organic Waste Management Facilities to Qualified Organic Waste Management Facilities, which increases the amount of Eligible Waste sent to Qualified Organic Waste Management Facilities without increasing overall waste diversion rates.

This is addressed in the Protocol in section 8.0, in the calculation of total diverted Eligible Waste that is eligible for Offset Units in year \( m \), in Step 6, by accounting for the decrease from year \( m-1 \) to year \( m \), in the amount of Eligible Waste diverted in Project Instance \( PI \) to Unqualified Organic Waste Management Facilities.
8.4 Project Reduction

In this section, quantification results from sub-sections 8.1 to 8.3 are inputs for quantifying the Project Reduction for a project report period \( m \), from all Project Instances \( PI \).

Total Baseline Emissions for year \( m \) are calculated by using Equation PR1 and total Project Emissions for year \( m \) are calculated as shown in Equation PR2:

**Equation PR1: Total Baseline Emissions for year \( m \)**

\[
T_{\text{Baseline},m} = \sum_{PI} T_{B8.PI,m}
\]

Where,

\( T_{B8.PI,m} \) = GHG emissions from anaerobic decomposition of baseline Eligible Waste that would have been disposed at landfills in year \( m \) in Project Instance \( PI \) (tonnes of CO\(_2\)e).

**Equation PR2: Total Project Emissions for year \( m \)**

\[
T_{\text{Project},m} = \sum_{PI} \{ T_{P1.PI,m} + T_{P2.PI,m} + T_{P3C.PI,m} + T_{P4D.PI,m} + T_{P5D.PI,m} + T_{P6D.PI,m} + T_{P7D.PI,m} \\
+ T_{P8.PI,m} + T_{P9D.PI,m} \}
\]

Where,

\( T_{P1.PI,m} \) = GHG emissions from all non-electricity Fuel consumption associated with the transportation of Fuel used at all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \);

\( T_{P2.PI,m} \) = GHG emissions from all Project Organic Waste Management Facilities in year \( m \) involving the combustion of non-electricity fuel, other than flaring, and involving the use of electricity, in Project Instance \( PI \);

\( T_{P3C.PI,m} \) = GHG emissions from Aerobic Composting at all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \);

\( T_{P4D.PI,m} \) = GHG emissions from the treatment of digestate at all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \);

\( T_{P5D.PI,m} \) = GHG emissions from digester effluent discharged to an open storage pond from all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \);

\( T_{P6D.PI,m} \) = GHG emissions from venting biogas during upset events from all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \);

\( T_{P7D.PI,m} \) = GHG emissions from flaring biogas and supplementary Fuels from all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \);

\( T_{P8.PI,m} \) = GHG emissions from anaerobic decomposition of Residual Waste disposed at all landfills from all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \);

\( T_{P9D.PI,m} \) = GHG emissions from biogas combustion for energy generation from all Project Organic Waste Management Facilities in year \( m \), in Project Instance \( PI \).
Total Project Reduction for year \( m \) is then calculated using Equation PR3:

\[
\text{Equation PR3: Total Project Reduction for year } m \\
T_{\text{ProjectReduction},m} = T_{\text{Baseline},m} - T_{\text{Project},m}
\]

Total Project Reduction is reported as a positive value and net emissions increase is reported as a negative value.
9.0 PROJECT REDUCTION ESTIMATES

In accordance with section 14 (3) (I) of the Regulation, the Project Plan must include an estimate of the expected Project Reduction to be achieved during the Crediting Period. In the Project Plan, the Project Proponent must include the estimated Project Reduction for each Project Report Period, for each Project Instance if applicable. The Project Proponent must explain anticipated variability of the Project Reduction across Project Report Periods.
10.0 DATA COLLECTION

In the Project Plan, the Project Proponent must detail how data will be collected and managed in accordance with ISO 14064-2:06, sections 5.9 and 5.10 over the Crediting Period and record retention period established in section 27 of the Regulation. The data collection and monitoring approach must be validated and followed throughout the Crediting Period.

For Program of Activities Projects, some of the data or parameters may only be available for aspects of the Project included at initial validation. Project Instances added afterwards would be evaluated during the next verification.

Fuel sampling, analysis and measurement must be in accordance with WCI.25 Sampling, Analysis and Measurement Requirements. For electricity Fuel, electricity emission factors must be updated for each Project Report Period. Total electricity consumed must be measured continuously using an electricity meter approved by Measurement Canada.

Mass of various waste quantities used in the calculations in the previous sections must be measured directly by weigh scale for every load received at, or produced by, an Organic Waste Management Facility. Record the type of waste contained in every load.

Volumes of digester effluent and biogas must be metered directly.

In an emergency situation where biogas is vented and biogas flow rate could not be measured directly, the average flow rate for the last 7 days with non-zero steady-state flow rate should be used to estimate the flow rate at the time of venting.

Volume fraction of CH₄ in biogas (vented, flared, or combusted for energy generation) must be measured with a continuous analyzer or, alternatively, with monthly measurements by using a direct sampling approach that yields a value with at least 95% confidence. CH₄ content measurement must be carried out close to a location in the system where a biogas flow measurement takes place.

All gas flow meters and continuous methane analyzers must be:

1) Cleaned and inspected on a quarterly basis with maintenance logs outlining maintenance duties according to manufacturer’s specifications
2) Field checked by a trained professional for calibration accuracy with the percent drift documented, using either a portable instrument (such as a pitot tube), a permanent fixture or manufacturer specifications, at the end of but no more than two months prior to the end date of the reporting period; and
3) Calibrated by the manufacturer or by a certified calibration service as per manufacturer’s specifications, or every 5 years, whichever is more frequent.

If using a calibrated portable gas analyzer for CH₄ content measurement, all of the following information must also be included:

1) Date, time, and location of methane measurement;
2) Methane content of biogas (% by volume) for each measurement;
3) Methane measurement instrument type and serial number;
4) Date, time, and results of instrument calibration; and
5) Corrective measures taken if instrument does not meet performance specifications.
APPENDIX A: LOCAL GOVERNMENTS, LANDFILLS, AND ORGANIC WASTE MANAGEMENT FACILITIES: AN ILLUSTRATION
APPENDIX B: LANDFILL PARAMETERS

The landfill-specific decay rates for organic waste decomposition at B.C. landfills are shown in the table below.

Table 4: Landfill Decay Rate $k_{LF}$ for Organic Waste

<table>
<thead>
<tr>
<th>Landfill Name</th>
<th>$k_{LF}$ (years$^{-1}$)</th>
<th>Landfill Name</th>
<th>$k_{LF}$ (years$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberni Valley</td>
<td>0.11</td>
<td>Heffley Creek</td>
<td>0.05</td>
</tr>
<tr>
<td>Armstrong</td>
<td>0.05</td>
<td>Knockholt</td>
<td>0.05</td>
</tr>
<tr>
<td>Bailey</td>
<td>0.11</td>
<td>Lower Nicola</td>
<td>0.05</td>
</tr>
<tr>
<td>Bessborough</td>
<td>0.05</td>
<td>McKelvey Creek3</td>
<td>0.09</td>
</tr>
<tr>
<td>Cache Creek</td>
<td>0.05</td>
<td>Mini's Pit</td>
<td>0.11</td>
</tr>
<tr>
<td>Campbell Mtn</td>
<td>0.05</td>
<td>Mission Flats</td>
<td>0.05</td>
</tr>
<tr>
<td>Campbell River</td>
<td>0.11</td>
<td>Nanaimo</td>
<td>0.11</td>
</tr>
<tr>
<td>Central</td>
<td>0.09</td>
<td>Ootischenia</td>
<td>0.09</td>
</tr>
<tr>
<td>Central Subregion</td>
<td>0.05</td>
<td>Prince Rupert</td>
<td>0.12</td>
</tr>
<tr>
<td>Comox Valley</td>
<td>0.11</td>
<td>Salmon Arm</td>
<td>0.09</td>
</tr>
<tr>
<td>Ecowaste</td>
<td>0.11</td>
<td>Sechelt</td>
<td>0.11</td>
</tr>
<tr>
<td>Foothills</td>
<td>0.09</td>
<td>Squamish</td>
<td>0.12</td>
</tr>
<tr>
<td>Ft. Nelson</td>
<td>0.05</td>
<td>Terrace</td>
<td>0.11</td>
</tr>
<tr>
<td>Ft. St. John</td>
<td>0.05</td>
<td>Thornhill</td>
<td>0.11</td>
</tr>
<tr>
<td>Gibraltar</td>
<td>0.09</td>
<td>Vancouver</td>
<td>0.11</td>
</tr>
<tr>
<td>Glenmore</td>
<td>0.05</td>
<td>Vernon</td>
<td>0.05</td>
</tr>
<tr>
<td>Hartland</td>
<td>0.09</td>
<td>Westside</td>
<td>0.05</td>
</tr>
</tbody>
</table>
## APPENDIX C: PARAMETER CONSTANTS USED IN EQUATIONS

### Table 5: Parameter Constants

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{DOC}$</td>
<td>Default fraction of total degradable organic carbon in organic waste</td>
<td>0.15</td>
<td>n/a</td>
</tr>
<tr>
<td>$DOC$</td>
<td>Default fraction of organic waste that decomposes under anaerobic conditions</td>
<td>0.5</td>
<td>n/a</td>
</tr>
<tr>
<td>$F_{CH_4}$</td>
<td>Default fraction of methane in gas produced at a landfill</td>
<td>0.5</td>
<td>n/a</td>
</tr>
<tr>
<td>$OX$</td>
<td>Default factor for the oxidation of methane by cover soil bacteria</td>
<td>0.1</td>
<td>n/a</td>
</tr>
<tr>
<td>$4_{maxCH_4}$</td>
<td>Maximum fraction of methane assumed to be generated at a landfill out of the theoretical maximum methane generation</td>
<td>0.95</td>
<td>n/a</td>
</tr>
<tr>
<td>$n_{max}$</td>
<td>Maximum number of years it would take for waste disposed at a B.C. landfill to reach 95% decomposition</td>
<td>60</td>
<td>years</td>
</tr>
<tr>
<td>$MC_{FLF}$</td>
<td>Default methane correction factor for a landfill</td>
<td>1.0</td>
<td>n/a</td>
</tr>
<tr>
<td>$MC_{Feff}$</td>
<td>Default methane correction factor for digester effluent</td>
<td>0.3</td>
<td>n/a</td>
</tr>
<tr>
<td>$B_{n,eff}$</td>
<td>Maximum methane producing capacity of digester effluent per tonne chemical oxygen demand</td>
<td>0.25</td>
<td>tonne CH$_4$/tonne COD</td>
</tr>
<tr>
<td>$\rho_{CH_4}$</td>
<td>Density of CH$_4$ at standard temperature and pressure (15°C and 1 atm)</td>
<td>0.678</td>
<td>kg/m$^3$ CH$_4$</td>
</tr>
<tr>
<td>$e$</td>
<td>Mathematical constant that is the base of the natural logarithm, rounded to five decimal places</td>
<td>2.71828</td>
<td>n/a</td>
</tr>
</tbody>
</table>