

British Columbia Greenhouse Gas Offset Protocol: Methane from Organic Waste

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GREENHOUSE GAS INDUSTRIAL REPORTING AND CONTROL ACT

Table of Contents

Guidance	5
Part 1: Definitions and Interpretation	7
DEFINITIONS AND INTERPRETATION.....	7
Part 2: Applicability and Eligibility	10
APPLICABILITY OF PROTOCOL.....	10
ELIGIBILITY ASSERTION	10
ELIGIBLE LANDFILL GAS MANAGEMENT PROJECTS.....	10
ELIGIBLE ANAEROBIC DIGESTION PROJECTS	10
EXCLUDED PROJECTS.....	11
Part 3: General Rules	11
GGECR APPLIES UNLESS EXPRESSLY DISALLOWED OR VARIED	11
DETERMINATION OF PROJECT START DATE	11
CREDITING PERIOD 12	
QUANTIFICATION OF PROJECT REDUCTIONS.....	12
Part 4: General Project Plan Requirements.....	12
TECHNICAL DESCRIPTIONS IN PROJECT PLAN.....	12
PROJECT IDENTIFICATION INFORMATION.....	12
CHRONOLOGICAL PLAN FOR THE PROJECT	12
DISAPPLICATION OF LEAKAGE REQUIREMENTS IN PLAN.....	13
Part 5: General Project Report Requirements	13
ASSERTIONS IN PROJECT REPORTS APPLY TO THE PROJECT REPORT PERIOD	13
PROJECT REPORT PERIOD	13
PROJECT REPORT ORGANIZATION	13
PROJECT REPORTS FOR PROGRAMS OF ACTIVITIES.....	13
Part 6: Additionality and Double counting.....	13
FINANCIAL ADDITIONALITY ASSERTION	13
HISTORIC PRACTICE ASSERTION.....	13
DOUBLE COUNTING	14
BIOGAS SALES CONTRACTS REPORTING TO AVOID DOUBLE COUNTING	14

REGULATORY ADDITIONALITY – LFG PROJECT PLAN REQUIREMENTS	16
REGULATORY ADDITIONALITY – PROJECT REPORTS	16
Part 6: Historical practices	16
HISTORIC PRACTICES – LANDFILL GAS MANAGEMENT PROJECTS	16
HISTORIC PRACTICES – ANAEROBIC DIGESTION PROJECTS	16
Part 7: Materiality Thresholds	17
MATERIALITY THRESHOLD FOR VALIDATION	17
MATERIALITY THRESHOLD FOR VERIFICATION	17
Appendix A: Quantification	18
SUB- APPENDIX A.1: LANDFILL GAS PROJECTS	19
SUB- APPENDIX A.2: ANAEROBIC DIGESTION PROJECTS	20
Appendix B: Reference Materials	23
SUB- APPENDIX B.1 DESTRUCTION EFFICIENCIES FOR COMBUSTION DEVICES.....	23
SUB- APPENDIX B.2 DATA SUBSTITUTION	24
SUB- APPENDIX B.3 OPERATIONAL STATUS OF ELIGIBLE DESTRUCTION DEVICES	25
SUB- APPENDIX B.4 PROJECT REPORT REQUIREMENTS	25

Equations

Equation 1 - Total Project Reductions in Project Report Period.....	18
Equation 2 - Discount Factor	18
Equation 3 - Total baseline emissions in Project Report Period for LFG Projects.....	20

Tables

Table 1 - Default Destruction Efficiencies for Combustion Devices	23
Table 2 - Methodology for Determining Substituted Data	24

GUIDANCE

This document contains both a protocol for the carrying out of certain emission offset projects that reduce methane emissions from anaerobic decomposition of organic waste, and guidance associated with such projects. The Protocol is established under section 10 of the Greenhouse Gas Industrial Reporting and Control Act (“GGIRCA”). It creates legal requirements that Project Proponents, Validation Bodies and Verification Bodies must follow for the proponent to obtain Offset Units under GGIRCA. This document also contains guidance which is intended to assist Project Proponents, Verification Bodies and Validation Bodies. Such guidance is not a legal requirement imposed although it may refer to binding legal requirements. For example, explaining implications of a Protocol requirement or reminding Project Proponents that they may be subject to other legislation or regulations and that nothing in this Protocol affects those obligations.

The guidance included within this Protocol is for the purpose of providing additional information only and may not be applicable to specific Projects. Project Proponents are responsible for ensuring compliance with all applicable laws, including but not limited to, this Protocol, [GGECR](#), [GGIRCA](#), the [Municipal Wastewater Regulation \(B.C. Reg 87/2012\)](#), the [Code of Practice for Agricultural Environmental Management \(B.C. Reg. 8/2019\)](#), the [Landfill Gas Management Regulation \(B.C. Reg. 391/2008\)](#) and the [Organic Matter Recycling Regulation \(B.C. Reg. 18/2002\)](#), as applicable.

Text in this document which is italicized is guidance and is not part of this Protocol. Text in this document which is not italicized is part of this Protocol. Terms that are capitalized, other than for grammatic purposes, have the definitions ascribed to them in this Protocol, GGIRCA or the Greenhouse Gas Emission Control Regulation (“GGECR”).

The Protocol expands on GGECR requirements for Eligible Projects and provides detailed rules for quantification of Project Reductions from Eligible Projects. The Protocol must be read in conjunction with GGECR as most of the requirements of GGECR apply fully to Eligible Projects.

Simply meeting the eligibility requirements in this Protocol does not guarantee a Project will be able to generate offset units. Project Proponents are advised to confirm that the rules for calculating Baseline Emissions under this Protocol will allow for generation of offset units. Project Proponents are also advised to confirm that the required assertions related to additionality of the Project can be made.

Project Proponents are further responsible for understanding the interaction of Projects under this Protocol with other regulatory and funding programs. This will vary according to the rules of GGECR, this Protocol and the rules applicable to other programs. For example, obtaining funding for a project under the CleanBC Industry Fund may affect the ability to obtain validation of a Project Plan, and attempting to obtain Offset Units from a Project may be a breach of funding agreements. Similarly, if Biogas produced by relevant Facilities or practices is supplied for transportation in substitution of diesel or gasoline, or otherwise supplied in a manner that is expected to generate credits or debits under the Low Carbon Fuel Requirements

Program, Eligible Projects under this Protocol will only generate Offset Units in relation to the portion of Biogas from the Project that is not supplied for the purposes of that program.

Project Proponents are also responsible to ensure that the Validation Body or Verification Body used is accredited in relation to projects in the sector covered under this Protocol (i.e. accreditation by the Standards Council of Canada to Technical Sector F: Decomposition of Waste Material, Handling and Disposal or by the American National Standards Institute (ANSI) to Sector Group 6: GHG Waste Handling and Disposal).

Project Proponents are strongly encouraged to test the feasibility of potential projects prior to developing a Project Plan under this Protocol. The Ministry of Environment and Climate Change Strategy has developed estimation tools that may be useful, including, the Landfill Gas Estimation Tool ([link](#)) and/or the GHG Estimation Tool for CleanBC organics infrastructure and collection program ([link](#)). Project Proponents assume all risk if the emission reductions estimated using these tools or any other means of estimation are different from those calculated using the quantification methodology contained in the Protocol.

PART 1: DEFINITIONS AND INTERPRETATION

Definitions and Interpretation

1 (1) In this Protocol, a word or expression that is capitalized other than for grammatic purposes has same meaning as in GGIRCA or GGEGR or as set out below:

“Accepted Design Plan” means an accepted design plan within the meaning of section 8 (1) of the LFGMR;

“Anerobic Decomposition” means a biological process through which organic matter is broken down by bacterial action in the absence of oxygen;

“Anaerobic Digestion Project” means a Project, other than an LFG Management Project, that reduces GHG emissions by capturing and destroying methane from Anaerobic Decomposition of organic matter, including organic matter consisting of

- (a) solid waste,
- (b) manure, or
- (c) municipal wastewater within the meaning of the Municipal Wastewater Regulation, B.C. Reg 87/2012;

“Biogas” means the mixture of methane different or other gases produced by the Anaerobic Decomposition of organic matter and includes processed Biogas;

“BCS” or **“Biogas Control System”** means

- (a) in the case of an LFG Project, landfill gas management facilities as defined in the LFGMR, and
- (b) in the case of an Anaerobic Digestion Project, a system designed to capture and destroy Biogas from an anaerobic digester which consists of a Biogas collection system, metering equipment, and one or more Biogas destruction devices as appropriate for the Eligible Waste associated with the generation of Biogas;

“Bioreactor” means any portion of a municipal solid waste landfill in which a liquid, other than leachate or landfill gas condensate, is added

- (a) in a controlled fashion into the waste mass, often in combination with recirculating leachate, to reach a minimum average moisture content of at least 40 percent by weight, and
- (b) to accelerate or enhance Anaerobic Decomposition of the waste;

“CO₂e” or **“Carbon Dioxide Equivalent”** means carbon dioxide equivalent as determined in accordance subsection (5) of this section;

“Effective Date” means the date on which public notice of this Protocol was provided under section 10 (3) of GGIRCA *[as shown for guidance purposes on the cover page of this protocol]*;

“Eligible Destruction Device” means a destruction device listed in Table 1 of Sub-Appendix B1;

“Eligible Project” means

- (a) an LFG Management Project that is eligible under section 4, or
- (b) an Anaerobic Digestion Project that is eligible under section 5;

“Eligible Waste” means the organic waste that was treated or managed in a way that resulted in the production of methane in the Baseline Scenario;

“GGECR” means the Greenhouse Gas Emission Control Regulation, B.C. Reg 250/2015;

“GGIRCA” means the *Greenhouse Gas Industrial Reporting and Control Act*;

“GHG” means Greenhouse Gas;

“GWP” or **“Global Warming Potential”** means the global warming potential referred to in subsection (5) of this section;

“LFG” or **“Landfill Gas”** means Biogas generated by the Anaerobic Decomposition of Eligible Waste in a landfill;

“LFG Management Project” means a Project that reduces GHG emissions by capturing and destroying methane generated by Anaerobic Decomposition of waste in a landfill;

“LFGMR” or **“Landfill Gas Management Regulation”** means the Landfill Gas Management Regulation, B.C. Reg. 391/2008;

“Low Carbon Fuel Requirements Program” means the regulatory scheme under Part 3 of the *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act*, the low carbon fuel requirements program under the *Low Carbon Fuel Act*, S.B.C. 2022, c. 21, or any regulatory scheme for reducing carbon intensity of fuels that replaces either Act;

“New Regulatory Requirement”, in relation to a Project, means a Regulatory Requirement that arises during a Project Report Period;

“Offset Project” means a project that results in reductions in GHG emissions or increases in GHG removals that are quantified and applied toward a Regulatory Requirement, or are recognized under a voluntary or regulatory program, for the purposes of offsetting GHG emissions;

“Primary Project Activities” means the following activities that cause methane emissions to be captured and destroyed:

- (a) in the case of an LFG Management Project, the activities described in section 4 (a);
- (b) in the case of an Anaerobic Digestion Project, the activities described in section 5 (a);

“Program of Activities” means a Project made up of activities occurring at multiple facilities or operations that each would individually constitute an Eligible Project;

“Project Instance” means an individual Eligible Project within a Program of Activities;

“Regulatory Requirement” means any of the following requirements that directly or indirectly regulate LFG or Anaerobic Decomposition management practices or facilities:

- (a) in relation to the *Environmental Management Act*, a requirement related to the capture or destruction of methane imposed
 - (i) in a permit, operational certificate or approval,
 - (ii) by a director, or
 - (iii) under a regulation made under the Act, including, for certainty, section 8 (3) of the LFGMR, an Accepted Design Plan, or a design standard or performance objective respecting collection efficiency set out in a guideline under the LFGMR;
- (b) a requirement in an order or other instrument that
 - (i) is issued by, or entered into with, the government or federal government, and
 - (ii) requires a Project Proponent to take action to bring the Project Proponent's LFG or Anaerobic Decomposition management practices or facilities into compliance with a law that relates to the capture or destruction of methane;

“Stand-Alone Project” means an Eligible Project in which the Primary Project Activities are limited to a single facility or operation.

- (2) Text in this Protocol that is italicized, other than a reference to an Act, is for guidance only and is not part of this Protocol.
- (3) The *Interpretation Act* applies to this Protocol.
- (4) A definition or requirement that is expressed as including items in a list is not limited to those listed items.
- (5) Section 1 (3) and (4) of the Greenhouse Gas Emission Reporting Regulation, B.C. Reg. 249/2015, applies to the calculation of carbon dioxide equivalent and, for that purpose,
 - (a) the global warming potential that applies to a calculation contained in a Project Plan is the global warming potential in effect as of the date of the Project Plan, and
 - (b) the global warming potential that applies to a calculation contained in a Project Report is the global warming potential in effect as of the date of the Project Report.
- (6) For certainty, unless a contrary intention appears, a requirement imposed by this Protocol applies to Eligible Projects.
- (7) For certainty, an assertion required by this Protocol to be included in a Project Plan is
 - (a) an assertion of the Project Proponent, and
 - (b) an assertion for the purposes of section 15 (1) (a) of GGEGR.
- (8) The Appendices to this Protocol form part of this Protocol.

PART 2. APPLICABILITY AND ELIGIBILITY

Applicability of Protocol

- 2 (1) This Protocol applies to the following Projects in British Columbia:
- (a) an LFG Management Project;
 - (b) an Anaerobic Digestion Project.
- (2) For certainty, in accordance with section 10 (4) of GGIRCA, this Protocol does not apply to a Project if the Project Plan was validated before the Effective Date.

Eligibility Assertion

- 3 A Project Plan must contain an assertion that the Project is an Eligible Project under this Protocol.

Eligible Landfill Gas Management Projects

- 4 An LFG Management Project is eligible under this Protocol if all of the following apply:
- (a) the Project involves
 - (i) the capture and destruction of methane in LFG, and
 - (ii) a change in the BCS or management practices, or both, used to achieve that capture and destruction of methane;
 - (b) the methane is captured and destroyed using an Eligible Destruction Device;
 - (c) the landfill associated with the Project
 - (i) is not designed to be or operated as a Bioreactor, and
 - (ii) is designed and operated in accordance with sections 5.6 and 10.3.2 of the Ministry of Environment Landfill Criteria for Municipal Solid Waste, or any criteria related to minimizing surface water contact with waste set out in a document that replaces it;
 - (d) the Project is not excluded under section 6.

Note re: landfill eligibility: both landfills that are subject to the Landfill Gas Management Regulation and industrial landfills that are not subject to that regulation are potentially eligible under this Protocol, but the regulatory requirements applicable to a landfill will affect baselines.

Eligible Anaerobic Digestion Projects

- 5 An Anaerobic Digestion Project is eligible under this Protocol if all of the following apply:
- (a) the Project involves

- (i) the capture and destruction of methane generated from the Anerobic Decomposition of one or more streams of Eligible Waste, and
- (ii) a change in the BCS or management practices, or both, used to achieve that capture and destruction of methane;
- (b) the methane is captured and destroyed using an Eligible Destruction Device;
- (c) the BCS manages a stream of Eligible Waste that prior to the Project was managed under conditions that created an oxygen-free layer in which decomposition occurred through any of the following baseline conditions:
 - (i) solid waste landfill;
 - (ii) liquid manure storage;
 - (iii) passive anaerobic wastewater treatment;
- (d) the Project is not excluded under section 6.

Note RE: Documenting past waste management regime. Proponents must be able to provide to the Validation Body and Verification Body documentation to substantiate the previous waste management approach used for all sources of waste identified in the Project Plan or added subsequently under a PoA.

Excluded Projects

- 6** A Project is not eligible under this Protocol if
- (a) the Project Start Date was before January 1, 2020, or
 - (b) the Project will not result in Emissions Reductions, as determined in the Project Plan in accordance with this Protocol.

PART 3. GENERAL RULES

GGEGR applies unless expressly disallowed or varied

- 7** Unless this Protocol specifically states that a requirement under GGEGR is inapplicable, all Project Plans, Validation Statements, Project Reports and Verification Statements must meet the requirements of both this Protocol and GGEGR.

Note re: consequences of failure to comply with GGIRCA or GGEGR. Failure to meet such requirements may cause a project plan not being accepted under GGIRCA or offset units not being issued.

Determination of Project Start Date

- 8 A Project Start Date is the earliest date on which the Primary Project Activities cause an increase in the capture and destruction of methane in the Biogas relative to the baseline.

Crediting Period

- 9 The Crediting Period for an accepted Project may not exceed ten years.

Notes re: Crediting Periods: while the crediting period is ten years from the Project start date, the Baseline Emissions of the Project will be adjusted to reflect increased Regulatory Requirements over time and this may eliminate the ability of a Project to produce Project Reductions.

While there is a possibility that a Project may receive a revalidation based on any applicable protocol in effect at the end of the Crediting Period, this will be based on the continuation of the project meeting all GGECR and protocol requirements in place at that time, e.g. that the continuation of the Project exceeds regulatory requirements and requires the financial incentives of credits.

Quantification of Project Reductions

- 10 Project Reductions must be quantified in accordance with the Appendices.

PART 4: GENERAL PROJECT PLAN REQUIREMENTS

Technical Descriptions in Project Plan

- 11 The technical description referred to in section 14 (3) (c) of GGECR must include a detailed description of the Primary Project Activities.

Project Identification Information

- 12 The Project identification information referred to in section 14 (3) (d) of GGECR must include one of the following:
- (a) in the case of a Stand-Alone Project, the street address, GPS coordinates, and latitude and longitude of the Project's Facilities and, if different and applicable, any Facilities that prior to the Start Date managed the waste stream managed by the Project's Facilities;
 - (b) in the case of a Program of Activities, the street address, GPS coordinates, and latitude and longitude of all Project's Facilities for known Project Instances as of the date of the Project Plan and, if different and applicable, any Facilities that prior to the Start Date managed the waste stream managed by the known Project's Facilities.

Chronological plan for the Project

- 13 A chronological plan referred to in section 14 (3) (e) of GGECR must set out:

- (a) the key events in the development of the Project that occurred before the Start Date, and
- (b) the dates on which those events occurred.

Disapplication of Leakage Requirements in Plan

- 14** A Project Plan is not required to include the things referred to in section 14 (3) (k) of GGEGR.

PART 5: GENERAL PROJECT REPORT REQUIREMENTS

Assertions in Project Reports apply to the Project Report Period

- 15** An assertion that this Protocol requires in a Project Report is an assertion for the Project Report Period.

Project Report Period

- 16** (1) The first Project Report Period begins on the Start Date of a Project and extends for one year to the anniversary of the Start Date.
- (2) Each subsequent Project Report Period begins when the previous Project Report Period ends and extends for one, two or three years, as determined by the Project Proponent, to the anniversary of the Start Date.

Project Report Organization

- 17** If a Project Report Period of two or three years is used, the Project Report must be organized by year.

Project Reports for Programs of Activities

- 18** If a Project is a Program of Activities, the Project Report must include
- (a) a list of all Project Instances not described in the Project Plan, and
 - (b) a list of all Project Instances described in the Project Plan that have not proceeded.

PART 6: ADDITIONALITY AND DOUBLE COUNTING

Financial Additionality Assertion

- 19** A Project Plan
- (a) is not required to include the assertion in section 14 (3) (n) (xi) of GGEGR, but
 - (b) must include an assertion that the revenue from the sale of Offset Units was or will be required to implement the Project and a justification for that assertion.

Historic Practice Assertion

- 20** A Project Plan must include an assertion that the Project involves one or both of a change in the BCS or management practices, if any, used in the Baseline Scenario.

Double Counting

- 21** (1) A Project Proponent must ensure, and the Project Plan and every Project Report must include assertions as to all of the following:
- (a) Baseline Emissions, if emitted, would not be
 - (i) emissions attributable to a Regulated Operation under GGIRCA, or
 - (ii) subject to any other federal or provincial emission limit in which reductions below that limit generate credits or tradeable instruments that can be used to offset other emissions;
 - (b) Emission Reductions that are included in the determination of Project Reductions have not been, and will not be, counted
 - (i) as an emission reduction from other Offset Projects, including without limitation avoided emissions of methane being considered in determining carbon intensity of a fuel for the purpose of other Offset Projects,
 - (ii) towards any legal obligation of a utility supplying natural gas to reduce or limit GHG emissions from combustion of fuels the utility supplies to consumers or to implement any plan for GHG reductions that the utility is required to implement,
 - (iii) for the purpose of determining carbon intensity of a fuel under the Low Carbon Fuel Requirements Program, or
 - (iv) towards any legal obligation of a utility supplying natural gas to supply Biogas.
- (2) Any Biogas referred to in section 22 (2) (a) or (b) is deemed to have been counted for the purpose of determining carbon intensity of a fuel under the Low Carbon Fuel Requirements Program, as referred to in subsection (1) (b) (iii) of this section.
- (3) Any Biogas referred to in section 22 (2) (c) is deemed to have been counted towards a legal obligation referred to in subsection (1) (b) (ii) or (iv) of this section.

Note re s. 21(1)(b)(i) and fuel switching projects: If methane from organic waste generated by an Eligible Project is used to displace a more carbon intensive fuel, and a person wants to generate credits from both the avoided methane emissions and the reduction in emissions from displacing other fuel:

- *that part of the project that reduces GHG emissions through the avoidance of methane emissions from organic waste will be considered a separate project from that part of the project that reduces emissions through displacement of a more carbon intensive fuel, and*
- *separate project plans, validation statements, project reports and verification statements are required in relation to both parts of the project but may be submitted together.*

Biogas Sales Contracts reporting to avoid double counting

- 22** (1) If Biogas produced by a Project is supplied to a person, the Project Proponent must have agreements with each recipient that, for each Project Report Period, the recipient will provide the Project Proponent with a report detailing the amount of Biogas supplied by the Project Proponent to that recipient during the Project Report Period.
- (2) For the purposes of subsection (1), the report must delineate between Biogas that falls into each of the following categories:
- (a) Biogas in relation to which the recipient will or has received credits or debits under the Low Carbon Fuel Requirements Program based on a published carbon intensity under that program that is specific to a project or projects that avoid emissions of Biogas to the atmosphere;
 - (b) Biogas that the recipient has supplied to a person along with the following, as applicable:
 - (i) carbon intensity record under the Low Carbon Fuel Requirements Program indicating that the fuel has a published carbon intensity that is specific to a project or projects that avoid emissions of Biogas to the atmosphere;
 - (ii) any other record related to the carbon intensity of the fuel which would allow the person to claim credit under the Low Carbon Fuel Requirements Program;
 - (c) Biogas that will be used by a utility to meet a requirement referred to in section 21 (1) (b) (ii) or (iv) of this Protocol [*GHG Reduction and RNG Requirements for Utilities*];
 - (d) Biogas to which none of paragraphs (a), (b) or (c) of this subsection apply.
- Note re: purpose of section 21. This section ensures that the proponent will have the information available to ascertain that the environmental attributes of the Biogas they supply (i.e. the avoided emissions of Biogas) are not double counted by being used to generate credits under the Low Carbon Fuel Requirements Program, which relies on carbon intensity records to allow downstream vendors or users of gas to claim environmental attributes of a specific fuel. Only Biogas referred to in paragraph (d) may be included in calculations of Emission Reductions.*
- (3) A Project Plan for must include an assertion that as of the date of the Project Plan
- (a) Biogas from the Project has not been supplied to a recipient referred to in subsection (1), or
 - (b) the Project Proponent has an agreement described in subsection (1) with each recipient to whom Biogas has been supplied.
- (4) A Project Report must include, for the relevant Project Report Period,
- (a) an assertion that during the Project Report Period Biogas from the Project was not supplied to a recipient referred to in subsection (1), or

- (b) the report referred to in subsection (1) that is provided by the recipient to the Project Proponent.

Regulatory Additionality – LFG Project Plan Requirements

- 23** (1) A Project Plan must include
- (a) an assertion that the Primary Project Activities are not required, directly or indirectly, by a Regulatory Requirement, or
 - (b) an assertion that the Primary Project Activities are required, directly or indirectly, by a Regulatory Requirement, but the Primary Project Activities exceed the standards required by the Regulatory Requirement.
- (2) For the purposes of validation of a Project Plan, if a Project Plan includes an assertion referred to in subsection (1) (b), the Project Proponent must demonstrate in the Project Plan that the Primary Project Activities exceed the standards required by the Regulatory Requirement.

Regulatory Additionality – Project Reports

- 24** (1) Each Project Report for a Project Report Period must include either
- (a) an assertion that the Primary Project Activities are not required, directly or indirectly, by a New Regulatory Requirement that arose during the Project Report Period, or
 - (b) an assertion that the Primary Project Activities are required, directly or indirectly, by a New Regulatory Requirement that arose during the Project Report Period but the Primary Project Activities exceed the standards required by the New Regulatory Requirement.
- (2) If a Project Report includes an assertion referred to subsection (1) (b), the Project Proponent must demonstrate, in the Project Report, that the Primary Project Activities exceed the standards referred to in that subsection.

PART 6: HISTORICAL PRACTICES

Historic Practices – Landfill Gas Management Projects

- 25** For an LFG Management Project, the technical description required by section 11 of this Protocol must clearly distinguish between the elements of the BCS in place prior to the Start Date and those established on or started after the Start Date.

Historic Practices – Anaerobic Digestion Projects

- 26 For an Anaerobic Digestion Project, the Project Plan must include a description of how Eligible Waste was managed prior to the Project Start Date, including a description of the type of treatment and handling system in place including the impoundment depths and aeration regime.

PART 7: MATERIALITY THRESHOLDS

Materiality Threshold for Validation

- 27 For the purposes of sections 15 (3) (c) of GGECR, errors, omissions or misrepresentations are considered material if the aggregate effects of all errors, omissions and misrepresentations result in an overestimation of the Project Reductions of more than 5%.

Materiality Threshold for Verification

- 28 For the purposes of sections 21 (4) (c) of GGECR, errors, omissions or misrepresentations are considered material if the aggregate effects of all errors, omissions and misrepresentations result in an overestimation of the Project Reductions in a Project Report Period of more than 5%.

APPENDIX A: QUANTIFICATION

Section A.1 Deviations from GGECR Requirement for Project Plans and Project Reports in Relation to Quantification

- (1) A Project Plan is not required to include the things referred to in section 14 (3) (l) of GGECR.
- (2) For the purposes of section 20 (3) (f) (vi) of GGECR, the measurements and calculations that result in the amounts asserted under section 20 (3) (f) (v) must be carried out in accordance with this Appendix.

Section A.2 Quantification of Project Reductions

- (1) For each Project Instance, Project Reductions for a Project Report Period must be calculated by using Equation 1

Equation 1 - Total Project Reductions in Project Report Period

$$PR = (BE - PE) \times (\text{Discount})$$

Where, Variable	Description	Units
PR	= means Project Reductions in the Project Report Period and is the value being calculated	t CO ₂ e
BE	= means the total of all Baseline Emissions in the Project Report Period as calculated in accordance with the methodology referred to in Appendix A.1 or A.2, as applicable.	t CO ₂ e
PE	= means the total of all Project Emissions in the Project Report Period as calculated in accordance with the methodology referred to in Appendix A.1 or A.2, as applicable.	t CO ₂ e
Discount	= means the Discount determined under subsection (2)	Unitless

- (2) The Discount in equation 1 must be calculated by using Equation 2

Equation 2 - Discount Factor

$$\text{Discount} = (1 - \text{Supplied}_{\text{Credited}})$$

Where, Variable	Description	Units
Supplied _{Credited}	= the fraction of the total Biogas captured and supplied under another regulatory regime that may reasonably be expected to be, or have been <ol style="list-style-type: none"> a. recognized or applied in relation to a regulatory requirement related to greenhouse gas reductions under another enactment, b. or submitted for recognition under a voluntary or mandatory emission offset scheme and includes, without limitation any Biogas referred to in section 21 (1) (b) [<i>Double Counting</i>] or 22 (2) (a), (b) or (c) [<i>Biogas Sales Contracts</i>].	Unitless
Discount	= the value being calculated	Unitless

- (3) Baseline Emissions and Project Emissions must be calculated in accordance with the applicable Sub-Appendix in this Appendix.
- (4) Project Reports must show each equation applicable to the quantification of Project Reductions and, for the relevant Project Report Period, how the inputs into those equations were derived and the outputs from those equations.
- (5) For a Project which is a Program of Activities, the Project Reductions must be calculated by applying subsections (1) to (4) to each Project Instance as if each instance was a Stand-Alone Project and totaling the result.

SUB- APPENDIX A.1: LANDFILL GAS PROJECTS

Section A1.1 Application of Sub-Appendix

This Sub-Appendix applies only to LFG Projects.

Section A1.2 Quantification Methodology

The quantification of the Baseline Emissions (BE) and Project Emissions (PE) for LFG Projects must follow the method outlined in Environment and Climate Change Canada's Landfill Methane Recovery and Destruction (2020) ([link](#)) as described and modified below.

That document will be referred to within this Protocol as the ECCC Methodology. References to specific equations from the ECCC Methodology will include the prefix "ECCC"; for example, ECCC Equation 1.

Section A1.3 Emission factors and default values

- (1) Global Warming Potentials for GHGs must be taken from column 4 of the Schedule in the Carbon Neutral Government Regulation, B.C. Reg. 392/2008.
- (2) Emission Factors for fuels and electricity must be taken from the following:
 - Grid Electricity – B.C. Grid Factors are available at: <https://www2.gov.bc.ca/gov/content/environment/climate-change/industry/reporting/quantify/electricity>
 - Fuels - Table 20-2 of the Western Climate Initiative's Final Essential Requirements of Mandatory Reporting Amended for Canadian Harmonization.
- (3) Default values for Destruction Efficiency of Eligible Destruction Devices must be taken from Table 1.

Section A1.4 Emission sources and sinks

Section 7.0 of the ECCC Methodology [*Project GHG Boundary*] sets out the emission sources and sinks that must be used in relation to the assessment of reductions in emissions associated with LFG Projects.

Section A1.5 Baseline Scenario Emissions

Section 8.1 of the ECCC Methodology must be used to quantify the emissions associated with the Baseline Scenario (BE) with the following modification: Equation 3 below replaces ECCC Equation 1.

Equation 3 - Total baseline emissions in Project Report Period for LFG Projects

$$BE_{LFG} = [CH_4REC_{PR} \times (1 - OX)] \times (1 - \text{Required Capture Rate})$$

Where,

Variable	Description	Units
BE_{LFG}	= Baseline Scenario Emissions during Project Report Period for LFG projects	t CO ₂ e
CH_4REC_{PR}	= Total quantity of methane recovered by the BCS during Project Report Period, calculated in ECCC Equation 2.	t CO ₂ e
OX	= Oxidation factor: <ul style="list-style-type: none"> • 0.1 for landfills <u>without</u> a synthetic liner covering the entire landfill area, or • 0 for landfills <u>with</u> a synthetic liner covering the entire landfill area 	Unitless
Required Capture Rate	= Portion of methane that is required to be captured as per the LFGMR during the Project Report Period. <ul style="list-style-type: none"> • Facilities <u>required</u> to capture biogas under the LFGMR in the Project Report Period must use a capture rate of 0.75 or greater, as required in an accepted LFG management plan for the Project Site. • Facilities <u>not required</u> to capture biogas under the LFGMR must use a capture rate of 0. 	Unitless

Section A1.6 Project Scenario Emissions

Section 8.2 of the ECCC Methodology must be used to quantify the emissions associated with the Project Scenario (PE).

Section A1.7 Measurement and Data

Section 11 of the ECCC Methodology sets out the requirements that must be used for the management, operation and calibration of measuring devices and data collection associated with a Project with the following modifications:

- (a) Sub-Appendix B.2 of this Protocol replaces section 11.4 of the ECCC Methodology;
- (b) Sub-Appendix B.3 of this Protocol replaces section 11.5 of the ECCC Methodology.

SUB- APPENDIX A.2: ANAEROBIC DIGESTION PROJECTS

Section A2.1 Emission factors and default values

This Sub-Appendix applies only to Anaerobic Digestion Projects.

Section A2.2 Quantification Methodology

The quantification of the Baseline Emissions (BE) and Project Emissions (PE) for AD Projects must follow the method outlined in Government of Alberta Quantification Protocol for Biogas Production and Combustion (2020) ([link](#)) as described and modified below.

That document will be referred to within this Protocol as the AB Methodology. References to specific equations from the AB Methodology will include the prefix “AB”; for example, AB Equation 1.

Section A2.3 Emission factors and default values

- (1) Global Warming Potentials for GHGs used in the calculations must be taken from column 4 of the Schedule in the Carbon Neutral Government Regulation.
- (2) Default values for Destruction Efficiency of Eligible Destruction Devices must be taken from Table 1.

Section A2.4 Emission sources and sinks

The following sections of the AB Methodology are to be applied for the identification of the emissions sources and sinks relevant to AD projects:

- (a) Section 2.1 Identification of Baseline Sources and Sinks, and
- (b) Section 3.1 Identification of Project Sources and Sinks.

Section A2.5 Quantifying Emissions

- (1) AB Equation 4.1.2 Offset-Eligible reductions (non-priced emissions) must be used to quantify the emissions associated with the Baseline and Project Scenarios, where for the purposes of calculating Project Reductions under Equation 1 of this Protocol
 - (a) The value of Emissions_{Non-priced Baseline} from the AB Methodology represents the value of the Baseline Emissions (BE), and
 - (b) The value of Emissions_{Non-priced Project} from the AB Methodology represents the value of the Project Emissions (PE) with the following modification:
- (2) The equation for calculating the emissions associated with Project Source P45 of the AB Methodology must include the relative efficiency of the destruction device(s) utilized from Table 1.

Note: For example, assuming the use of an open flare (with a destruction efficiency of 0.96), the equation for AB P46 then becomes:

$$Emissions_{End-use\ Combustion\ of\ Biogas} = ([Vol. Biogas_{Combusted} \times EF_{Biogas_{CH_4}} \times GWP_{CH_4} + Vol. Biogas_{Combusted} \times EF_{Biogas_{N_2O}} \times GWP_{N_2O}] / 1000) \times 0.96$$

- (1) Table 5: Quantification Methodology and Appendix A of the AB Methodology set out the requirements that must be used for the management, operation and calibration of measuring devices and data collection associated with a Project.
- (2) Sub-Appendices B.2 and B.3 apply to Anaerobic Digestion Projects for the purposes of substituting missing data.

Section A2.7 Record Requirements [Supporting Evidence]

The forms of acceptable documentation outlined in Table 7: Record Requirements of the AB Methodology to substantiate assertions made in the Project Plan or Project Reports must be followed without modification.

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APPENDIX B: REFERENCE MATERIALS

SUB- APPENDIX B.1 DESTRUCTION EFFICIENCIES FOR COMBUSTION DEVICES

A Project Proponent must use the appropriate default CH₄ destruction efficiencies provided in Table 1. The values presented in Table 1 apply to all Project types.

Table 1 - Default Destruction Efficiencies for Combustion Devices

Destruction Device	Destruction Efficiency (DE)
Open Flare	0.96
Enclosed Flare	0.995
Lean-burn Internal Combustion Engine	0.936
Rich-burn Internal Combustion Engine	0.995
Boiler	0.98
Micro turbine or large gas turbine	0.995
Upgrade and use of Biogas as CNG/LNG	0.95
Upgrade of Biogas and injection into natural gas transmission and distribution pipeline	0.98*
Offsite use of Biogas under direct-use agreement	Per corresponding destruction device factor (not pipeline)

Note: The Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories gives a standard value for the fraction of carbon oxidized for gas destroyed of 99.5% (Reference Manual, Table 1.6, page 1.29). It also gives a value for emissions from processing, transmission and distribution of gas which would be a very conservative estimate for losses in the pipeline and for Leakage at the end user (Reference Manual, Table 1.58, page 1.121).

These emissions are given as 118,000kgCH₄/PJ on the basis of gas consumption, which is 0.6%. Leakage in the residential and commercial sectors is stated to be 0 to 87,000kgCH₄/PJ, which equates to 0.4%, and in industrial plants and power station the losses are 0 to 175,000kg/CH₄/PJ, which is 0.8%.

*These Leakage estimates are compounded and multiplied. The methane destruction efficiency for landfill gas injected into the natural gas transmission and distribution system can now be calculated as the product of these three efficiency factors, giving a total efficiency of (99.5% * 99.4% * 99.6%) 98.5% for residential and commercial sector users, and (99.5% * 99.4% * 99.2%) 98.1% for industrial plants and power stations*

SUB- APPENDIX B.2 DATA SUBSTITUTION

- (1) If measuring devices fail to produce data required in the calculation of Project Reductions, missing data may only be substituted using the methodology in this section.
- (2) Missing data from a measuring device may be replaced only if the following two conditions are met:
 - (a) The operational status of the Eligible Destruction Device(s) can be demonstrated in accordance with the requirements in Sub-Appendix B.3;
 - (b) The operational status and proper functioning of the thermocouple or destruction device monitoring instrument(s) referred to in Sub-Appendix B.3 can be demonstrated with the appropriate data.
- (3) Missing data from a flow meter or CH₄ analyzer may be replaced only in accordance with the following rules:
 - (a) Biogas volume data may be replaced when CH₄ content data is not missing and the CH₄ analyzer is demonstrated to be consistent with normal operations;
 - (b) CH₄ content data may be replaced when Biogas volume data is not missing and the flow meter is demonstrated to be consistent with normal operations.
- (4) For projects that destroy Biogas in an Eligible Destruction Device with Biogas volume or CH₄ content data missing for a period of up to seven days, the appropriate substitution method from Table 2 may be employed to replace the data.

Table 2 - Methodology for Determining Substituted Data

Duration of Missing Data	Methodological Procedure
Less than 6 hours	Use the arithmetic mean of the four hours immediately before and following the missing data period.
6 to 24 hours	Use the 95% lower or upper confidence limit of the 24 hours prior to and after the missing data period, whichever results in greater conservativeness.
From 1 to 7 days	Use the 90% lower or upper confidence limit of the 72 hours prior to and after the outage, whichever results in greater conservativeness.
More than 7 days	No data may be substituted.

SUB- APPENDIX B.3 OPERATIONAL STATUS OF ELIGIBLE DESTRUCTION DEVICES

- (1) For the purposes of section 2 of Sub-Appendix B.2, the operational status of each Eligible Destruction Device must be monitored with a destruction device monitoring instrument with measurements recorded at least hourly.
- (2) For the purposes of section 2 of Sub-Appendix B.2, for a flare (enclosed or open), the operational status must be determined based on data from a thermocouple. The thermocouple must indicate a minimum combustion temperature that meets or exceeds 260 C. If the temperature is below 260 C, the conditions set out in section 2 of Sub-Appendix B.2 are not met.
- (3) If the Eligible Destruction Device, thermocouple or other destruction device monitoring instrument is not functioning properly, the conditions set out in section 2 of Sub-Appendix B.2 are not met.
- (4) If the engineering design of the Biogas recovery and destruction systems is such that Biogas is not delivered to an Eligible Destruction Device when the Eligible Destruction Device is not operating, hourly monitoring of operational status is not required.

SUB- APPENDIX B.4 PROJECT REPORT REQUIREMENTS

- (1) If Biogas volume data or CH₄ content data was missing and could not be substituted using a method referred to in Sub-Appendix B.2, a Project Report must
 - (a) identify the periods for which the data was missing, and
 - (b) contain an explanation as to why the data was missing.
- (2) If Biogas volume data or CH₄ content data was missing and was substituted using a method referred to in Sub-Appendix B.2, a Project Report must
 - (a) identify the periods for which the data was missing,
 - (b) contain a description of how the substituted data was determined,
 - (c) demonstrate the things that must be demonstrated under sections 2 (a) and (b) and 3 (a) and (b) of Sub-Appendix B.2, as applicable, and
 - (d) contain an assertion that, in respect of the substituted data, the conditions set out in section 2 of Sub-Appendix B.2 were met.