Mine Methane Capture Project Protocol

~~Active Coal Mines:~~ Capture and Destruction of ~~CH~~$_4$ Mine Methane from Drainage and Ventilation Systems ~~and Ventilation Air Methane~~ at Active Coal Mines

Protocol Version

[Effective Date]

Notes on the draft protocol:

This protocol adaptation is based on the Quebec compliance offset protocol for drainage projects at active underground and surface coal mines (protocol 4), combined with elements of the Quebec protocol for ventilation air methane projects at active coal mines (protocol 5). The QC protocol has been reformatted, with proposed revisions implemented. These revisions have already undergone review by a Technical Task Team, including staff from MOECC and MDDELCC. Redlining indicates content that has changed from the previous Stakeholder draft.

Table of Contents

List of Tables

Abbreviations and Acronyms

CO_2	Carbon dioxide
CH_4	Methane
GHG	Greenhouse gas
GJ/h	Gigajoule per hour
K	Kelvin
Kg	Kilogram
kPa	Kilopascal
L	Litres
LNG	Liquid Natural Gas
Mg	Mega gram (1,000,000 grams or one tonne, or “t”)
MDDELCC	Ministère du Développment durable, de l’Environnement et de la Lutte contre les changements climatiques du Québec (Quebec Ministry of Sustainable Development, Environment, and Fight Against Climate Change)
MOECC	Ontario Ministry of Environment and Climate Change
m^3	Cubic metres
t	Metric ton (or tonne)
N_2O	Nitrous oxide
NG	Natural gas
SSR	Source, sink, and reservoir
USEPA	United States Environmental Protection Agency

1 Introduction

The purpose of the mine methane capture ~~and destruction~~ (MMC) protocol is to quantify greenhouse gas emissions reductions associated with any project designed to reduce GHG emissions by capturing and destroying ~~CH_4~~ methane from active coal mines that would have otherwise been vented to the atmosphere from degasification systems.

Project Developers that install mine methane capture and destruction technologies use this document to register GHG emission reductions with either the Ontario Cap and Trade Program[1] ~~and~~ or the Quebec Cap and Trade System.[2] This protocol provides eligibility rules, methods to calculate reductions, performance-monitoring instructions, and procedures for reporting project information. This protocol is designed to ensure the complete, consistent, transparent, accurate, and conservative quantification and verification of GHG emission reductions associated with a mine methane capture and destruction project.[3] If there are multiple versions of this protocol, Project Developers shall refer to the Regulation to determine the appropriate version for their mine methane project.

For the purposes of this protocol, the term "Regulation" is used to refer to the following:

1. For projects to be registered with the Ontario Cap and Trade Program, ~~located at coal mines outside of the Province of Quebec,~~ the term "Regulation" shall refer to the Ontario Regulation concerning The Cap and Trade Program, made under the Climate Change Mitigation and Low-Carbon Economy Act;
2. For projects to be registered with the Quebec Cap and Trade Program, ~~located at coal mines within the Province of Quebec,~~ the term "Regulation" shall refer to the Quebec Regulation respecting a cap-and-trade system for greenhouse gas emission allowances, made under the Environment Quality Act.

For the purposes of this protocol, the term "Ministry" is used to refer to the following:

1. For projects to be registered with the Ontario Cap and Trade Program, ~~located at coal mines outside of the Province of Quebec,~~ the term "Ministry" shall refer to the Ontario Ministry of Environment and Climate Change (MOECC);
2. For projects to be registered with the Quebec Cap and Trade Program, ~~located at coal mines within the Province of Quebec,~~ the term "Ministry" shall refer to the Quebec Ministry of Sustainable Development, Environment, and Fight Against Climate Change (MDDELCC).

For the purpose of this protocol, the term "project" is equivalent to the term "offset initiative" in the Ontario Regulation.

For the purposes of this protocol, the term "Project Developer" is used to refer to the following:

[1] As created by the Climate Change Mitigation and Low-Carbon Economy Act, 2016, Ontario Regulation 144/16, "The Cap and Trade Program."
[2] As created by the Environmental Quality Act, Chapter Q-2, r. 46.1, "Regulation Respecting a Cap and Trade System for Greenhouse Gas Emission Allowances."
[3] See the WRI/WBCSD GHG Protocol for Project Accounting (Part I, Chapter 4) for a description of GHG reduction project accounting principles.

1. For projects to be registered with the Ontario Cap and Trade Program, the equivalent term is “Offset Initiative Operator”;[4]
2. For projects to be registered with the Quebec Cap and Trade Program, the equivalent term is “Project Promoter.”

[4] In certain circumstances, the Ontario Regulation may allow for an Offset Initiative Sponsor to fulfill duties that this protocol assigns to the Project Developer.

2 The GHG Reduction Project

2.1 Project Definition

~~For the purpose of this protocol, the term "project" is equivalent to the term "offset initiative" in the Ontario Regulation.~~

For the purpose of this protocol, the GHG reduction project is defined as the use of an eligible device (or multiple devices) to capture and destroy methane ~~CH_4~~ from:

- a methane ~~CH_4~~ drainage system at an active underground or active surface coal mine in Canada, except a mountaintop removal mine (~~Active~~ Drainage project, as defined further below)
- the ventilation system of an active underground coal mine in Canada (Ventilation Air Methane, or VAM, project, as defined further below)

The project must enable the capture and destruction of ~~CH_4~~ methane that, ~~before the project,~~ in the absence of the project, would have been ~~was~~ emitted to the atmosphere.

Only ~~The CH_4~~ methane ~~must be~~ captured within the mine boundaries is eligible. The mine boundaries are defined by the mine area or mine map permitted by the province in which the mine is located, ~~based on the current mine map~~ and is no more than 50 m below the mined seam and, in the case of an underground mine, up to 150 m above that seam. Where surface and/or horizontal pre-mining boreholes are used to extract methane before a mining operation, methane emissions from past periods are considered only during the project reporting period in which the emissions would have occurred (i.e. when the well is mined through). The Project Developer must follow additional guidelines provided in Section 5.1.1 to appropriately account for these methane emissions.

Commented [TL1]: Comment by stakeholder: Please better define mine boundaries.

Is this insufficient? We welcome additional comments. One stakeholder recommendation is to expand to provide additional specificity (as included in California MMC Protocol)

The project must not use CO_2, steam or any other fluid or gas to enhance ~~CH_4~~ methane drainage. Projects may not destroy virgin coal bed methane (e.g. methane of high quality extracted from coal seams independently of any mining activities) are also ineligible.

.

For ~~Ventilation Air Methane~~ all projects, the methane must be destroyed on the site of the mine where it was captured using an eligible destruction device, except for projects in which pipeline injection of the mine methane is the chosen end-use, in which case destruction off-site is allowable. Pipeline injections is an eligible end-use for all project types. ~~The CH_4 must be destroyed on the site of the mine where it was captured using an eligible destruction device~~. Eligible destruction devices for all project types include, but are not limited to, ~~are~~ enclosed flares, open flares, combustion engines, boilers, turbines, microturbines, methane ~~CH_4~~ liquefaction units and oxidizers. ~~, and fuel cells. Emission reductions following pipeline injection of CH_4 are considered as common practice in the operation of an underground mine and are eligible only for a surface mine.~~

The protocol does not apply to projects at abandoned coal mines, defined as coal mines where all mining activity including mine development and mineral production have ceased, mine personnel are not present in the mine workings, and mine ventilation fans are no longer operative. Such projects are ineligible.

For the purposes of this protocol,

Commented [TL2]: Do we need to add anything to this very high level glossary?

(Please note, we have updated and added to the Glossary in Section 9) "room and pillar" means a method of underground mining in which approximately half of the coal is left in place as "pillars" to support the roof of the active mining area while "rooms" of coal are extracted;

"coal" means all solid fuels classified as anthracite, bituminous, subbituminous, or lignite under ASTM D388, entitled Standard Classification of Coals by Rank;

(1) "active coal mine" means any mine with mine works that are actively ventilated by the mine operator and which has the primary purpose of being used in extracting coal from its natural deposits in the earth by any means or method. An active coal mine is any coal mine that is not "abandoned." Active coal mines of all types (underground and surface mines) are eligible under this protocol.

(2) "mine gas" means the untreated gas extracted from within a mine through a methane CH_4 drainage system that often contains various levels of other components such as nitrogen, oxygen, CO_2 and hydrogen sulfide;

(3) "mine CH_4methane" means the CH_4methane portion of the mine gas contained in coal seams and surrounding strata that is released as a result of mining operations;

"drainage system" means a system installed in a mine to drain CH_4 from coal seams.

(4) "ventilation air" means air from a mine ventilation system;

"ventilation air CH_4" means the CH_4 contained in ventilation air.

2.1.1 Drainage Projects

A drainage project is one that destroys methane that would otherwise be vented to the atmosphere from a methane drainage system, installed in a mine to drain methane from coal seams. The methane drainage system may use any of the following extraction activities:

- Surface boreholes, including vertical and surface-to-seam directional drilling, located within the boundary of the mine to capture pre-mining coal mine methane (CMM)
- In-mine underground horizontal boreholes located within the boundary of the mine to capture pre-mining CMM
- Surface gob wells, underground boreholes, gas drainage galleries or other gob gas capture techniques located within the boundary of the mine, including gas from sealed areas, to capture post mining CMM

The borehole(s) that make up each project's drainage system must be defined by the Project Developer at the time of project submittal. The Project Developer must also specify what destruction device(s) is/are part of the drainage project. A single project must be explicitly defined and associated with specific boreholes and destruction devices. Multiple drainage projects may be implemented at a single mine, each with its own start date, crediting period, registration, and verification cycle. Each project's drainage system and destruction devices shall be detailed in the project diagram.

If additional boreholes are drilled and/or connected to an existing project destruction device, this is considered a project expansion. Similarly, if a new or additional destruction device is added to boreholes that are already connected to an existing project destruction device, this is

Commented [TL3]: Still need to ensure we are consistent in use of CMM vs. MM throughout.

Commented [TL4]: Update with term in Regulation considered a project expansion. If a new borehole or a borehole that is currently venting CMM is connected to a new destruction device, this may be considered a new project or a project expansion. If the Project Developer chooses to define it as a project expansion, the project start date and crediting period remain the same as the original project, and a single verification will cover all activities. If the Project Developer chooses to define it as a new project, the project will have a new start date and crediting period, and the new project will require separate verification.

2.1.2 Ventilation Air Methane Projects

A ventilation air methane (VAM) project is one that destroys methane that would otherwise be vented from a ventilation shaft (or multiple shafts), which are part of the mine's ventilation system. The ventilation shaft(s) and VAM destruction device(s) that make up each VAM project must be defined by the Project Developer at the time of project submittal. A single project must be explicitly defined and associated with a specific shaft (or multiple shafts that are operating concurrently). Multiple projects may be implemented at a single mine, each with its own start date, crediting period, registration, and verification cycle. Each project's ventilation shaft(s) and VAM destruction device(s) shall be detailed in the project diagram.

Commented [TL5]: Update with proper term from regulation

If additional VAM destruction equipment is added to a shaft that is part of an existing project, this is considered a project expansion. If VAM destruction equipment is installed at a shaft that is not part of an existing project, this new shaft may be considered a new project or a project expansion. If the Project Developer chooses to define it as a project expansion, the project start date and crediting period remain the same, and a single verification will cover activities at both shafts. If the Project Developer chooses to define it as a new project, activities at the new shaft will have a new start date and crediting period, and will require separate verification. For a new VAM project, the VAM destruction equipment does not need to be new; it is only the ventilation shaft that must be new.

~~For the purposes of this protocol,~~

~~1.~~(1) ~~"room and pillar" means a method of underground mining in which approximately half of the coal is left in place as "pillars" to support the roof of the active mining area while "rooms" of coal are extracted;~~

Formatted: Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0" + Indent at: 0.25", Tab stops: Not at 0.5"

~~2.~~(1) ~~"coal" means all solid fuels classified as anthracite, bituminous, subbituminous, or lignite under ASTM D388, entitled Standard Classification of Coals by Rank;~~

~~3.~~(1) ~~"mine gas" means the untreated gas extracted from within a mine through a CH_4 drainage system that often contains various levels of other components such as nitrogen, oxygen, CO_2 and hydrogen sulfide;~~

~~4.~~(1) ~~"mine CH_4" means the CH_4 portion of the mine gas contained in coal seams and surrounding strata that is released as a result of mining operations;~~

~~5.~~(1) ~~"drainage system" means a system installed in a mine to drain CH_4 from coal seams.~~

~~6.~~(1) ~~"ventilation air" means air from a mine ventilation system;~~

~~7.~~(1) ~~"ventilation air CH_4" means the CH_4 contained in ventilation air.~~

2.2 The Project Developer

~~The term "Project Developer" is defined within the Regulations as follows:~~

1. ~~For the Ontario Regulation, the equivalent term is "Offset Initiative Operator";[5]~~
1. ~~For the Quebec Regulation, the equivalent term is "Project Promoter."~~

The definition and responsibilities of the Project Developer can be found in the Regulation.

[5] ~~In certain circumstances, the Ontario Regulation may allow for an Offset Initiative Sponsor to fulfill duties that this protocol assigns to the Project Developer.~~

3 Eligibility Rules

Projects must fully satisfy the following eligibility rules in order to register offset credits. The criteria only apply to projects that meet the definition of a GHG reduction project (Section 2.1).

Eligibility Rule I:	Location	⟶	*Canadian provinces and territories*
Eligibility Rule II:	Project Start Date	⟶	*Per the guidance of the Regulation*
Eligibility Rule III:	Additionality	⟶	*Meet the performance standard test and the legal requirement test*

3.1 Location

The project must be implemented at an active underground or surface coal mine in Canada, permitted for mining activities by the provincial authority in the province where it is located.

3.2 Project Start Date

The project start date of a mine methane project is defined as the date of commencement of ~~continuous~~ methane ~~CH_4~~ destruction following the completion of a start-up and/or testing period, which is not to exceed six (6) months.[6] A mine methane project may be operational regardless of whether sufficient monitoring data are available to report emission reductions. Project Developers shall refer to the Regulation to determine the eligibility of their start date, including deadlines related to submittal of applications to the Ministry.

3.3 Project Crediting Period

Project Developers shall refer to the Regulation for guidance regarding the definition, length, and rules related to project crediting periods.

3.4 Additionality

The project is considered to go beyond current practice when it meets the conditions ~~in the Regulation~~of this document. Reductions in GHG emissions must be additional and result from a project that is voluntary, that is that it is not being carried out, at the time of registration or renewal, in response to a legislative or regulatory provision, a permit or other type of authorization, an order made under an Act or regulation, or a court decision. The requirements of additionality are assessed through ~~the Performance Standard Test in~~this Section 3.4.1.

3.4.1 The Performance Standard Test

Projects pass the Performance Standard Test by meeting a performance threshold, i.e., a standard of performance applicable to all mine methane capture and destruction projects, established on an ex-ante basis by this protocol.

There are numerous possible management options and end uses for coal mine methane, ranging from venting, to destruction by flares, to injection of the methane into natural gas pipelines. The Performance Standard Test employed by this protocol is based on a national

[6] The start-up period begins on the first day of mine methane destruction in the project system.

assessment of "common practice" for managing coal mine methane. The performance standard defines those end uses that have been determined to exceed common practice and therefore generates additional GHG reductions.[7]

Drainage projects pass the Performance Standard Test if they destroy CMM through any end-use management option other than injection into a natural gas pipeline for off-site consumption (e.g., flares, power generation, heat generation, pipeline injection producing CNG/LNG for vehicle use, etc.).

All VAM projects pass the Performance Standard Test. Such projects may include, but are not limited to, the following end uses for VAM:

- Thermal flow reversal reactors oxidizers with or without catalysts
- Volatile organic compound concentrators
- Carbureted gas turbines
- Lean-fueled turbines with catalytic combustors that compress the air/methane mixture and then combust it in a catalytic combustor
- Hybrid coal- and ventilation air-fueled gas turbine technology
- Lean-fueled catalytic microturbine technology
- Combustion air for commercial engine and turbine technologies or a coal-fired steam power plant

Formatted: Bulleted + Level: 1 + Aligned at: 0.25" + Tab after: 0.5" + Indent at: 0.5"

3.4.2 The Legal Requirement Test

A project passes the Legal Requirement Test when there are no laws, statutes, regulations, court orders, environmental mitigation agreements, permitting conditions, or other legally binding mandates requiring the capture and destruction of mine methane. To satisfy the Legal Requirement Test, Project Developers must attest to satisfaction of this requirement each time the project is verified (see Section 8). In addition, the project's Surveillance Plan (Section 6) must include procedures that the Project Developer will follow to ascertain and demonstrate that the project at all times passes the Legal Requirement Test.

Coal mine methane emissions are not currently subject to regulation at the federal level in Canada. Further, no Canadian provinces or territories, nor the US states with which they may link their cap-and-trade programs (e.g., California), have individual regulations related to the control of methane emissions at coal mines.[8] Nevertheless, in addition to the above requirements, the project's Surveillance Plan (Section 6) must include procedures that the Project Developer will follow to ascertain and demonstrate that the project at all times passes the Legal Requirement Test. This includes monitoring the applicable federal and provincial regulations to ascertain and demonstrate ensure that no new regulations may be have been put in place which would make the project ineligible.

[7] Analysis used to establish the Performance Standard Test was based heavily "Global Map of Methane Sites" managed by the Global Methane Initiative, Available at: http://www.globalmethane.org/sites/index.aspx, as well as: "Coal Mine Methane Country Protocols," Chapter 6: Canada, United States Environmental Protection Agency, Coalbed Methane Outreach Program in support of the Global Methane Initiative (June 2015), Available at: http://www.globalmethane.org/tools-resources/coal_overview.aspx

[8] Some provinces, such as Ontario, do have regulations preventing the use of electricity generated from coal-fired power plants, but such regulations do not cover methane emissions from coal mining activities.

~~All projects are subject to a Legal Requirement Test to ensure that the GHG reductions achieved by a project would not otherwise have occurred due to federal, state, or local regulations, or other legally binding mandates. At the initial application for registration, the Project Developer must attest that the above is true. In addition, the project's Surveillance plan (Section 6) must include procedures that the Project Developer will follow to ascertain and demonstrate that the project at all times passes the Legal Requirement Test.~~

~~3.4.2.1 Federal Regulations~~

~~Coal mine methane emissions are not subject to regulation at the federal level in Canada.~~

~~3.4.2.2 Provincial, Territorial, and State Regulations~~

~~At this time, no Canadian provinces or territories, nor the US states (e.g., California) with which they may link their cap-and-trade programs, have individual regulations related to the control of methane emissions at coal mines. As noted above, the project's Surveillance plan (Section 6) must include procedures that the Project Developer will follow to ascertain and demonstrate that the project at all times passes the Legal Requirement Test. This includes monitoring the applicable provincial regulations to ensure no new regulations may be put in place which would make the project ineligible.~~

3.5 Regulatory Compliance

As a final eligibility requirement, Project Developers must attest that project activities do not cause material violations of applicable laws (e.g., air, water quality, safety, etc.). Project Developers are required to disclose in writing to the verifier any and all instances of legal violations – material or otherwise – caused by the project activities.

A violation should be considered to be "caused" by project activities if it can be reasonably argued that the violation would not have occurred in the absence of the project activities. If there is any question of causality, the Project Developer shall disclose the violation to the verifier.

If ~~it is determined~~ a verifier finds that project activities have caused a material violation, then credits will not be issued for GHG reductions that occurred during the period(s) when the violation occurred. Individual violations due to administrative or reporting issues, or due to "acts of nature," are not considered material and will not affect crediting. However, recurrent administrative violations directly related to project activities may affect crediting. Verifiers must determine if recurrent violations rise to the level of materiality. If the verifier is unable to assess the materiality of the violation, then the verifier shall consult with the Ministry.

Commented [TL6]: This language varies slightly from language currently in LFG Protocol. However, I think this language might be slightly preferable, as it avoids the implication that verifier has power to decide to withhold credits.

(In LFG it reads: "If a verifier finds…")

4 The GHG Assessment Boundary

The GHG Assessment Boundary delineates the GHG sources, sinks, and reservoirs (SSRs) that must be assessed by Project Developers in order to determine the net change in emissions caused by a mine methane project.[9]

This protocol does not account for carbon dioxide emission reductions associated with displacing grid-delivered electricity or fossil fuel use.

Figure 4.1 illustrates all relevant GHG SSRs associated with drainage project activities and delineates the GHG Assessment Boundary.

Figure 4.2 illustrates all relevant GHG SSRs associated with ventilation air methane project activities and delineates the GHG Assessment Boundary.

Table 4.1 provides greater detail on each SSR and justification for the inclusion or exclusion of certain SSRs and gases from the GHG Assessment Boundary.

[9] The definition and assessment of SSRs is consistent with ISO 14064-2 guidance.

Figure 4.1. GHG Assessment Boundary for Active Underground and Active Surface Mines

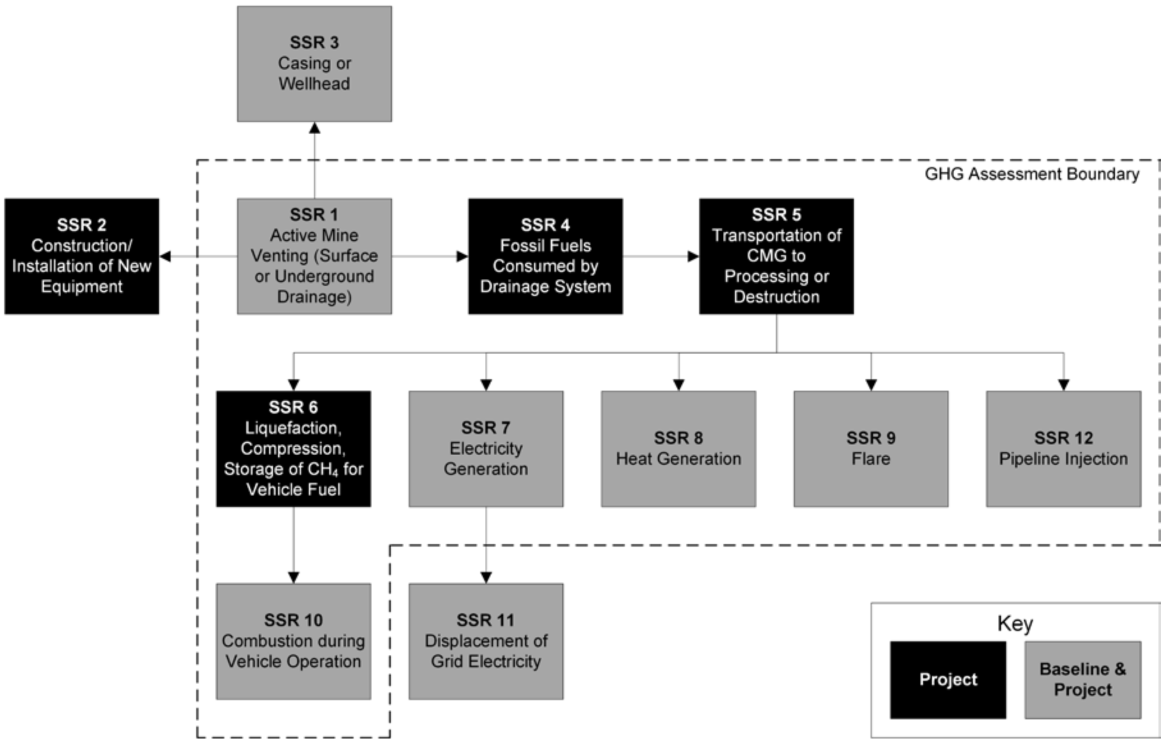


Figure 4.2. GHG Assessment Boundary for Ventilation Air Methane Mines

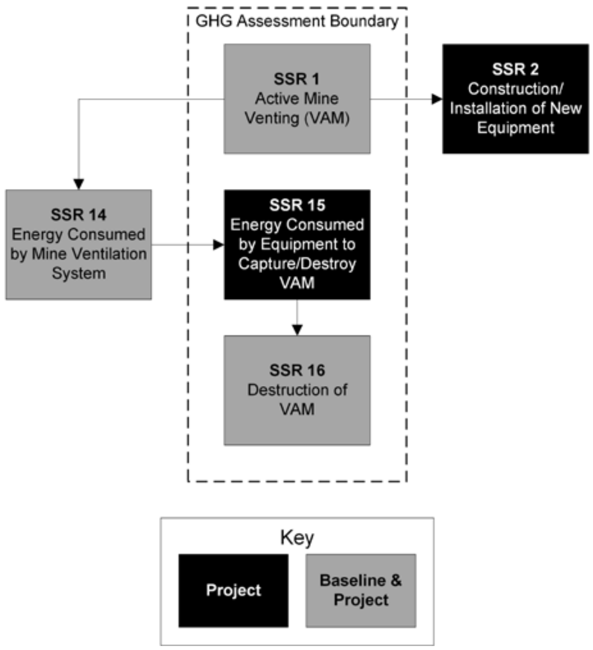


Table 4.1. Description of all Sources, Sinks, and Reservoirs

SSR	Source Description	GHG	Relevant to Baseline (B) or Project (P)	Included or Excluded	Justification/Explanation
1	Active mine – emissions as a result of venting (Surface~~,~~ or Underground Drainage, or VAM)~~CH_4 emissions from mining activities~~	CH_4	B, P	Included	Main emission source of methane from active mines. A GHG project will directly affect these emissions. Only the change in mine methane emissions release will be taken into account, by monitoring the methane used or destroyed by the project
2	Emissions from construction and/or installation of new equipment	CO_2	P	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		CH_4			Excluded for simplification. This emission source is assumed to be very small.
		N_2O			Excluded for simplification. This emission source is assumed to be very small.
3	Fugitive emissions resulting from casing or wellhead	CH_4	B,P	Excluded	The project is unlikely to affect quantities of methane from this source.
4	Emissions resulting from fossil fuels consumed to operate the methane ~~CH_4~~ drainage system including the drilling of additional wells	CO_2	P	Included	If any additional equipment is required by the project beyond what is required in the baseline, energy consumption from additional equipment shall be accounted for. Energy used by equipment installed for the safety of the mine shall be excluded.
		CH_4		Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Fugitive emissions resulting from compressors, blowers, and/or gathering system	CH_4	P	Excluded	Excluded for simplification. This emission source is assumed to be very small.
5	Fuel consumption for transport of mine gas (MG) to processing or Destruction equipment~~Emissions from the use of supplemental fossil fuels~~	CO_2	P	Included	If any additional equipment is required by the project beyond what is required in the baseline, energy consumption from additional equipment shall be accounted for.

Commented [MH7]: First use of "MG" for mine gas – also add to list of abbreviations? Note that Mg for megagram is already on that list

Commented [TL8]: Renamed to be more inclusive. Please let us know if this unintentionally excluded something else that may have been categorized as "supplemental fossil fuels"

SSR	Source Description	GHG	Relevant to Baseline (B) or Project (P)	Included or Excluded	Justification/Explanation
		CH_4		Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
6	Emissions resulting from liquefaction, compression, or storage of methane for vehicle fuel	CO_2	P	Included	If any additional equipment is required by the project beyond what is required in the baseline, energy consumption from additional equipment shall be accounted for.
		CH_4		Excluded	
		N_2O		Excluded	
7	Emissions from methane ~~CH_4~~ destruction for electricity generation	CO_2	B,P	Included	If mine methane is used for on-site power generation, project will result in increased CO_2 emissions from the destruction of methane to generate power. This source is also included where mine methane is sent to a non-qualifying device for electricity generation.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions of uncombusted methane ~~CH_4~~	CH_4	P	Included	If mine methane is used for on-site power generation, project will result in increased methane ~~CH_4~~ emissions from incomplete combustion. This source is also included where mine methane is sent to a non-qualifying device for electricity generation.
8	Emissions from methane ~~CH_4~~ destruction for heat generation	CO_2	B,P	Included	If mine methane is used for on-site thermal energy generation, project will result in increased CO_2 emissions from the destruction of methane to generate energy. This source is also included where mine methane is sent to a non-qualifying device to generate energy.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.

SSR	Source Description	GHG	Relevant to Baseline (B) or Project (P)	Included or Excluded	Justification/Explanation
	Emissions of uncombusted methane~~CH_4~~	CH_4	P	Included	If mine methane is used for on-site thermal energy generation, project will result in increased methane ~~CH_4~~ emissions from incomplete combustion. This source is also included where mine methane is sent to a non-qualifying device to generate energy.
9	Emissions from methane ~~CH_4~~ destruction using a flare	CO_2	B,P	Included	If mine methane is sent to a flare, project will result in increased CO_2 emissions from the destruction of methane in flare. This source is also included where mine methane is sent to a non-qualifying device for flaring.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions of uncombusted methane~~CH_4~~	CH_4	P	Included	If mine methane is sent to a flare, project will result in increased methane ~~CH_4~~ emissions from incomplete combustion. This source is also included where mine methane is sent to a non-qualifying device for flaring.
10	Emissions resulting from combustion during vehicle operation	CO_2	B,P	Included	If CMM is used to produce CNG/LNG to fuel vehicle operation, project will result in increased CO2 emissions from the destruction of methane in CNG/LNG vehicles. This source is also included where CMM is used for non-qualifying vehicle operation.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions resulting from incomplete combustion during vehicle operation	CH_4	P	Included	If CMM is used to produce CNG/LNG to fuel vehicle operation, project will result in increased methane ~~CH_4~~ emissions from incomplete combustion. This source is also included where CMM is used for non-qualifying vehicle operation.

SSR	Source Description	GHG	Relevant to Baseline (B) or Project (P)	Included or Excluded	Justification/Explanation
11	Emission reductions resulting from the displacement of fossil fuels or electricity ~~Delivery of electricity to grid~~	CO_2	B,P	Excluded	This protocol does not cover displacement of GHG emissions from the use of CMM for grid-connected electricity generation.
		CH_4			
		N_2O			
12	Emissions resulting from the combustion of methane ~~CH_4~~ by end-users after it has been injected into a pipeline	CO_2	B,P	Included~~Excluded~~	If mine methane is injected into a pipeline, project will result in increased CO_2 emissions from the destruction of methane at the end use.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions of uncombusted methane ~~CH_4~~ injected into a pipeline	CH_4	P	Included	If mine methane is injected into a pipeline, project will result in increased methane ~~CH_4~~ emissions from incomplete combustion.
14	Emissions attributable to energy consumed to operate mine ventilation system	CO_2	B,P	Excluded	Operation of mine ventilation system will not be affected by the project.
		CH_4			
		N_2O			
15	Emissions attributable to energy consumed to operate equipment to capture and destroy VAM	CO_2	P	Included	The VAM collection system will result in increased combustion emissions due to energy consumption from equipment used to capture and destroy VAM.
		CH_4		Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
16	Emissions from the destruction of VAM	CO_2	B,P	Included	VAM project will result in increased CO_2 emissions from the oxidation of methane in ventilation air.
		N_2O		Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions of uncombusted VAM	CH_4		Included	VAM project will result in methane ~~CH_4~~ emissions from non-oxidized methane ~~CH_4~~ from the ventilation air stream.

5 ~~Quantifying~~ Calculation of ~~GHG~~ Emission Reductions

GHG emission reductions from a coal mine methane project are quantified by comparing actual project emissions to baseline emissions at the mine. Baseline emissions are an estimate of the GHG emissions from sources within the GHG Assessment Boundary that would have occurred in the absence of the coal mine methane project. Project emissions are actual GHG emissions that occur at sources within the GHG Assessment Boundary. Project emissions must be subtracted from the baseline emissions to quantify the project's total net GHG emission reductions.

5.1 ~~Quantifying GHG~~ Calculation of Emission Reductions from Active Drainage Projects

The Project Developer must calculate the quantity of GHG emission reductions attributable to the project using Equation 5.1.

Equation 5.1. GHG Emission Reductions

$$ER = BE - PE$$

Where,			Units
ER	=	GHG emission reductions attributable to the project during the project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
BE	=	Emissions under the baseline scenario during the project reporting period, calculated using Equation 5.3~~, in metric tonnes CO_2 equivalent~~	tCO_2e
PE	=	Project emissions during the project reporting period, calculated using Equation 5.5~~, in metric tonnes CO_2 equivalent~~	tCO_2e

When the flow meter does not correct for the temperature and pressure of the mine gas at standard conditions, the Project Developer must measure mine pressure and temperature separately and correct the flow values using Equation 5.2. The Project Developer must use the corrected flow values in all the equations of this protocol. The reference pressure shall be 1 atm (101.325 kPa), but the reference temperature may be chosen by the Project Developer from Table A.2, based on the prevailing standard of the relevant jurisdiction.

Equation 5.2. Adjusting ~~C~~MG Flow for Temperature and Pressure

$$MG_{i,t} = MG_{uncorrected} \times \frac{T_{ref} \cancel{293.15}}{T_m \cancel{T}} \times \frac{P_m \cancel{P}}{101.325}$$

Where,			Units
$MG_{i,t}$	=	Volume of mine gas sent to destruction device *i* in time interval *t*, in cubic metres at standard conditions	m^3~~/unit time~~
$MG_{uncorrected}$	=	Uncorrected volume of mine gas sent to destruction device *i* in time interval *t*, in cubic metres	m^3~~/unit time~~
t	=	Time interval shown in the table in Table 6.1 for which CH_4 flow and content measurements are aggregated	

~~293.15~~	~~=~~	~~Reference temperature, in Kelvin~~	~~Kelvin~~
P_m	=	Pressure of the mine gas for the given time period, in kilopascals	~~kilopascals~~kPa
T_{ref}	=	Reference temperature of the MG for the project	K
T_m		Measured temperature of mine gas for the given time period, in Kelvin (°C + 273.15)	K~~elvin (°C + 273.15)~~
101.325	=	Standard pressure, in kilopascals	~~kilopascals~~kPa

5.1.1 ~~Quantifying~~ Calculation of Baseline Emissions from Active Drainage Projects

In the baseline scenario, ~~CH_4~~ methane sent to a destruction device during the project reporting period, except methane ~~CH_4~~ captured by a pre-mining surface well used to extract methane ~~CH_4~~, must be taken into account.

In the case of a surface well used to extract ~~CH_4~~ methane before a mining operation, ~~CH_4~~ methane emissions from past periods are considered only during the~~a~~ project reporting period in which the emissions would have occurred (i.e. when the well is mined through), in other words when one of the following situations occurs:

~~(0)~~(1) the well is physically bisected by mining activities;

~~(0)~~(2) the well produces elevated amounts of atmospheric gases so that the percent concentration of nitrogen in the mine gas increases by 5 compared to baseline concentrations according to a gas analysis using a gas chromatograph completed by an ISO 17025 accredited laboratory. To ensure that the elevated nitrogen concentrations are not solely the result of a leak in the well, the oxygen concentration must not have increased by the same proportion as the nitrogen concentration;

~~(0)~~(3) in the case of an underground mine, the working face passes less than 150 m below the well;

~~(0)~~(4) in the case of an underground mine, the room and pillar method is used and the block of coal that will be left unmined as a pillar is less than 150 m directly below the well.

The Project Operator must calculate GHG emissions in the baseline scenario using Equation 5.3:

Equation 5.3. Calculating Baseline Emissions

$$BE = \left[\sum_{i=1}^{n} [Q_i] \times \rho_{CH_4} \, \cancel{0.667} \times 0.001 \times \cancel{21}\, GWP \times (1 - DF)\right] + BE_{MD}$$

Where, Units

BE	=	Baseline scenario emissions during the project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e

Commented [TL9]: The discussion of "when the well is mined through" is an important one. Quebec, California, and CAR protocols each address this slightly differently. The current wording is Quebec's, but please comment on any additional clarification here, that should be included.

Commented [MH10]: Deleted to match Equation 5.1

n	=	Number of destruction devices	
i	=	Destruction device	
Q_i	=	Total quantity of CH_4 sent to destruction device *i* during the project reporting period, calculated using Equation 5.4, in cubic metres of CH_4 at standard conditions	m^3 CH_4
ρ_{CH4} ~~0.667~~	=	Density of CH_4 (Table A.2)~~, in kilograms of CH_4 per cubic metre of CH_4 at standard conditions~~	kg CH_4 / m^3 CH_4
0.001	=	Conversion factor, kilograms to metric tonnes	
~~21~~GWP	=	Global Warming Potential factor of CH_4, as set out in Ontario and Quebec regulations concerning the reporting of GHG emissions.~~Global Warming Potential of CH_4~~	
DF	=	Discount factor to account for uncertainties associated with the monitoring equipment for CH_4 content in the MG, namely a factor of 0 when the CH_4 content in the MG is measured continuously, and 0.1 in other cases, with measurements made at least weekly	
BE_{MD}	=	Baseline scenario emissions during the project reporting period, from any pre-project destruction of methane, in metric tonnes CO_2	tCO_2

Equation 5.4. Baseline Methane Released to Atmosphere

$$Qi = \sum_{i=1}^{n} \left[(MG_{i,t} - PPMG_{i,t}) \times C_{CH4,t} \right]$$

Where,			Units
Q_i	=	Total quantity of CH_4 sent to destruction device *i* during the project reporting period, in cubic metres of CH_4 at standard conditions	m^3 CH_4
n	=	Number of time intervals during the project reporting period	
t	=	Time interval shown in the table in Table 6.1 for which CH_4 flow and content measurements for the mine gas are aggregated	
$MG_{i,t}$	=	Volume of mine gas sent to destruction device *i* in time interval *t*, in cubic metres at standard conditions, except mine gas from a surface well that is not yet mined through. Despite the foregoing, if the surface well is mined through during the project reporting period, the mine gas sent to a destruction device during the current reporting period and in previous years must be included	m^3
$PPMG_{i,t}$	=	Volume of mine gas that would have been sent to a pre-project destruction device *i* in time interval *t*, in cubic metres at standard conditions	m^3
$C_{CH4,t}$	=	Average CH_4 content in the mine gas sent to a destruction device during time interval *t*, in cubic metres of CH_4 per cubic metre of mine gas	m^3 CH_4/ m^3 mine gas

5.1.2 ~~Quantifying~~ Calculation of Project Emissions from Active Drainage Projects

Project emissions are actual GHG emissions that occur within the GHG Assessment Boundary as a result of the project activity. Project emissions must be quantified every reporting period on an ex post basis. The Project Developer must calculate the GHG project emissions using Equations 5.5 to 5.8. The CO_2 emissions attributable to the destruction of methane ~~CH_4~~ from a pre-mining surface well used to extract methane ~~CH_4~~ during a current project reporting period, calculated using Equation 5.7, must be included even if the well has not yet been mined through.

Equation 5.5. Calculating Project Emissions

$$PE = FF_{CO2} + DM_{CO2} + UM_{CH4}$$

Where,

			Units
PE	=	Project emissions during the project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
FF_{CO2}	=	Total CO_2 emissions attributable to the consumption of fossil fuel to capture and destroy mine CH_4 during the project reporting period, calculated using Equation 5.6~~, in metric tonnes CO_2 equivalent~~	tCO_2e
DM_{CO2}	=	Total CO_2 attributable to the destruction of CH_4 during the project reporting period, calculated using Equation 5.7~~, in metric tonnes CO_2 equivalent~~	tCO_2e
UM_{CH4}	=	CH_4 emissions attributable to uncombusted CH_4 during a project reporting period, calculated using Equation 5.8~~, in metric tonnes CO_2 equivalent~~	tCO_2e

Equation 5.6. Project Emissions from Fossil Fuels

$$FF_{CO2} = \frac{\sum_{j=1}^{n}\left(FF_{PR,j} \times EF_{CF,j}\right)}{1,000}$$

Where,

			Units
FF_{CO2}	=	Total CO_2 attributable to the consumption of fossil fuel to capture and destroy mine CH_4 during the project reporting period~~, in metric tonnes CO2 equivalent~~	tCO_2e
n	=	Number of types of fossil fuel	
j	=	Type of fossil fuel	
$FF_{PR,j}$	=	Total quantity of fossil fuel *j* consumed, expressed - in kilograms, in the case of fuels whose quantity is expressed as a mass - in cubic metres at standard conditions, in the case of fuels whose quantity is expressed as a volume of gas - in litres, in the case of fuels whose quantity is expressed as a volume of liquid	$kg/m^3/l$
$EF_{CF,j}$	=	CO_2 emission factor for fossil fuel *j* specified in the Regulation - in kilograms of CO_2 per kilogram, in the case of fuels whose quantity is expressed as a mass - in kilograms of CO_2 per cubic metre at standard conditions, in the case of fuels whose quantity is expressed as a volume of gas - in kilograms of CO_2 per litre, in the case of fuels whose quantity is expressed as a volume of liquid	$kg/m^3/l$
1,000	=	Conversion factor, metric tonnes to kilograms	

Equation 5.7. Project Emissions from Destruction of Captured Methane

$$DM_{CO2} = \sum_{ti=1}^{n} [Q_i \times DE_i] \times 1.556 \times 0.001$$

Where,			Units
DM_{CO2}	=	Project emissions during the project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
n	=	Number of destruction devices	
i	=	Destruction device	
Q_i	=	Total quantity of CH_4 sent to destruction device *i* during the project reporting period, calculated using Equation 5.4, in cubic metres of CH_4 at standard conditions	tCO_2e
DE_i	=	Default CH_4 destruction efficiency of destruction device *i*, determined in accordance with Appendix A	
1.556	=	CO_2 emission factor attributable to the combustion of CH_4, in kilograms of CO_2 per cubic metre of CH_4 combusted	kg CO_2/m^3 CH_4
0.001	=	Conversion factor, kilograms to metric tonnes	

Equation 5.8. Project Emissions from Uncombusted Methane

$$UM_{CH4} = \sum_{ti=1}^{n} [Q_i \times (1 - DE_i)] \times \rho_{CH_4} \sout{0.667} \times 0.001 \times \sout{21} GWP$$

Where,			Units
UM_{CH4}	=	CH_4 emissions attributable to uncombusted CH_4 during the project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
n	=	Number of destruction devices	
i	=	Destruction device	
Q_i	=	Total quantity of CH_4 sent to destruction device *i* during the project reporting period, calculated using Equation 5.4, in cubic metres of CH_4 at standard conditions	m^3
DE_i	=	Default CH_4 destruction efficiency of destruction device *i*, determined in accordance with Appendix A	kg/m^3/l
ρ_{CH4}~~0.667~~	==	Density of CH_4 (Table A.2)~~Density of CH_4, in kilograms of CH_4 per cubic metre of CH_4 at standard conditions~~	kg CH_4 / m^3 CH_4
0.001	=	Conversion factor, kilograms to metric tonnes	
~~21~~GWP	=	Global Warming Potential factor of CH_4, as set out in Ontario and Quebec regulations concerning the reporting of GHG emissions.~~Global Warming Potential factor of CH_4~~	

5.2 Calculation of ~~Quantifying GHG~~ Emission Reductions from Ventilation Air Methane Projects

The Project Developer must calculate the quantity of GHG emission reductions attributable to the project using Equation 5.9:

Equation 5.9. GHG Emission Reductions

$$ER = BE - PE$$

Where,			<u>Units</u>
ER	=	GHG emission reductions attributable to the project during the project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
BE	=	Emissions under the baseline scenario during the project reporting period, calculated using Equation 5.10~~, in metric tonnes CO_2 equivalent~~	tCO_2e
PE	=	Project emissions during the project reporting period, calculated using Equation 5.11~~, in metric tonnes CO_2 equivalent~~	tCO_2e

5.2.1 Calculation of~~Quantifying~~ Baseline Emissions from Ventilation Air Methane Projects

The Project Developer must calculate GHG emissions in the baseline scenario using Equation 5.10:

Equation 5.10. Calculating Baseline Methane Emissions

$$BE = \left[\sum_{t=1}^{n} (VA_{Et} - VA_{PP}) \times C_{CH4,t} \times \rho_{CH_4} \cancel{0.667} \times 0.001 \times \cancel{21} GWP\right] + BE_{MD}$$

Where,			<u>Units</u>
BE	=	Baseline scenario emissions during the project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
n	=	Number of time intervals during the project reporting period	
t	=	Time interval shown in the table in Table 6.1 for which flow and content measurements of ventilation air CH_4 are aggregated	
VA_{Et}	=	Volume of ventilation air sent to destruction device during time interval *t*, in cubic metres at standard conditions	m^3~~/unit time~~
VA_{PP}	=	Volume of ventilation air that would have been sent to pre-project destruction device, during time interval *t*, in cubic metres at standard conditions	m^3~~/unit time~~
$C_{CH4,t}$	=	Average CH_4 content in ventilation air before entering destruction device during time interval *t*, in cubic metres of CH_4 per cubic metre of ventilation air	$m^3\ CH_4/m^3$
ρ_{CH4}~~0.667~~	=	Density of CH_4 (Table A.2)~~Density of CH_4, in kilograms of CH_4 per cubic metre of CH_4 at standard conditions~~	$kg\ CH_4 / m^3\ CH_4$
0.001	=	Conversion factor, kilograms to metric tonnes	
~~21~~GWP	=	Global Warming Potential factor of CH_4, as set out in Ontario and Quebec regulations concerning the reporting of GHG emissions.~~Global Warming Potential of CH_4~~	
BE_{MD}	=	Baseline scenario emissions during the project reporting period, from any pre-project destruction of methane~~, in metric tonnes CO_2~~	tCO_2e

If a mass flow meter is used to monitor gas flow instead of a volumetric flow meter, the volume and density terms must be replaced by the monitored mass value in kilograms. The methane ~~CH_4~~ content must be in mass percent.

5.2.2 ~~Quantifying~~ Calculation of Project Emissions from Ventilation Air Methane Projects

The Project Developer must calculate the GHG project emissions using Equations 5.11 to 5.15:

Equation 5.11. Calculating Project Emissions

$$PE = FF_{CO2} + DM_{CO2} + UM_{CH4}$$

Where,

			Units
PE	=	Project emissions during a project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
FF_{CO2}	=	Total CO_2 attributable to the consumption of fossil fuel to capture and destroy ventilation air CH_4 during a project reporting period, calculated using Equation 5.12~~, in metric tonnes CO_2 equivalent~~	tCO_2e
DM_{CO2}	=	Total CO_2 attributable to the destruction of CH_4 during a project reporting period, calculated using Equation 5.14~~, in metric tonnes CO_2 equivalent~~	tCO_2e
UM_{CH4}	=	CH_4 emissions attributable to uncombusted CH_4 during a project reporting period, calculated using Equation 5.15~~, in metric tonnes CO_2 equivalent~~	tCO_2e

Equation 5.12. Project Emissions from Fossil Fuels

$$FF_{CO2} = \frac{\sum_{j=1}^{n}\left(FF_{PR,j} \times EF_{CF,j}\right)}{1,000}$$

Where,

			Units
FF_{CO2}	=	Total CO_2 attributable to the consumption of fossil fuel to capture and destroy ventilation air CH_4 during a project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
n	=	Number of types of fossil fuel	
j	=	Type of fossil fuel	
$FF_{PR,j}$	=	Annual quantity of fossil fuel *j* consumed, expressed - in kilograms, in the case of fuels whose quantity is expressed as a mass - in cubic metres at standard conditions, in the case of fuels whose quantity is expressed as a volume of gas - in litres, in the case of fuels whose quantity is expressed as a volume of liquid	$kg/m^3/l$

$EF_{CF,j}$	=	CO_2 emission factor for fossil fuel *j* specified in tables 1-3 to 1-8 of QC.1.7 in Schedule A.2 to the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere (chapter Q-2, r. 15), expressed - in kilograms of CO_2 per kilogram, in the case of fuels whose quantity is expressed as a mass - in kilograms of CO_2 per cubic metre at standard conditions, in the case of fuels whose quantity is expressed as a volume of gas - in kilograms of CO_2 per litre, in the case of fuels whose quantity is expressed as a volume of liquid	kg/m^3/l
1,000	=	Conversion factor, metric tonnes to kilograms	

If the volume of ventilation air leaving the destruction device is not measured as specified in Table 6.1, it must be calculated using Equation 5.13:

Equation 5.13. Ventilation Air Leaving the Destruction Device

$$VA_S = VA_E + CA$$

Where,

			Units
VA_S	=	Volume of ventilation air leaving the destruction device during the project reporting period, in cubic metres at standard conditions	m^3
VA_E	=	Volume of ventilation air sent to a destruction device during the project reporting period, in cubic metres at standard conditions	m^3
CA	=	Volume of cooling air added after the point of metering for the volume of ventilation air sent to the destruction device (VA_E), in cubic metres at standard conditions, or a value of 0 if no cooling air is added	m^3

Equation 5.14. Project Emissions from Destruction of Captured Methane

$$DM_{CO2} = [(VA_E \times C_{CH4}) - (VA_S \times C_{dest-CH4})] \times 1.556 \times 0.001$$

Where,

			Units
DM_{CO2}	=	Total CO_2 attributable to the destruction of CH_4 during a project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
VA_E	=	Volume of ventilation air sent to a destruction device during the project reporting period, in cubic metres at standard conditions	m^3
VA_S	=	Volume of ventilation air leaving the destruction device during the project reporting period, in cubic metres at standard conditions	m^3
C_{CH4}	=	Average CH_4 content in ventilation air before entering destruction device during the project reporting period, in cubic metres of CH_4 per cubic metre of gas	m^3 CH_4/m^3
$C_{dest-CH4}$	=	Average CH_4 content in ventilation air leaving the destruction device during the project reporting period, in cubic metres of CH_4 per cubic metre of gas	m^3 CH_4/m^3
1.556	=	CO_2 emission factor attributable to the combustion of CH_4, in kilograms of CO_2 per cubic metre of CH_4 combusted	kg CO_2/m^3 CH_4
0.001	=	Conversion factor, kilograms to metric tonnes	

Equation 5.15. Project Emissions from Uncombusted Methane

$$UM_{CH4} = VA_S \times T_{dest-CH4} \times \rho_{CH_4} ~~0.667~~ \times 0.001 \times ~~21~~ GWP$$

Where,

			Units
UM_{CH4}	=	CH_4 emissions attributable to uncombusted CH_4 during a project reporting period~~, in metric tonnes CO_2 equivalent~~	tCO_2e
VA_S	=	Volume of ventilation air leaving the destruction device during the project reporting period, in cubic metres at standard conditions	m^3
$T_{dest-CH4}$	=	Average CH_4 content in ventilation air leaving the destruction device during the project reporting period, in cubic metres of CH_4 per cubic metre of gas	m^3 CH_4/m^3
ρ_{CH4}~~0.667~~	=	Density of CH_4 (Table A.2)~~, in kilograms of CH_4 per cubic metre of CH_4 at standard conditions~~	kg CH_4 / m^3 CH_4
0.001	=	Conversion factor, kilograms to metric tonnes	
~~21~~GWP	=	Global Warming Potential factor of CH_4, as set out in Ontario and Quebec regulations concerning the reporting of GHG emissions.~~Global Warming Potential factor of CH_4~~	

If a mass flow meter is used to monitor gas flow instead of a volumetric flow meter, the volume and density terms must be replaced by the monitored mass value in kilograms. The methane ~~CH_4~~ content must be in mass percent.

6 Data Management and Project ~~Monitoring~~Surveillance

6.1 Data Collection and Validation

The Project Developer is responsible for collecting the information required for project monitoring.

The Project Developer must show that the data collected are actual and that rigorous supervision and record-keeping procedures are applied at the project site.

The Project Developer must institute a transparent, verifiable methodology for the validation of all project data to ensure that any erroneous or unusual data are identified, subject to verifier review and approval. Any data which are determined to be invalid shall be replaced using the Missing Data procedures in Appendix B.

6.2 ~~Surveillance~~ ~~Monitoring~~ Surveillance Plan

~~The monitoringsurveillance plan must specify the methods used to collect and record the data required for all the relevant parameters in Table 6.1.~~

At a minimum, the surveillance plan must include the following:

1. Methods used to collect and record the data required for all the relevant parameters in Table 6.1;

2. Frequency of data acquisition;

3. Record keeping plan (see Section 7.2 for minimum record keeping requirements)

4. Frequency of instrument cleaning, inspection and calibration activities, and of the verification of instrument calibration accuracy; and

5. The role and qualifications of the person responsible for each ~~monitoring~~surveillance activity, as well as the quality assurance and quality control measures taken to ensure that data acquisition and instrument calibration are carried out consistently and with precision; and

6. A detailed diagram of the ~~LFG~~ mine methane capture and treatment or destruction system, including the placement of all measurement instrument and equipment that affect included SSRs; and

7. Procedures which will be followed to ascertain and demonstrate that the project at all times ~~meets the additionality requirements of the Regulation.~~ passes the Legal Requirement Test (Section 3.4.3).

6.3 ~~Monitoring~~Surveillance Requirements

Project Developers are responsible for monitoring the performance of the project and ensuring that the operation of all project-related equipment is consistent with the manufacturer's recommendations. ~~Methane~~ For drainage projects, methane emission reductions from mine gas capture and control systems must be monitored with measurement equipment that directly meters:

1. The flow of mine gas delivered to each destruction device[10], measured continuously and recorded every 15 minutes or totalized and recorded at least daily, adjusted for temperature and pressure;
1.2. The fraction of methane CH_4 in the mine gas delivered to each destruction device, measured continuously and recorded every 15 minutes and averaged at least daily (measurements taken at a frequency that is between daily and weekly may be used with the application of a 10% discount in Equation 5.3).

For VAM projects, the measurement equipment must directly meter:

1. The flow of ventilation air sent to each destruction device, measured continuously and recorded every 2 minutes and totalized as an hourly average, adjusted for temperature and pressure;
2. The fraction of methane in the ventilation air delivered to each destruction device, measured continuously and recorded every 2 minutes and totalized as an hourly average.

All flow data collected must be corrected for temperature and pressure. at 15º C and 1 atm. Pressure correction is to 1 atm, but temperature correction may be chosen according to one of the values listed in Table A.2 and then applied to all gas measurement data for the project. The appropriate value for the density of methane is based on the chosen reference temperature. The temperature and pressure of the mine gas must be measured continuously. No separate monitoring of temperature and pressure is necessary when using flow meters that automatically correct for temperature and pressure, expressing mine gas volumes in normalized cubic meters.

The continuous methane analyzer is the preferred option for monitoring methane concentrations. When using an alternative approach of up to weekly methane concentration measurement for drainage projects, Project Developers must account for the uncertainty associated with these measurements by applying a 10% discount factor to the total quantity of methane collected and destroyed in Equation 5.3. Non-continuous methane measurement may occur through the use of a calibrated, portable methane analyzer, or a device which collects gas samples into a common container which is then analyzed by an off-site laboratory, providing an average methane content for the period. In the latter case, the device must collect samples at least weekly, and the gas analysis must be carried out at least monthly.

Methane fraction of the mine gas to be measured on a wet/dry basis for drainage projects (must be measured on same basis as flow, temperature, and pressure). The methane analyzer and flow meter should be installed in the same relative placement to any moisture-removing components of the mine gas system (there should not be a moisture-removing component separating the measurement of flow and methane fraction). An acceptable variation to this arrangement would be in the case where the flow meter is placed after a moisture-removing component (dry basis), while the methane analyzer is placed before this component (wet basis). The opposite arrangement is not permissible.

Commented [TL11]: SH Comments not yet addressed: "Depending on project type and well type, the % of methane can vary greatly. Maybe allow the weekly measurement w/discount for a limited amount of time – 4 weeks? Also, changes here may affect Appendix B – Missing Data."

This is an interesting idea. This would stray from the LFG approach, but if % methane in mine gas varies more than LFG Protocol, it is worth consideration. Further comment?

Commented [MH12]: We do not think wet/dry is relevant to VAM, but not 100% sure.

Comments?

[10] A single meter may be used for multiple, identical destruction devices. In this instance, methane destruction in these units will be eligible only if both units are monitored to be operational, unless evidence is available to document that the design of the device is such that methane may not pass through when it is not operational.

The ~~operating status~~ operational activity of the mine gas or ventilation air collection system and destruction devices ~~must~~ shall be monitored and recorded at least hourly to ensure actual mine gas destruction. GHG reductions will not be accounted for during periods in which the destruction device is not operational. For flares, operation is defined ~~as thermocouple readings above 260°C~~ according to the regulatory standard for the relevant jurisdiction. For all other destruction devices, the means of demonstration shall be determined by the ~~project operator~~Project Developer, according to applicable regulatory standards, should they exist, and otherwise ~~subject~~ according to manufacturer guidance, and subject to verifier review.

If the Project Developer can demonstrate that the engineering design of the destruction system is such that gas may not be released when the device is not operational, and that such design elements are functioning properly, it is not required to monitor operational status on an hourly basis.

6.3.1 Arrangement of Metering Equipment

For drainage projects, the mine gas from each drainage system (i.e., surface pre-mining boreholes, horizontal pre-mining boreholes, or post-mining boreholes) must be monitored separately prior to interconnection with other sources. The volumetric gas flow, methane concentration, temperature, and pressure shall be monitored and recorded separately for each drainage system.

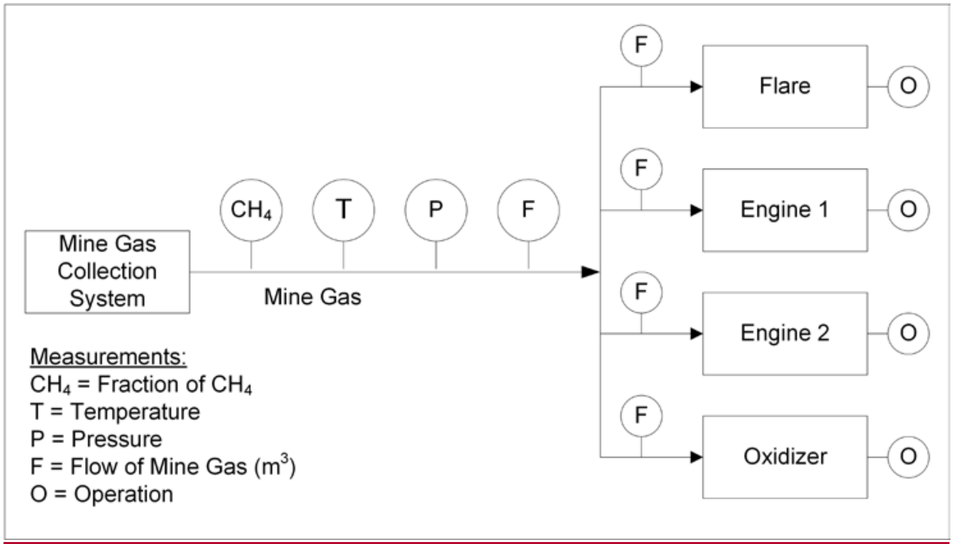
In addition, the flow of gas to each destruction device must be monitored separately for each destruction device, except under certain conditions. Specifically, if all destruction devices are of identical efficiency and verified to be operational throughout the reporting period, a single flow meter may be used to monitor gas flow to all destruction devices. Otherwise, the destruction efficiency of the least efficient destruction device shall be used as the destruction efficiency for all destruction devices monitored by this meter.

If a project using a single meter to monitor gas flow to multiple destruction devices has any periods when not all destruction devices downstream of a single flow meter are operational, methane destruction from the set of downstream devices during these periods will only be eligible provided that the verifier can confirm all of the following requirements and conditions are met:

1. The destruction efficiency of the least efficient downstream destruction device in operation shall be used as the destruction efficiency for all destruction devices downstream of the single meter; and
2. All devices are either equipped with valves on the input gas line that close automatically if the device becomes non-operational (requiring no manual intervention), or designed in such a manner that it is physically impossible for gas to pass through while the device is non-operational; and
3. For any period during which one or more downstream destruction devices are not operational, it must be documented that the remaining operational devices have the capacity to destroy the maximum gas flow recorded during the period.

Figure 6.1 represents the suggested arrangement of destruction system metering equipment.

Figure 6.1. Suggested Arrangement of MMC Metering Equipment



Note: The number and arrangement of flow meters must be sufficient to track the flow to each combustion device. The above scenario includes one more flow meter than would be necessary to achieve this objective.

6.4 ~~Measurement instruments~~ Instrument Quality Assurance and Quality Control (QA/QC)

The Project Developer must ensure that all mine gas flow meters and methane ~~CH_4~~ analyzers are:

1. Documented to be in calibration at the time of installation at the project; and
2. Cleaned and inspected as specified in the project's surveillance plan and at the minimum cleaning and inspection frequency specified by the manufacturer, with all cleaning and inspection activities documented by mine site personnel. ~~If the manufacturer does not specify a minimum frequency of cleaning and inspection, then meters must be cleaned and inspected at least quarterly~~; and
3. Not more than 2 months before or after the project reporting period end date, either
    a) Checked for accuracy by a qualified and independent person, either using a portable instrument, such as a pitot tube, or manufacturer's specifications, and ensure that the percentage drift is recorded; or
    b) Calibrated by the manufacturer, or by a third person certified for that purpose by the manufacturer; and
4. Calibrated by the manufacturer, or by a third-party certified for that purpose by the manufacturer, according to the manufacturer's specifications or every 5 years, whichever is more frequent.

A calibration certificate or a verification report on calibration accuracy, from either the manufacturer or a qualified third-party service provider, must be produced and included in the project report. ~~The verification provided for in the Regulation must include confirmation that the person is qualified to verify calibration accuracy.~~

Commented [MH13]: Do we need to elaborate on what "qualified" means here?

Flow meters and/or methane analyzers which are installed temporarily (not portable devices) must be documented to be in calibration at the time of installation. ~~If the device is used for 60 days or more, the device must be field checked for calibration accuracy prior to its removal from the system.~~

Flow meter calibrations must be documented to show that the meter was calibrated to a range of flow rates corresponding to the flow rates expected for the ~~drainage~~ system. Methane ~~CH_4~~ analyzer calibrations must be documented to show that the calibration was carried out to a range of temperature and pressure conditions corresponding to the range of conditions measured for the ~~drainage~~ system.

The verification of flow meter and analyzer calibration accuracy must show that the instruments provide a reading of volumetric flow or methane ~~CH_4~~ content that is within a +/-5% accuracy threshold.

When ~~a verification of the calibration accuracy of~~ either a calibration or a field check of a device shows a shift outside the ± 5% accuracy threshold, but the manufacturer specifies a cleaning procedure for ~~calibration~~ accuracy checks, the device may be cleaned and rechecked. If the device is still out of the allowable threshold, the device must be calibrated by the manufacturer or by a third ~~person~~ party certified for that purpose by the manufacturer. In addition, for the entire period from the last calibration or field check that confirmed accuracy within the ± 5% threshold until such time as the piece of equipment is correctly calibrated, all the data from the piece of equipment must be corrected according to the following procedure:

1. When the calibration indicates an under-reporting of flow rates or methane ~~CH_4~~ content, the ~~operator~~ Project Developer must use the measured values without correction;

2. When the calibration indicates an over-reporting of flow rates or methane ~~CH_4~~ content, the ~~operator~~ Project Developer must apply to the measured values the greatest calibration drift recorded at the time of calibration.

For devices which are cleaned and rechecked, with the second check showing a return to calibration accuracy, the device does not need further calibration, but the data must be adjusted per the procedure outlined above.

If the Project Developer uses a portable methane analyzer, it must be maintained and calibrated according to the manufacturer's specifications, and calibrated at least annually by the manufacturer, by a laboratory certified by the manufacturer, or by an ISO 17025 accredited laboratory. The portable analyzer also must be calibrated per the manufacturer's guidance prior to each use.

~~The last calibration confirming accuracy within the ± 5% threshold must not have taken place more than 2 months before the end date for the project reporting period.~~ No offset credit may be issued for a project reporting period when the calibration or verification of the calibration accuracy of the required instruments has not been correctly carried out and documented.

Commented [TL14]: We believe this language may be a bit overly restrictive, and are seeking comment on how to revise. Potentially consider applying this language to only to periods that the project cannot provide proof of equipment calibration.

6.5 Missing Data

In situations where the flow rate or methane concentration monitoring equipment is missing data, the Project Developer shall apply the data substitution methodology provided in Appendix B. If for any reason the destruction device monitoring equipment is inoperable (for example, the thermal coupler on the flare), then no emission reductions can be registered for that device for the period of inoperability.

6.6 Monitoring Parameters

Prescribed monitoring parameters necessary to calculate baseline and project emissions are provided in Table 6.1.

Table 6.1. Mine Methane Project ~~Surveillance~~ ~~Monitoring~~ Surveillance Plan

Eq. #	Parameter	Description	Data Unit	Calculated (c) Measured (m) Reference (r) Operating Records (o)	Measurement Frequency	Comment
--	Operating status of destruction device	N/A	~~Degree Celsius or other, depending on the device~~Unit determined per destruction device	m	Hourly	Required for each destruction device.~~ For flares, operation is defined as thermocouple readings above 260°C~~
5.2	Uncorrected volume of mine gas sent to destruction device *i*, in time interval *t*	$MG_{uncorrected}$	Cubic metre per unit time	m	Only when flow data are not adjusted at standard conditions	Used only in cases where the flow meter does not automatically correct to ~~16°C and 101.325 kPa~~standard conditions
5.2	Corrected volume of mine gas sent to destruction device *i*, in time interval *t*	$MG_{i,t}$	Cubic metre per unit time at standard conditions	m/c	Continuous and recorded at least every 15 minutes or totalized and recorded at least daily and adjusted for temperature and pressure	Measured continuously by a flow meter and recorded at least once every 15 minutes. Data to be aggregated by time interval *t* (this parameter is calculated in cases where the metered flow must be corrected for temperature and pressure)
5.3 5.4 5.7 5.8	Total quantity of CH_4 sent to destruction device *i* during the project reporting period	Q_i	Cubic metre of CH_4 at standard conditions	c	Daily	Calculated daily

Commented [TL15]: SH Comment:
1) The substitution methodology should also apply to temperature and pressure missing data (used to correct flow rate and/or methane concentration readings).
2) As long as it can be demonstrated that the destruction device was operational, it should be possible to substitute data for both flow and concentration simultaneously (if required).
3) In the table B.1.: Use the average of the 4 hours of normal operation immediately before and following the missing data period (same comment for each row…).

Many scenarios may take place before and after the instrument outage. For example, a flow meter is down for 2 days. After 2 days of operation, the destruction device is stopped to fix the problem. Then the system is restarted, stopped again after a few hours for any other reason, then restarted again…

In this scenario, we should base the substitution methodology on the 72 hours of normal operation preceding and following the instrument outage, excluding the start-up periods during which flow conditions were not relevant to normal operation expected while the instrument was down…

We need some flexibility in this substitution methodology as long as the project operator use a methodology that is more conservative compared to what is specified in the Appendix B.

Commented [TL16]: We are working to make all updates in this table, but it is not final. We will be updating further to ensure consistency with Section 5, and where possible, Monitoring in LFG PRotocol

Eq. #	Parameter	Description	Data Unit	Calculated (c) Measured (m) Reference (r) Operating Records (o)	Measurement Frequency	Comment
5.2 5.4 5.10	Time interval for which mine gas CH_4 flow and content measurements are aggregated	t	Day, hour, or minute	m	Continuous or daily	Projects may use the interval used by their continuous CH_4 concentration data acquisition system, provided it is not more than 1 day for the continuous monitoring of CH_4 content
5.4	Average CH_4 fraction of the mine gas sent to destruction device in time interval *t*	$C_{CH4,t}$	Cubic metre of CH_4 at standard conditions per cubic metre of mine gas at standard conditions	m	Continuous and recorded at least every 15 minutes	Measured by continuous gas analyzer
5.6	Total fossil fuels consumed by the mine gas capture and destruction system during the project reporting period, by type of fuel *j*	$FF_{PR,j}$	Kilogram (solid) Cubic metre at standard conditions (gas) Litre (liquid)	c	Every reporting period	Calculated from monthly record of fossil fuel purchased and consumed
	Total electricity consumed by the mine gas capture and destruction system during the project reporting period		Megawatt-Hour	c	Every reporting period	Obtained from either onsite metering or utility purchase records. Required to determine CO_2 emissions from use of electricity to operate the project activity
	Total heat consumed by the mine gas capture and destruction system during the project reporting period		Volume	o	Every reporting period	Obtained from purchase records. Required to determine CO_2 emissions from use of additional heat to operate the project activity
5.2	Mine gas or ventilation air temperature	T_m	°~~C~~K	m	Continuous	No separate monitoring of temperature is necessary when using flow meters that automatically adjust flow volumes for temperature and pressure, expressing gas volumes in normalized kPa

Commented [MH17]: Need to include the appropriate equation in Section 5. (to be resolved)

Commented [MH18]: Need to include the appropriate equation in Section 5. (to be resolved)

Eq. #	Parameter	Description	Data Unit	Calculated (c) Measured (m) Reference (r) Operating Records (o)	Measurement Frequency	Comment
5.2	Mine gas or ventilation air pressure	P_m	kPa	m	Continuous	No separate monitoring of pressure is necessary when using flow meters that automatically measure adjust flow volumes for temperature and pressure, expressing gas volumes in normalized kPa
5.10	Volume of ventilation air sent to destruction device	VA_{Et}	Cubic metre at standard conditions	m, c	Continuous and recorded at least every 2 minutes	Readings taken at least every 2 minutes to calculate average hourly flow, adjusted for T and P
5.3 5.8 5.10 5.15	Global Warming Potential factor of CH_4, as set out in Ontario and Quebec Rregulations concerning the reporting of GHG emissions	GWP	N/A	r	At each reporting period	As set out in Ontario and Quebec regulations concerning the reporting of GHG emissions
5.13	Volume of cooling air added	CA	Cubic metre at standard conditions	m, c	Continuous and recorded at least every 2 minutes	Readings taken at least every 2 minutes to calculate average hourly flow, adjusted for T and P
5.13 5.14 5.15	Volume of ventilation air leaving the destruction device	VA_S	Cubic metre at standard conditions	m, c	Continuous and recorded at least every 2 minutes	Readings taken at least every 2 minutes to calculate average hourly flow, adjusted for T and P
5.10 5.14	Methane concentration in ventilation air sent to destruction device	C_{CH4}	Cubic metre of CH_4 per cubic metre of gas at standard conditions	m	Continuous and recorded at least every 2 minutes	Readings taken at least every 2 minutes and used to calculate average methane concentration per hour
5.14	Methane concentration in ventilation air leaving the destruction device	$C_{Dest-CH4}$	Cubic metre of CH_4 per cubic metre of gas at standard conditions	m	Continuous and recorded at least every 2 minutes	Readings taken at least every 2 minutes (either average over 2 minutes or instantaneous) and used to calculate average methane concentration per hour

7 Reporting ~~Parameters~~

This section provides requirements and guidance on reporting rules and procedures. A priority of the Ministry is to facilitate consistent and transparent information disclosure among Project Developers. Project Developers shall conduct regular project reporting according the guidance in the Regulation.

7.1 ~~First~~ Project Report

In addition to the information required under the [Reference to the Regulation], the ~~first~~ MMC project reports must include the following information:

1. in the case of an underground mine, the mining method employed, such as room and pillar or longwall;

2. annual coal production, in metric tonnes;

3. the year of initial mine operation;

4. the scheduled year of mine closure, if known;

5. a diagram of the mine site that includes
   a. the location of existing and planned wells and boreholes, specifying whether they were used for pre-mining or post-mining drainage, and whether they are part of the project;
   ~~a.~~b. the location of the equipment that will be used to treat or destroy the mine methane~~CH_4~~.

Commented [TL19]: We are still figuring out what to do with this section. Quebec's protocols originally included them but LFG and ODS do not currently include (were deleted in most recent drafts).

We did not delete section entirely, since this information was not included elsewhere. Has been updated to just general reporting requirements. We are still working to confim whether any reporting requirements along these lines will be included in the Regulations? Or must be included here.

7.2 Record Keeping

For purposes of independent verification and historical documentation, Project Developers are required to keep all information outlined in this protocol for the period of time defined by the Regulation ~~a period of 7 years starting on the date of the end of the final reporting period~~. Information on data procedures and data monitoring must be managed in a way that guarantees the integrity, exhaustiveness, accuracy and validity of the data.

The Project Developer must keep the following documents and information:

~~0.~~1. ~~the~~ The information and data required under the surveillance plan, including all GHG calculations and their related data inputs;

~~0.~~2. I~~i~~nformation on each flow meter, methane ~~CH_4~~ analyzer and destruction device used, including type, model number, serial number and manufacturer's maintenance and calibration procedures;

~~0.~~3. ~~t~~The calibration date, time and results for methane ~~CH_4~~ analyzers and flow meters, and the corrective measures applied if a piece of equipment fails to meet the requirements of this Regulation;

~~0.~~4. ~~t~~The maintenance records for capture, destruction and monitoring systems;

5. OOperating records showing annual coal production.

6. All documentation related to permits related to the coal mine (e.g., mining permits, air quality, water quality, land use, system construction, etc.), as well as documentation related to any regulatory compliance inquiries, warnings, or violations.

Commented [TL20]: Is this necessary? May be considered proprietary? Consider other options for demonstrating mine status (Not required in CA protocol; perhaps this data point can be one option?)

7.3 Reporting Period and Verification Cycle

Project Developers must report GHG reductions resulting from project activities during each reporting period. Reporting periods shall be 12 months in length. Guidance regarding the deadlines for verification of each reporting period can be found in the Regulation.

Except for the initial reporting period, projects which generate fewer than 25,000 tonnes of emission reductions in a calendar year may delay verification for up to a year. These projects may verify two 12-month reporting periods at the same time.

8 Verification Guidance

Only accredited verification bodies, as defined in the Regulation, ~~approved by the Ministry for this project type~~ are eligible to verify ~~Canadian~~ mine methane project reports. ~~Verification bodies approved under other project protocol types are not permitted to verify mine methane projects.~~

8.1 Standard of Verification

The Ministry's standard of verification for mine methane projects is the ~~Canada~~ Mine Methane Capture ~~& Destruction~~ Project Protocol (this document) and the Regulation. To verify a mine methane project report, verification bodies apply the guidance in the Regulation and this section of the protocol to the standards described in Sections 2 through 7 of this protocol. In cases where the Regulation differs from the guidance in this protocol, the Regulation takes precedent.

Verification bodies are expected to use their professional judgment to confirm that protocol requirements have been met in instances where the protocol does not provide (sufficiently) prescriptive guidance. For more information on the Ministry's verification process and professional judgment, please see the Regulation.

8.2 Surveillance ~~Monitoring~~ Plan

Verification bodies shall confirm that the surveillance~~monitoring~~ plan covers all aspects of monitoring and reporting contained in this protocol and specifies how data for all relevant parameters in Table 6.1 are collected and recorded.

8.3 Verifying Project Eligibility

Verification bodies must affirm a mine methane project's eligibility according to the rules described in this protocol. The table below outlines the eligibility criteria for a mine methane project. This table does not represent all criteria for determining eligibility comprehensively; verification bodies must also look to Section 3 and the verification items list in Table 8.2.

Table 8.1 Summary of Eligibility Criteria

Eligibility Rule	Eligibility Criteria	Frequency of Rule Application
Start Date	Per guidance in the Regulation	Once during first verification
Location	Canada	Once during first verification
Performance Standard	Installation of an ~~qualifying~~ eligible destruction device where not required by law (see Section 3.4.1 for other requirements)	Once during first verification
Legal Requirement Test	~~Specific to each province (see Section 3.4.2 for more information)~~Confirm that new no laws have been promulgated that impact methane emissions from coal mines, and that the Surveillance Plan addresses how the Project Developer will ascertain this	Every verification
Regulatory Compliance Test	Disclosure of all non-compliance events to verifier; project must be in material compliance with all applicable laws	Every verification
Exclusions	▪ Abandoned coal mines ▪ Coal bed methane destruction ▪ Use of CO_2 or other fluid/gas to enhance methane drainage before mining takes place	Every verification

8.4 Core Verification Activities

The Regulation describes the core verification activities that shall be performed by verification bodies for all project verifications. They are summarized below in the context of a mine methane project, but verification bodies must also follow the general guidance in the Regulation.

Verification is a risk assessment and data sampling effort designed to ensure that the risk of reporting error is assessed and addressed through appropriate sampling, testing, and review. The three core verification activities are:

1. Identifying emission sources, sinks, and reservoirs (SSRs)
2. Reviewing GHG management systems and estimation methodologies
3. Verifying emission reduction estimates

Identifying emission sources, sinks, and reservoirs
The verification body reviews for completeness the sources, sinks, and reservoirs identified for a project, such as, *inter alia*, mine methane emissions, system energy use, fuel consumption, and combustion and destruction from various ~~qualifying~~ eligible and ~~non-qualifying~~ineligible destruction devices.

Reviewing GHG management systems and estimation methodologies
The verification body reviews and assesses the appropriateness of the methodologies and management systems that the mine methane Project Developer uses to gather data and calculate baseline and project emissions.

Verifying emission reduction estimates
The verification body further investigates areas that have the greatest potential for material misstatements and then confirms whether or not material misstatements have occurred. This

involves site visits to the project facility (or facilities if the project includes multiple facilities) to ensure the systems on the ground correspond to and are consistent with data provided to the verification body. In addition, the verification body recalculates a representative sample of the performance or emissions data for comparison with data reported by the Project Developer in order to double-check the calculations of GHG emission reductions.

8.5 Mine Methane Project Verification Items

The following tables provide lists of items that a verification body needs to address while verifying a mine methane project. The tables include references to the section in the protocol where requirements are further described. The table also identifies items for which a verification body is expected to apply professional judgment during the verification process. Verification bodies are expected to use their professional judgment to confirm that protocol requirements have been met in instances where the protocol does not provide (sufficiently) prescriptive guidance.

Note: These tables shall not be viewed as a comprehensive list or plan for verification activities, but rather guidance on areas specific to mine methane projects that must be addressed during verification.

8.5.1 Project Eligibility and Credit Issuance

Table 8.2 lists the criteria for reasonable assurance with respect to eligibility and credit issuance for mine methane projects. These requirements determine if a project is eligible to register credits for the reporting period. If any one requirement is not met, either the project may be determined ineligible or the GHG reductions from the reporting period (or sub-set of the reporting period) may be ineligible for issuance of credits, as specified in Sections 2, 3, and 6.

Table 8.2 Eligibility Verification Items

Protocol Section	Eligibility Qualification Item	Apply Professional Judgment?
3.4.1	Verify that the project meets the appropriate Performance Standard Test for the project type per Section 3.4.1	No
3.4.3	Verify that the project activities comply with applicable laws by reviewing any instances of non-compliance provided by the Project Developer and performing a risk-based assessment	Yes
4	Confirm all baseline destruction devices have been properly accounted for within project's GHG Assessment Boundary	No
6	Verify that monitoring meets the requirements of the protocol	No
6	Verify that the project surveillance plan contains procedures for ascertaining and demonstrating that the project passes the Legal Requirement Test at all times	Yes
6	Verify that the mine ~~gas~~ methane and/or VAM destruction system operated in a manner consistent with the design specifications	Yes
6	Verify that there is an individual responsible for managing and reporting GHG emissions, and that individual properly trained and qualified to perform this function	Yes
6.2	Verify that all gas flow meters and methane analyzers adhered to the inspection, cleaning, and calibration schedule specified in the protocol. If they do not, verify whether any non-conformances should be considered material.	Yes
6.2	If any piece of equipment failed a calibration check, verify that data from that equipment was scaled according to the failed calibration procedure for the appropriate time period	No
6.3	If used, verify that data substitution methodology was properly applied	No
7	Verify that appropriate documents are created to support and/or substantiate activities related to GHG emission reporting activities, and that such documentation is retained appropriately	Yes

8.5.2 Quantification of GHG Emission Reductions

Table 8.3 lists the items that verification bodies shall include in their risk assessment and re-calculation of the project's GHG emission reductions. These quantification items inform any determination as to whether there are material and/or immaterial misstatements in the project's GHG emission reduction calculations. If there are material misstatements, the calculations must be revised before credits are issued.

Table 8.3. Quantification Verification Items

Protocol Section	Quantification Item	Apply Professional Judgment?
4	Verify that SSRs included in the GHG Assessment Boundary correspond to those required by the protocol and those represented in the project	No
5	Verify that the Project Developer correctly accounted for baseline methane destruction in the baseline scenario	No

Protocol Section	Quantification Item	Apply Professional Judgment?
5	Verify that the Project Developer correctly monitored, quantified and aggregated the amount of mine methane collected and destroyed by mine ~~gas~~ methane or VAM destruction system	No
5.1.2.1	Verify definition of mined through was properly applied to surface mine methane boreholes	No
5	Verify that the Project Developer correctly quantified and aggregated electricity use	Yes
5	Verify that the Project Developer correctly quantified and aggregated fossil fuel use	Yes
5	Verify that the Project Developer correctly quantified and aggregated heat consumption	Yes
5	Verify that the Project Developer applied the correct emission factors for fossil fuel combustion and grid-delivered electricity	No
5	Verify that the Project Developer applied the correct methane destruction efficiencies	No
Appendix A	If the Project Developer used source test data in place of the default destruction efficiencies (Appendix A), verify accuracy and appropriateness of data and calculations	Yes
Appendix B	If data substitution was employed, verify that it meets the guidance in Appendix B	No

8.5.3 Risk Assessment

Verification bodies will review the following items in Table 8.4 to guide and prioritize their assessment of data used in determining eligibility and quantifying GHG emission reductions.

Table 8.4. Risk Assessment Verification Items

Protocol Section	Item that Informs Risk Assessment	Apply Professional Judgment?
8.2	Verify that the surveillance plan is sufficiently rigorous to support the requirements of the protocol and proper operation of the project	Yes
6.3, 6.6	Verify that appropriate monitoring equipment is in place to meet the requirements of the protocol	No
6.4	Verify that equipment calibrations have been carried out to satisfy the requirements of the protocol	No
6	Verify that the individual or team responsible for managing and reporting project activities are qualified to perform this function	Yes
6	Verify that appropriate training was provided to personnel assigned to greenhouse gas reporting duties	Yes
6	Verify that all contractors are qualified for managing and reporting greenhouse gas emissions if relied upon by the Project Developer. Verify that there is internal oversight to assure the quality of the contractor's work	Yes
6.4	Verify that the methane destruction equipment was operated and maintained according to manufacturer specifications	Yes
7.1	Verify that all required records have been retained by the Project Developer	No

8.6 Verification of Multiple Projects at a Single Mine

Commented [TL21]: Need to confirm whether this type of verification option is allowable in the Regulation.

Because the protocol allows for multiple projects at a single mine site, Project Developers have the option to hire a single verification body to verify multiple projects under a joint project verification. This may provide economies of scale for the project verifications and improve the efficiency of the verification process. Joint project verification is only available as an option for a single Project Developer; joint project verification cannot be applied to multiple projects registered by different Project Developers at the same mine.

Under joint project verification, each project, as defined by the protocol and the Project Developer, must still be registered separately as described in the Regulation and each project requires its own verification process and Verification Statement (i.e. each project is assessed by the verification body separately as if it were the only project at the mine). However, all projects may be verified together by a single site visit to the mine. Furthermore, a single Verification Report may be filed, as described in the Regulation, that summarizes the findings from multiple project verifications.

Finally, the verification body may submit one Notification of Verification Activities/Conflict of Interest (NOVA/COI) Assessment form that details and applies to all of the projects at a single mine that it intends to verify.

If, during joint project verification, the verification activities of one project are delaying the registration of another project, the Project Developer can choose to forego joint project verification. There are no additional administrative requirements of the Project Developer or the verification body if a joint project verification is terminated.

~~8.6~~8.7 Completing Verification

The Regulation provides detailed information and instructions for verification bodies to finalize the verification process. It describes completing a Verification Report, preparing a Verification Opinion, submitting the necessary documents to the Ministry, and notifying the Ministry of the project's verified status.

9 Glossary of Terms

Commented [TL22]: Numerous additional terms added and updated in this glossary. Please review.

Abandoned mine	A mine where all mining activity including mine development and mineral production have ceased, mine personnel are not present in the mine workings, and mine ventilation fans are no longer operative.[11] In the U.S., mines are declared "abandoned" from the date when ventilation is discontinued.[12] This mine type is not eligible under this protocol.
Active coal mine	An Aactive coal mine is defined as any mine with mine works that are actively ventilated by the mine operator and which has the primary purpose of being used in extracting coal from its natural deposits in the earth by any means or method. An active coal mine is any coal mine that is not "abandoned." Active coal mines of all types (underground and surface mines) are eligible under this protocol.
Additionality	Project activities that are above and beyond "business as usual" operation, exceed the baseline characterization, and are not mandated by regulation.
Baseline emissions	Baseline emissions represent the GHG emissions within the GHG Assessment Boundary that would have occurred in the absence of the GHG reduction project.
Carbon dioxide (CO_2)	The most common of the six primary greenhouse gases, consisting of a single carbon atom and two oxygen atoms.
CO_2 equivalent (CO_2e)	The quantity of a given GHG multiplied by its total global warming potential. This is the standard unit for comparing the degree of warming which can be caused by different GHGs.
Coal	All solid fuels classified as anthracite, bituminous, subbituminous, or lignite under ASTM D388, entitled Standard Classification of Coals by Rank
Coal bed methane (CBM)	A generic term for methane originating in coal seams that is drained from virgin coal seams and surrounding strata. CBM is unrelated to mining activities and ineligible under this protocol.
Coal mine methane (CMM)	Methane contained in coal and surrounding strata that is released because of mining activity. For the purposes of this protocol, CMM also refers to the methane gas that is released because of mining activity at Category III gassy underground trona mines.
Direct emissions	GHG emissions from sources that are owned or controlled by the reporting entity.
Drainage system	A term used to encompass the entirety of the equipment that is used to drain the gas from underground and collect it at a common point, such as a vacuum pumping station. In this protocol, methane drainage

[11] UN Economic and Social Council, Economic Commission for Europe, Committee on Sustainable Energy, Glossary of Coal Mine Methane Terms and Definitions, July 2008.
[12] MSHA Program Policy Manual Volume V, January 2006, p.120.

	systems include surface pre-mining, horizontal pre-mining, and post-mining.
Effective Date	The date of adoption of this protocol by the MOECC or the MDDELCC.
Eligible coal mine	An active coal mine that meets the performance standard evaluation and uses an eligible device to treat or destroy methane captured at a coal mine site.
Eligible destruction device	Eligible treatment or destruction devices include enclosed flares, open flares, combustion engines, boilers, turbines, microturbines, natural gas pipeline injection, and methane liquefaction units. Additional types of devices may be approved by the Ministry.
~~Eligible end use~~	~~For the purposes of this protocol, all end uses that result in the destruction/oxidation of methane except for injection into natural gas pipeline for underground mines.~~
Emission factor (EF)	A unique value for determining an amount of a GHG emitted for a given quantity of activity data (e.g., metric tons of carbon dioxide emitted per barrel of fossil fuel burned).
Emission reduction	1 metric tonne CO_2 equivalent reduced, as compared to a baseline level of emissions
Environment and Climate Change Canada	Governmental organization responsible for accurate and transparent monitoring, reporting and verification of Canada's greenhouse gas emissions and removals.
Fossil fuel	A fuel, such as coal, oil, and natural gas, produced by the decomposition of ancient (fossilized) plants and animals.
Gob	Also referred to as goaf, it is the collapsed area of strata produced by the removal of coal and artificial supports behind a working coalface. Strata above and below the gob are de-stressed and fractured by the mining activity.
Greenhouse gas (GHG)	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), or perfluorocarbons (PFCs).
GHG reservoir	A physical unit or component of the biosphere, geosphere, or hydrosphere with the capability to store or accumulate a GHG that has been removed from the atmosphere by a GHG sink or a GHG captured from a GHG source.
GHG sink	A physical unit or process that removes GHG from the atmosphere.
GHG source	A physical unit or process that releases GHG into the atmosphere.
Global Warming Potential (GWP)	The ratio of radiative forcing (degree of warming to the atmosphere) that would result from the emission of one unit of a given GHG compared to one unit of CO_2. GWPs for this protocol are defined by the Regulation

Indirect emissions	Reductions in GHG emissions that occur at a location other than where the reduction activity is implemented, and/or at sources not owned or controlled by project participants.
~~Non-qualifying~~Ineligible destruction device	A methane destruction device that does not meet one or more of the eligibility rules as described in Section 3 (e.g., it was in operation prior to the project's operational start date~~, regulatory requirement, injection into natural gas pipeline~~) and is located at the same mine where eligible project activities are taking place.
Longwall mine	An underground mining type that uses at least one longwall panel during coal excavation.
Metric ton (t, tonne)	A common international measurement for the quantity of GHG emissions, equivalent to about 2204.623 pounds or 1.1 short tons.
Methane (CH_4)	A potent GHG with a high global warming potential, consisting of a single carbon atom and four hydrogen atoms. GWP for methane is defined by the Regulation.
Mine	An area of land and all structures, facilities, machinery tools, equipment, shafts, slopes, tunnels, excavations, and other property, real or personal, placed upon, under, or above the surface of such land by any person, used in, or to be used in, or resulting from, the work of extracting minerals. The mine boundaries are defined by the mine area as permitted by the province in which the mine is located.
Mine gas	The untreated gas extracted from within a mine through a methane ~~Gas from~~ drainage system~~s~~ before any processing or enrichment that often contains various levels of other components (e.g., nitrogen, oxygen carbon dioxide, hydrogen sulfide, NMHC, etc.).
Mine methane	The ~~M~~methane portion of the mine gas contained in coal seams and surrounding strata that is released because of mining ~~activity~~operations.
Mined through	When the linear distance between the endpoint of the borehole and the working face that will pass nearest the endpoint of the borehole has reached an absolute minimum. Coal mine methane from surface pre-mining boreholes shall not be quantified in the baseline until the endpoint of the borehole is mined through.
Ministry	Ontario Ministry of the Environment and Climate Change (MOECC) or Quebec Ministry of Sustainable Development, Environment, and Fight Against Climate Change (MDDELC)
~~MMBtu~~	~~One million British thermal units.~~
Oxidizer	For the purposes of this protocol, the term oxidizer refers to technology for destruction of ventilation air methane with or without utilization of thermal energy and/or with or without a catalyst.
Project diagram	A diagram of the mine that illustrates the location, quantity, and type of boreholes, ventilations shafts, eligible destruction devices and non-

	qualifying destruction devices within a project's GHG Assessment Boundary.
Project baseline	A "business as usual" GHG emission assessment against which GHG emission reductions from a specific GHG reduction activity are measured.
Project emissions	Project emissions are actual GHG emissions that occur within the GHG Assessment Boundary as a result of project activities. Project emissions are calculated at a minimum on an annual, *ex-post* basis.
Project ~~operator~~Developer	An entity that undertakes a GHG project, as identified in Section 2.1 of this protocol.
~~Qualifying destruction device~~	~~Eligible treatment or destruction devices include enclosed flares, open flares, combustion engines, boilers, turbines, microturbines, natural gas pipeline injection, fuel cells, and CH_4 liquefaction units. Additional types of devices may be approved by the Ministry.~~
Reporting period	Specific time period of project operation for which the P~~p~~roject Developer ~~operator~~ has calculated and reported emission reductions and is seeking verification and issuance of credits. The reporting period must be no longer than 12 months.
Room and pillar mine	An underground mining type in which approximately half of the coal is left in place as square or rectangular "pillars" to support the roof of the active mining area while "rooms" of coal are extracted, ~~that uses square or rectangular pillars of coal during excavation,~~ laid out in a checkerboard fashion. Pillars typically range in size from 60 feet by 60 feet to 100 feet by 100 feet and rooms are typically 20 feet wide and a few thousand feet long.
Ventilation air	Air from a mine ventilation system.
Ventilation air methane (VAM)	The ~~Coal mine~~ methane that is mixed with the ventilation air in the mine that is circulated in sufficient quantity to dilute methane to low concentrations for safety reasons (typically below 1 percent).
Ventilation system	A system that is used to control the concentration of methane and other deleterious gases within mine working areas. Ventilation systems consist of powerful fans that move large volumes of air through the mine workings to dilute methane concentrations. All underground coal mines in Canada are required to develop and maintain ventilation systems.
Verification organization	An organization that is accredited under ISO 14065 by a member of the International Accreditation Forum in Canada or the United States according to an ISO 17011 program.
Year	For the purposes of this protocol, year refers to a 12-month period of the project's crediting period, not a calendar year.

Appendix A Parameters for Quantification Destruction Efficiencies for Destruction Devices

Commented [TL23]: We are making every effort for consistency across protocols in this section.

A.1 Methane Destruction

Equations 5.7 and 5.8 requires the use of a value for the destruction efficiency for each individual destruction device for which methane destruction is to be quantified. Where available, site-specific source-testing data should be used to determine the appropriate value for DE_i. Such source testing results are valid for use by the offset project so long as they are valid for use in relevant regulatory reporting applications. Otherwise, projects shall select the appropriate default destruction efficiency from Table A.1, below.

If a device not listed in table A.1 is approved for use by the Ministry, the destruction efficiency shall be determined through on-site emissions testing or monitoring, unless otherwise directed by the Ministry.

Table A.1. Destruction Efficiencies for Destruction Devices

Treatment or Destruction Device	Efficiency
Open Flare	0.96
Enclosed Flare	0.995
Internal Combustion Engine	0.936
Boiler	0.98
Microturbine or Large Gas Turbine	0.995
Boiler Following Upgrade and Injection into a Pipeline	0.96
Methane CH_4 Liquefaction Unit	0.95
Injection into natural gas transmission pipeline	0.98
Direct use pipeline (to end use other than boiler)	*Per the appropriate end use device*

If a device not listed here is approved for use by the Ministry, the destruction efficiency shall be determined through on-site emissions testing or monitoring, unless otherwise directed by the Ministry.

Commented [TL24]: Recommend distinguishing between lean burn and rich burn internal combustion engines (0.936 vs. 0.995), as is done in CA and CAR protocols

Commented [TL25]: Reconsider DE for pipeline injection (0.981 in California protocol, 0.98 in Reserve protocol), priority on harmonizing destruction efficiencies across all protocols.

A.2 Methane Density

Table A.2. Density of Methane at Reference Conditions

Reference Pressure (atm)	Reference Temperature (°C)		Density of CH_4 (kg/m^3) [13,14]
	°C	K	
1	0	273.15	0.717
1	5	278.15	0.704
1	10	283.15	0.692
1	15	288.15	0.680
1	20	293.15	0.668

[13] Lemmon, E.W., Huber, M.L., McLinden, M.O. NIST Standard Reference Database 23: Reference Fluid Thermodynamic and Transport Properties-REFPROP, Version 9.1, National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, 2013.

[14] Setzmann, U. and Wagner, W., "A New Equation of State and Tables of Thermodynamic Properties for Methane Covering the Range from the Melting Line to 625 K at Pressures up to 1000 MPa," J. Phys. Chem. Ref. Data, 20(6):1061-1151, 1991.

1	25	298.15	0.657

Appendix B Missing Data – Substitution Methods

The ~~replacement~~ substitution methods below may be used only:

1. For methane ~~CH_4~~ content or mine gas flow rate parameters;
2. For missing data on mine gas flow rates that are discrete, non-chronic and due to unforeseen circumstances;
3. When the proper functioning of the treatment or destruction device can be ~~shown by thermocouple readings at the flare or other device;~~ demonstrated in accordance with the requirements of Section 6.3;
4. ~~0.~~4. When data on mine gas flow rate only, or methane ~~CH_4~~ content only, are missing~~;~~ (except as described below for electric generators);
5. ~~0.~~5. To replace data on mine gas flow rates when a continuous analyzer is used to measure methane ~~CH_4~~ content and when it is shown that methane ~~CH_4~~ content was consistent with normal operations for the time when the data are missing; and
6. ~~0.~~6. To replace data on methane ~~CH_4~~ content when it is shown that the mine gas flow rate was consistent with normal operations for the time when the data are missing.

No offset credit may be issued for periods when the ~~replacement~~ substitution methods cannot be used.

For projects which destroy mine gas in a device which generates electricity, missing data for periods greater than 7 days may be replaced through the use of Equation B.1, below. This approach may be used to replace missing flow and methane concentration data simultaneously. The electrical output must be continuously monitored, and totalized at a frequency no greater than monthly.

Equation B.1 Alternative Method of Estimating the Volume of Methane Destroyed

$$CH_{4,dest,i,alt} = \frac{kWh \times HR}{HHV_{CH_4}}$$

Where,

			Units
$CH_{4,dest,i,alt}$	=	Net quantity of CH_4 treated or destroyed by device *i* during the period of missing data, calculated using the alternative method	m^3
kWh	=	Total electrical output of device *i* during the period of missing data	kWh
HR	=	Heat rate of destruction device *i*, as determined through the most recent source testing event. If no source test data are available, the heat rate specified by the manufacturer shall be used.	GJ/kWh
HHV_{CH4}	=	The high heat value of the CH_4 portion of the MG, 0.0359, as set out in Table 20-1 of Appendix 10 of ON.20, the guidance for quantification method for General Stationary Combustion under the Ontario Guideline for Greenhouse Gas Emissions Reporting.[15]	GJ/m^3

For devices other than electric generators, or for missing data gaps of less than 7 days, the substitution methods in Table B.1 shall be employed.

[15] Quebec landfill projects shall use a value of 0.03982 GJ/m^3, as set out in Table 1-1 of QC.1.7 in Schedule A.2 to the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere (chapter Q-2, r. 15).

Table B.1. Missing Data – ~~Replacement~~ Substitution Methods

Missing Data Period	Substitution ~~Replacement~~ Method
Less than 6 hours	Use the average of the 4 hours immediately before and following the missing data period
6 to less than 24 hours	Use the 90% upper or lower confidence limit of the 72 hours prior to and after the missing data period, whichever results in greater conservativeness
1 to 7 days	Use the 95% upper or lower confidence limit of the 72 hours prior to and after the missing data period, whichever results in greater conservativeness
More than 7 days	No data may be replaced and no reduction may be credited, except for projects which destroy MG in a device which generates electricity, as described above.