Federal Offset Protocol: Reducing Greenhouse Gas Emissions from Refrigeration Systems

Version 1.3

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Canada's Greenhouse Gas Offset Credit System

Environment and Climate Change Canada
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Foreword

Canada's Greenhouse Gas (GHG) Offset Credit System is established under Part 2 of the *Greenhouse Gas Pollution Pricing Act* to provide an incentive to undertake projects that result in domestic GHG reductions that would not have been generated in the absence of the project, that go beyond legal requirements and that are not subject to federal or provincial pricing mechanisms for GHG emissions.

Canada's GHG Offset Credit System consists of:

- the *Canadian Greenhouse Gas Offset Credit System Regulations* (the Regulations) which establish the system, implement the operational aspects and set the general requirements applicable to all project types
- federal offset protocols, included in the *Compendium of Federal Offset Protocols* (the Compendium), each containing requirements for project implementation and methods for quantifying GHG reductions for a given project type, and
- the Credit and Tracking System (CATS) to register offset projects, issue and track offset credits, and share key information through Canada's GHG Offset Credit System Public Registry

Only projects following a federal offset protocol included in the Compendium and meeting all requirements outlined in the Regulations can generate GHG reductions for which federal offset credits may be issued under the Regulations.

Document revision history

Version number	Publication date	Summary of changes
1.3	November 23, 2026	The conditions of the crediting period were amended so that the crediting period end date for any project does not go beyond December 31, 2036 (Sections 6.2 and 6.3).
1.2	January 27, 2025	A requirement was added to make the quantification of GHG emission reductions more conservative for projects where a pre-existing refrigeration system with a refrigerant containing a portion of ozone-depleting substances is replaced by a new system installation subject to a regulatory GWP limit (Section 8.1.2). Some requirements were added or modified to allow the replacement of multiple pre-existing refrigeration systems with a single new refrigeration system (Sections 3.0, 4.0 and 8.0). Some record and reporting requirements were added or modified (Sections 10.0 and 11.0). Some provisions were clarified or streamlined consistent with the original intent. The format of equations was modified to improve their readability.
1.1	December 8, 2023	A requirement was added to make ammonia non-eligible as a refrigerant in cases where a new refrigeration system is installed and there is no pre-existing system (Section 4.2). A document was added as a record to be retained for the installation of a new refrigeration system that replaces a pre-existing system (Section 10.0). Some provisions were clarified or streamlined consistent with the original intent.
1.0	February 24, 2023	Initial version of the protocol.

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1.0 Introduction

Emissions of hydrofluorocarbons (HFCs) from commercial and industrial refrigeration and air conditioning systems are caused by releases during equipment installation, when charging equipment with refrigerant, either initially or when re-filling (top-up), and leaks from equipment operations. Lowering the global warming potential (GWP) of refrigerants used in these systems in Canada ensures that the associated impacts on climate change from unavoidable equipment leaks are minimized to the extent possible.

The *Reducing Greenhouse Gas Emissions from Refrigeration Systems* federal offset protocol is intended for use by a proponent undertaking a project to transition away from refrigerants with high-GWP values in their commercial and industrial refrigeration or air conditioning systems, in order to generate greenhouse gas (GHG) emission reductions for which federal offset credits may be issued under the *Canadian Greenhouse Gas Offset Credit System Regulations* (Regulations) from the following eligible project activities:

- retrofitting a pre-existing refrigeration or air conditioning system to use an eligible refrigerant
- installing a new refrigeration or air conditioning system containing an eligible refrigerant.

The high-GWP refrigerant from a pre-existing system must be sent to an authorized destruction or reclamation facility in Canada.

The focus of the protocol is on the use of low-GWP refrigerants in retrofitted pre-existing systems or new systems. Nevertheless, supplemental GHG emission reductions can be generated from a project by destroying HFCs contained within high-GWP refrigerant from a pre-existing system, but for the whole project to be eligible, HFC destruction must occur in Canada.

GHG emissions reductions from destroying, reducing or replacing ozone-depleting substances (ODS) are not eligible for offset credits under this protocol, as ODS are not included in Schedule 3 of the *Greenhouse Gas Pollution Pricing Act*.

The proponent must follow the methodology and requirements contained in this protocol, including those to quantify and report GHG emission reductions generated by the eligible project activities. The requirements contained in this protocol are part of the Regulations and must be read in conjunction with provisions in the Regulations.

This protocol is designed to ensure the project generates GHG emission reductions that are real, additional, quantified, verified, unique and permanent. The protocol is also developed in accordance with the principles of ISO 14064-2:2019 *Greenhouse gases – Part 2 – Specification with guidance at the project level for quantification, monitoring and reporting greenhouse gas emission reductions or removal enhancements* to ensure reported GHG emission reductions generated as a result of implementing a project are relevant, complete, consistent, accurate, transparent, and conservative.

2.0 Terms and definitions

Absorption

for the purposes of this protocol, means a refrigeration cycle with a fluid absorbent and a fluid refrigerant that has a GWP equal to zero that is part of a refrigeration system.

Act

means the *Greenhouse Gas Pollution Pricing Act* (GGPPA).

Adsorption

for the purposes of this protocol, means a refrigeration cycle with a solid sorbent and a fluid refrigerant with a GWP equal to zero that is part of a refrigeration system.

Authorized destruction facility

means a facility located in Canada that is authorized by the government of the province or territory in which the facility is located to receive used refrigerants for the purpose of destroying HFCs.

Authorized reclamation facility

means a facility located in Canada that is authorized by the government of the province or territory in which the facility is located to receive used refrigerants for the purpose of reclaiming HFCs.

Eligible refrigerant

means a refrigerant used in the project scenario with either a GWP lower than the GWP value provided for the corresponding refrigeration system type in Table 2, or if applicable, a GWP lower than the GWP limit imposed by the province or territory in which the project is located for refrigerants contained within refrigeration systems, whichever is lower.

Global warming potential (GWP)

means a metric representing the ability of a GHG to trap heat in the atmosphere compared to carbon dioxide (CO_2), as provided in Column 2 of Schedule 3 to the Act.

High-GWP refrigerant

means a refrigerant that contains one or more HFCs and has a GWP equal to or higher than the GWP value provided for the corresponding refrigeration system type in Table 2, or if applicable, a GWP equal to or higher than the relevant provincial or territorial GWP limit for refrigerants contained within refrigeration systems where the project is located, whichever is lower.

Ozone-depleting substance (ODS)

means all substances identified in Parts 1, 2 and 3 of the *Ozone-depleting Substances and Halocarbon Alternatives Regulation* (ODSHAR).

Pre-existing refrigeration system

means a refrigeration system that has been using the same refrigerant and operating at the project site for more than three years prior to the project start date, and being retrofitted to use an eligible refrigerant, or replaced by a new refrigeration system that uses an eligible refrigerant.

Project site

means the location of a single commercial or industrial facility at which one or more refrigeration systems are operated in the project scenario, as applicable.

Refrigerant

means a single-component refrigerant, refrigerant blend or refrigerant alternative that is used in a refrigeration system.

Refrigeration system

means a commercial or industrial system providing refrigeration or air conditioning that is made up of one or more pieces of equipment.

Regulations

means the *Canadian Greenhouse Gas Offset Credit System Regulations.*

3.0 Baseline scenario

The baseline scenario for a project under this protocol is the release of high-GWP refrigerants from refrigeration equipment leaks at the project site, resulting in direct HFC emissions into the atmosphere. High-GWP refrigerants are released from either pre-existing refrigeration system(s), or if none exists, from a refrigeration system that would have been installed at the project site in the absence of the project.

3.1 Baseline conditions

For a project to be eligible under this protocol, one of the following baseline conditions must be met before the project start date:

- There is one or more pre-existing refrigeration systems of types identified in Table 1 at the project site, and:
    - no regulation or legal requirement exists to either replace the pre-existing refrigeration system(s), or to change the refrigerant or any piece of equipment within the pre-existing refrigeration system(s) (system retrofit)
    - none of the pre-existing refrigeration system(s) uses a refrigerant which consists entirely of ODS; or
- There is no pre-existing refrigeration system at the project site where one or more new refrigeration systems are installed.

Table 1: Baseline scenario refrigeration systems

Refrigeration system type	Description
Stand-alone medium temperature refrigeration system	Self-contained refrigeration system with components that are integrated within its structure and that is designed to maintain an internal temperature ≥ 0°C.
Stand-alone low temperature refrigeration system	Self-contained refrigeration system with components that are integrated within its structure and that is designed to maintain an internal temperature < 0°C but not < -50°C.
Centralized refrigeration system	Refrigeration system with a cooling evaporator in the refrigerated space connected to a compressor rack located in a machinery room and to a condenser located outdoors, and that is designed to maintain an internal temperature at ≥ -50°C.
Condensing unit	Refrigeration system with a cooling evaporator in the refrigerated space connected to a compressor and condenser unit that are located in a different location, and that is designed to maintain an internal temperature at ≥ -50°C.
Chiller	Refrigeration or air-conditioning system that has a compressor, an evaporator and a secondary coolant, other than an absorption chiller or adsorption chiller.
Commercial air conditioning (AC) system	Air conditioning system, other than a chiller, including large single split or multi-split air-conditioning, variable refrigerant flow systems and ducted or packaged rooftop systems.
Heat pump	Reversible air-conditioning / heat pump units that can operate as an air-conditioning unit in hot weather or can provide heating in cold weather, other than an absorption heat pump or an adsorption heat pump. In heating mode, the indoor unit functions as condenser and the outdoor unit as evaporator.

Definitions are from ODSHAR, except commercial AC system and heat pumps which are adapted from United Nations Environment Program's Ozone Secretariat.

4.0 Project scenario

4.1 Project conditions

To be eligible under this protocol, a project must meet one of the following project conditions on and after the project start date:

- An eligible refrigerant replaces a high-GWP refrigerant in one or more pre-existing refrigeration systems of types listed in Table 1 at the project site through a system or systems retrofit, or
- One or more new refrigeration systems of types listed in Table 2 that contain an eligible refrigerant are installed at the project site

If a new refrigeration system replaces one or more pre-existing refrigeration systems, the new system must not have a cooling capacity that is less than 90% of the cooling capacity of the pre-existing system, or the cooling capacity of the pre-existing systems combined.

4.2 Eligible refrigerants

To be eligible for use in the project scenario, refrigerants must have a GWP lower than the value applicable to the corresponding refrigeration system type as set out in Table 2 or, if applicable, lower than the provincial or territorial GWP limit. In addition, if a pre-existing refrigeration system is retrofitted or replaced, the eligible refrigerant used in the project scenario must have a GWP lower than the GWP of the refrigerant contained within the corresponding pre-existing refrigeration system. If more than one pre-existing refrigeration system is replaced with a single new refrigeration system, the eligible refrigerant used in the new system in the project scenario must have a GWP lower than the GWP of refrigerant contained within each corresponding pre-existing system.

When there is no pre-existing refrigeration system, ammonia is not an eligible refrigerant in the new refrigeration system being installed in the project scenario.

Eligible refrigerants must not consist in whole or in part of any ODS.

Eligible refrigerants in whole or in part must not have been previously used in another refrigeration system owned or operated by the proponent.

Table 2: GWP limits for eligible refrigerants

Refrigeration system type	Eligible refrigerant GWP limit
Stand-alone medium temperature refrigeration system	1400
Stand-alone low temperature refrigeration system	1500
Centralized refrigeration system	2200
Condensing unit	2200
Chiller (other than absorption or adsorption chiller)	750
Absorption or adsorption chiller	1
Commercial AC system	2000
Heat pump	2000
Absorption or adsorption heat pump	1

4.3 Eligible project activities

Eligible project activities are:

- The retrofit of a pre-existing refrigeration system of a type listed in Table 1 to utilize an eligible refrigerant, including the extraction of all high-GWP refrigerant from the pre-existing refrigeration system and either:

    - destruction of the high-GWP refrigerant's HFCs at an authorized destruction facility, or
    - reclamation of the high-GWP refrigerant's HFCs at an authorized reclamation facility

- The purchase and installation of a new refrigeration system of a type listed in Table 2 that contains an eligible refrigerant and does not utilize fossil fuel as a direct source of heat or power,[1] including, if applicable, the extraction of all high-GWP refrigerant from pre-existing refrigeration system(s) being replaced by the new system, and either:
    - destruction of the high-GWP refrigerant's HFCs at an authorized destruction facility, or
    - reclamation of the high-GWP refrigerant's HFCs at an authorized reclamation facility

5.0 Additionality

5.1 Legal additionality

GHG emission reductions generated by a project must not occur as a result of federal, provincial or territorial laws, including regulations, municipal by-laws, or any other legally binding mandates.

Federal and provincial laws, including regulations, exist in Canada that limit refrigerant GWP contained in specific types of new refrigeration systems. The subject of laws, including regulations, may vary by jurisdiction and can apply to either the manufacture, import, distribution, sale or installation of new refrigeration systems or equipment, all of which are considered to be relevant GWP limits with respect to baseline scenario quantification. For jurisdictions in which both a federal and a provincial or territorial GWP limit exist, the lowest GWP limit shall apply.

If at any time after project registration the GHG emission reductions generated by the project become required by law or the result of a legal requirement, the GHG emission reductions will no longer be additional and therefore federal offset credits can only be issued for GHG emission reductions generated up to the date immediately preceding the date on which the law or the legal requirement comes into force.

5.2 Provincial or federal pricing mechanisms for GHG emissions

Any emission sources that are included in a facility's GHG emissions reported under a federal, provincial or territorial pricing mechanism for GHG emissions are not eligible for federal offset credits. This includes GHG emissions from industrial refrigeration and air conditioning systems at covered facilities under the federal Output-Based Pricing System.

GHG emission reductions resulting from reducing or displacing fuels subject to a regulatory charge on fuel or another pricing mechanism for GHG emissions are also not eligible for federal offset credits.

[1] Waste heat is not considered to be a direct source of heat or power.

6.0 General requirements

6.1 Project start date

The start date of a project corresponds to the first day on which a retrofitted refrigeration system or a new refrigeration system installation is operated to provide refrigeration or air conditioning services at the project site.

6.2 Crediting period

For a project whose crediting period began on or after January 1, 2027, the crediting period of the project ends on December 31, 2036.

A project implemented under this protocol is not eligible for crediting period renewal.

6.3 Aggregation

Project activities that occur at multiple project sites can be registered as a group of projects within an aggregation of projects. Multiple project activities at a single project site form a single project and cannot be registered as an aggregation of projects.

For an aggregation of projects whose crediting period began on or after January 1, 2027, the crediting period of the aggregation of projects ends on December 31, 2036.

6.4 Project site location and geographic boundaries

The proponent must document and report the location and geographic boundaries of the project site and submit a site plan.

The site plan must show the location of all refrigeration systems, including air conditioning systems, and associated equipment at the project site, including equipment that is installed next to the facility or on rooftops, such as cooling towers. If applicable, the site plan must show where a refrigeration system is situated in relation to other refrigeration systems, and whether those other refrigeration systems are either included in, or excluded from the project.

The geographic boundary of the project site cannot change after the first reporting period. However, project activities can expand within the project site's geographic boundary to include additional refrigeration system retrofits or new refrigeration system installations at a later time and still be part of the registered project, provided that all relevant requirements are met. Any changes to the site plan must be communicated as specified in the Regulations.

6.5 Environmental and social safeguards

All refrigerants must be properly handled according to the environmental code of practice, regulations or standards that apply to the handling of refrigerants in the jurisdiction in which the project site is located.

The proponent must also ensure the project activities comply with any building codes or other legal requirements, including for the use of flammable or toxic refrigerants that may pose a human health risk in the jurisdiction in which the project site is located.

7.0 Project GHG boundary

The project GHG boundary (Figure 1) contains the GHG sources, sinks, and reservoirs (SSRs) that must be included or excluded by the proponent in the baseline and project scenarios to determine the GHG emission reductions generated by the project.

Table 3 provides additional details on the relevant SSRs identified for the baseline and project scenarios, as well as justification for their inclusion or exclusion in the quantification of GHG emission reductions. The proponent must quantify GHG emissions based on the "included" SSRs that are relevant to the specific activities taking place in the baseline and project scenarios.

Relevant GHGs in this protocol are carbon dioxide (CO_2) and all hydrofluorocarbons (HFCs) listed in Schedule 3 to the Act.

Figure 1: Illustration of the project GHG boundary

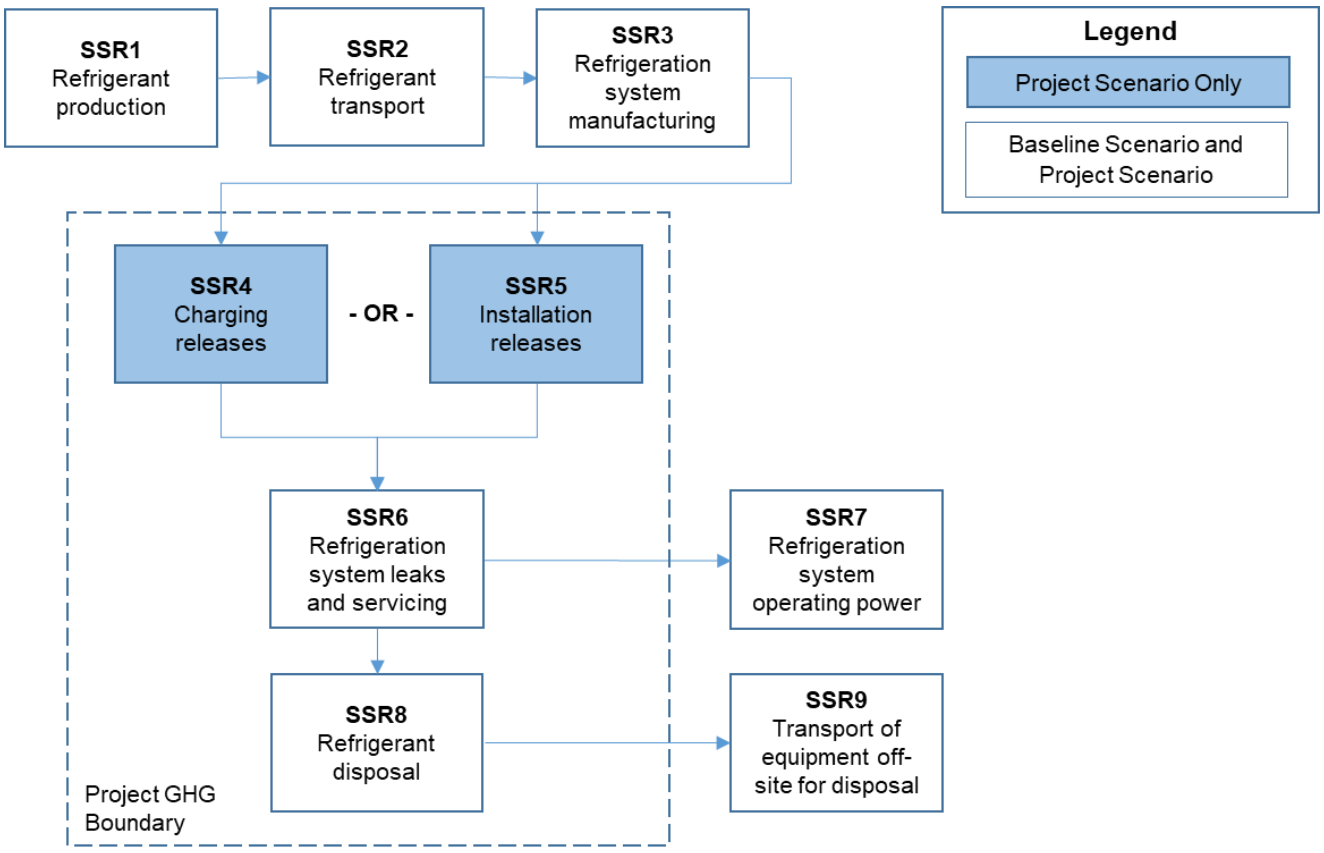

Table 3: Details on baseline and project scenario SSRs

SSR	Title	Description	Type	Baseline or project scenario	GHGs	Included or excluded
1	Refrigerant production	Electricity consumption, fossil fuel combustion, and refrigerant emissions during the production process.	Related	Baseline (B1) Project (P1)	CO_2, CH_4, N_2O, HFCs	**Excluded:** GHG emissions from this source currently occur outside Canada.
2	Refrigerant transport	Fossil fuel combustion from transport vehicles and refrigerant leaks during transport.	Related	Baseline (B2) Project (P2)	CO_2, CH_4, N_2O, HFCs	**Excluded:** GHG emissions from transport of refrigerants are assumed to be the same in both the baseline and project scenarios. Refrigerant leaks during transport are assumed to be very small.
3	Refrigeration system manufacturing	Electricity consumption, fossil fuel combustion, and refrigerant emissions during manufacturing.	Related	Baseline (B3) Project (P3)	CO_2, CH_4, N_2O, HFCs	**Excluded:** GHG emissions from this source are assumed to be the same in both the baseline and project scenarios, and vast majority of refrigeration systems are currently manufactured outside Canada.
4	Charging releases	Emissions from HFC releases when charging pre-existing refrigeration system with refrigerant after retrofit	Controlled	Project (P4)	CO_2, HFCs	**Included:** Amount of refrigerant released is expressed as a percentage of charge size in Equation 5.
5	Installation releases	Emissions from HFC releases when installing a new refrigeration system.	Controlled	Project (P5)	CO_2, HFCs	**Included:** Amount of refrigerant released is expressed as a percentage of charge size in Equation 5.
6	Refrigeration system leaks and servicing	High-GWP refrigerant leakage during normal operations and re-filling of a refrigeration system by certified technicians.	Controlled	Baseline (B6)	HFCs	**Included:** Amount of refrigerant released is expressed as a percentage of charge size in Equation 2.

SSR	Title	Description	Type	Baseline or project scenario	GHGs	Included or excluded
		Eligible refrigerant leakage during normal operations and re-filling of refrigeration system by certified technicians.	Controlled	Project (P6)	CO_2, HFCs	**Included:** Amount of refrigerant released is expressed as a percentage of charge size in Equation 5.
7	Refrigeration system operating power	Electricity consumption emissions from operating a refrigeration system.	Controlled	Baseline (B7) Project (P7)	CO_2, CH_4, N_2O	**Excluded:** The use of eligible refrigerant may be less energy efficient than using high-GWP refrigerant, but the difference in electricity consumption per unit of cooling, and the resulting emissions, is assumed to be very small. Technical and financial challenges exist to accurately measure power consumption from sub-metering specific pieces of equipment within a refrigeration system.
8	Refrigerant disposal	Proportion of remaining high-GWP refrigerant that is released during transfer to authorized reclamation facility, or an authorized destruction facility, at the end of life of the baseline scenario refrigeration system.	Controlled	Baseline (B8)	HFCs	**Included:** Amount of refrigerant released is expressed as a percentage of remaining charge size in Equation 2.
		Proportion of remaining eligible refrigerant released during transfer to an authorized reclamation facility at the end of life of the refrigeration system used in the project scenario.	Controlled	Project (P8)	CO_2, HFCs	**Included:** Amount of refrigerant released is expressed as a percentage of remaining charge size in Equation 5.

SSR	Title	Description	Type	Baseline or project scenario	GHGs	Included or excluded
9	Transport of equipment off-site for disposal	Fossil fuel combustion from transporting refrigeration system equipment off-site at end of its useful life, after remaining refrigerant has been extracted.	Related	Baseline (B9) Project (P9)	CO_2, CH_4, N_2O	**Excluded:** GHG emissions from this source are assumed to be the same in both the baseline and project scenarios.

8.0 Quantification methodology

This section contains the quantification methodology that the proponent must follow to quantify baseline and project scenario GHG emissions, which are subsequently used to quantify the GHG emission reductions generated by the project.

Baseline scenario GHG emissions are the GHG emissions that would have occurred in the absence of the project, quantified based on SSRs within the project GHG boundary. Project scenario GHG emissions are the actual GHG emissions that occur from SSRs within the project GHG boundary. The GHG emission reductions generated by the project are quantified by deducting the project scenario GHG emissions from the baseline scenario GHG emissions as outlined in Section 8.4.

Raw data must be converted to align with the units presented in the quantification methodology, if necessary.

The quantification of both baseline and project scenario GHG emissions must include all the GHG emissions that were likely to occur in the absence of the project (baseline scenario) and did occur (project scenario) during the reporting period and must include sub-totals in tonnes of CO_2 equivalent (t CO_2e) for each full or partial calendar year to support issuance of the resulting offset credits by calendar year.

8.0.1 Refrigerant GWP

The proponent must use Equation 1 to determine:

- the GWP of the baseline scenario refrigerant, which may have to be used in Equation 2 (as $GWP_{BRefrig}$)[2]
- the GWP of the project scenario refrigerant, which is to be used in Equation 5 (as $GWP_{PRefrig}$)

[2] As outlined in Section 8.1.1, the baseline scenario refrigerant GWP value may not be, in some cases, the GWP value of the actual pre-existing refrigeration system refrigerant; however, the proponent must still calculate the GWP value of the pre-existing system refrigerant through Equation 1 to ensure that the eligible refrigerant used in the project scenario has a GWP lower than the GWP of the pre-existing system refrigerant, as per the requirements in Section 4.2.

GHG emission reductions from a project can only be generated by reducing emissions of GHGs that are listed in Schedule 3 to the Act. The proponent must use the GWP values of each chemical component in the refrigerant as listed in Schedule 3 to the Act. For any chemical component not listed in Schedule 3 to the Act, the GWP value is zero.

Equation 1: Refrigerant GWP

$$GWP_{Refrig} = \sum_{i}^{n} (P_{GHG,i} \times GWP_{GHG,i})$$

Parameter	Description	Units
GWP_{Refrig}	GWP of a refrigerant	t CO_2e/t refrigerant [3]
$P_{GHG,i}$	Proportion of GHG, i, contained within the refrigerant by mass	%
$GWP_{GHG,i}$	GWP of GHG, i, as specified in Schedule 3 to the Act	t CO_2e/t refrigerant
i	GHG contained within the refrigerant	unitless
n	Number of GHGs contained within the refrigerant	unitless

8.1 Baseline scenario GHG emissions

The proponent must use Equation 2,[4] Equation 3 as applicable, and Equation 4 to quantify the baseline scenario GHG emissions for each full or partial calendar year covered by the reporting period, based on the included SSRs outlined in Table 3.

To quantify annual GHG emissions from a refrigeration system used in the baseline scenario, the proponent must use Equation 2. If there is more than one pre-existing refrigeration system, Equation 2 must be used and repeated for each system to quantify annual baseline scenario GHG emissions of each system. If there is no pre-existing refrigeration system, and more than one new refrigeration systems are installed, Equation 2 must be used and repeated for each new system to quantify annual GHG emissions of baseline scenario refrigeration system(s) corresponding to each new system. The results of the multiple uses of Equation 2 are to be used in Section 8.1.4.

[3] While GWP values are constants used as multipliers, this quantification methodology assigns units of equivalent mass in order to convert one unit of refrigerant to one unit of equivalent carbon dioxide when released directly into the atmosphere.
[4] Equation 2 is derived from the methodology in Chapter 7 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (PDF).

Equation 2: Annual GHG emissions for a baseline scenario refrigeration system

$$\mathrm{BE_{Annual}} = \mathrm{GWP_{BRefrig}} \times \frac{\mathrm{Q}}{1000} \times \left[\mathrm{AARL} + \left(\frac{\mathrm{QRD} \times (1 - \mathrm{RRE})}{\mathrm{LT}}\right)\right]$$

Parameter	Description	Units
$\mathrm{BE_{Annual}}$	Annual GHG emissions for a refrigeration system used in the baseline scenario (SSR B6 and SSR B8)	t CO_2e
$\mathrm{GWP_{BRefrig}}$	GWP of the refrigerant used in the baseline scenario refrigeration system, as per requirements in Section 8.1.1	t CO_2e/t refrigerant
Q	Amount of refrigerant in the baseline scenario refrigeration system (charge size), as per requirements in Section 8.1.2	kg
1000	Conversion factor, kilograms to tonnes	kg/t
AARL	Average annual refrigerant leakage for the refrigeration system type, as per Table 4	%/yr
QRD	Amount of refrigerant remaining at disposal for the refrigeration system type, as per Table 4	%
RRE	Refrigerant recovery efficiency of the refrigeration system, which is 99% if high-GWP refrigerant is reclaimed, and 0% if high-GWP refrigerant is destroyed	%
LT	Lifetime for the refrigeration system type, as per Table 4, unless HFCs are destroyed in which case LT = 10	years

Default values to be used in Equation 2 for refrigerant releases from each refrigeration system type are found in Table 4.

Table 4: Default values for annual GHG emissions of refrigeration systems[5]

Refrigeration system type	Installation loss (%) (IL)	Lifetime of equipment (yrs) (LT)	Annual average refrigerant leakage (%) (AARL)	Refrigerant remaining at disposal (%) (QRD)
Stand-alone medium-temperature refrigeration system	0%	10	1%	90%
Stand-alone low-temperature refrigeration system	0%	10	1%	90%
Centralized refrigeration system	2.0%	18	25%	90%
Condensing unit	2.0%	18	25%	90%
Chiller	0.5%	23	2%	95%
Commercial AC system	0%	25	8%	80%
Heat pump	0%	25	8%	80%

When there is no pre-existing refrigeration system:

- if the new refrigeration system is listed in Table 1, the same type of refrigeration system that is installed in the project scenario must be used for the quantification of baseline scenario GHG emissions
- if the new refrigeration system is an absorption or adsorption chiller or an absorption or adsorption heat pump, a chiller or a heat pump, respectively, must be used as the refrigeration system type for the quantification of baseline scenario GHG emissions

For the cases above, the proponent must select and justify a specific refrigerant and charge size for the refrigeration system type used to quantify baseline scenario GHG emissions, as per requirements in Section 8.1.2.

8.1.1 Baseline scenario refrigerant GWP value

The proponent must use the appropriate GWP value for baseline refrigerant GWP ($GWP_{BRefrig}$) in Equation 2 for annual GHG emissions quantification for a baseline scenario refrigeration system for each project activity, as follows:

- **System retrofit:** The GWP value of pre-existing refrigeration system's high-GWP refrigerant is used as the baseline refrigerant GWP, as calculated in Equation 1.

[5] Environmental Protection Agency (EPA) report: *Accounting Tool to Support Federal Reporting of Hydrofluorocarbon Emissions: Supporting Documentation*, October 2016, Table 3-3, p. 13 and Table 3-6, p. 17 (PDF).

- **New system installation:**
    - When a GWP limit applies to the new system being installed, baseline scenario emissions are quantified using either the corresponding GWP outlined in Table 5, or the applicable provincial or territorial GWP limit, whichever is lower. This applies whether or not there is a pre-existing system.
    - When no GWP limit applies to the new system being installed, i.e., commercial AC system and heat pump, and there **is** a pre-existing refrigeration system, the GWP value of pre-existing refrigeration system's high-GWP refrigerant is used as the baseline refrigerant GWP.
    - When no GWP limit applies to the new system being installed, i.e., commercial AC system and heat pump, and there **is no** pre-existing refrigeration system, the baseline refrigerant GWP for the refrigeration system type used to quantify baseline emissions is the corresponding value in Table 5.

Table 5: Baseline refrigerant GWP for each project activity by refrigeration system type[6]

Refrigeration system type in baseline scenario	**$GWP_{BRefrig}$ when installing new systems (as applicable)**
Stand-alone medium temperature refrigeration system	1400
Stand-alone low temperature refrigeration system	1500
Centralized refrigeration system	2200
Condensing unit	2200
Chiller – before January 1, 2025	1400
Chiller – on or after January 1, 2025	750
Commercial AC system	2000
Heat pump	2000

If at any time during the crediting period there is a change in the ODSHAR GWP limit or the provincial or territorial GWP limit applicable to the new refrigeration system being installed, the proponent must use the new GWP limit in the quantification of baseline scenario emissions from the day upon which the new GWP limit comes into force.

[6] Except for commercial AC systems and heat pumps, GWP values contained in Table 5 are taken from ODSHAR. Commercial AC systems and heat pumps are not currently regulated under OSDHAR, and corresponding GWP values in Table 5 are set to match GWP of refrigerants currently used in Canada.

When a chiller is the new refrigeration system installed in the project scenario, the proponent must use 750 GWP for quantifying baseline scenario refrigeration system GHG emissions in Equation 2 starting January 1, 2025, which is when the ODSHAR GWP limit for chillers comes into force. Prior to January 1, 2025, the proponent can use a GWP of 1400 to quantify baseline scenario refrigeration system GHG emissions in Equation 2 when a new chiller, absorption chiller or adsorption chiller refrigeration system is installed in the project scenario.

8.1.2 Refrigerant charge size

When a pre-existing refrigeration system is retrofitted or replaced by a new refrigeration system installation, the proponent must use the actual charge size, Q, of the pre-existing system for the quantification of baseline scenario refrigeration system GHG emissions in Equation 2, except for cases in the next paragraph below. The charge size of the pre-existing refrigeration system is the value provided by the manufacturer specifications. However, when project activities include HFC destruction, the charge size cannot be more than 90% of the manufacturer specifications' value in order to ensure baseline scenario refrigeration system GHG emissions are conservative.

When a pre-existing refrigeration system is replaced by a new refrigeration system installation subject to an ODSHAR GWP limit or a provincial or territorial GWP limit, and the pre-existing system's refrigerant contains a portion of ODS, the charge size of the pre-existing system, Q, to be used in Equation 2 must be determined using Equation 3 in order to subtract the mass of ODS.

Equation 3: Baseline scenario charge size of a pre-existing refrigeration system with a refrigerant containing a portion of ODS

$$Q = Q_{\text{Pre-existing System}} - Q_{ODS}$$

Parameter	Description	Units
Q	Charge size of a pre-existing refrigeration system with a refrigerant containing a portion of ODS, which excludes the ODS portion	kg
$Q_{\text{Pre-existing System}}$	Total amount of refrigerant in the pre-existing refrigeration system with a refrigerant containing a portion of ODS	kg
Q_{ODS}	Amount of ODS in the refrigerant of the pre-existing refrigeration system, determined using the proportions from the refrigerant's manufacturer specifications	kg

For new refrigeration system installations where there is no pre-existing refrigeration system, the baseline scenario charge size, Q, must be justified by the proponent based on the charge size of refrigerant needed for the refrigeration system identified for use in the baseline scenario to achieve the same cooling capacity as the refrigeration system used in the project scenario.

8.1.3 Refrigerant disposal

Halocarbon venting is prohibited across Canada and high-GWP refrigerant can only be disposed of through reclamation or destruction under this protocol.

When high-GWP refrigerant is removed from a pre-existing refrigeration system and sent to an authorized reclamation facility to be reclaimed, the proponent must use a 99% value for Refrigerant Recovery Efficiency (RRE) in Equation 2 (RRE = 99%).

If the proponent can demonstrate that the HFCs in the high-GWP refrigerant from a pre-existing refrigeration system has been destroyed at an authorized destruction facility by means of a destruction certificate and chain of custody records, they must use zero as the value for RRE in Equation 2 (RRE = 0).

HFCs must be reclaimed or destroyed no later than the end of the initial reporting period. If HFCs are destroyed, the GHG emission reductions associated with the destruction are equally spread over the crediting period. HFCs are considered to be reclaimed or destroyed once they are extracted from the pre-existing refrigeration system at the project site in order to be sent for reclamation or destruction at an authorized facility.

Destruction of HFCs from sources other than high-GWP refrigerant extracted from the pre-existing refrigeration system(s) used in the baseline scenario are not eligible for generating GHG emission reductions under this protocol.

8.1.4 Baseline scenario GHG emissions for a calendar year

Annual GHG emissions of baseline scenario refrigeration systems quantified in Equation 2 must then be adjusted using Equation 4[7] to match the length of each full or partial calendar year covered by the reporting period.

If more than one pre-existing refrigeration system is replaced by a single new refrigeration system in the project scenario, the proponent must first do the calculation of the summation in brackets ($\sum_{i}^{n_j} BE_{Annual,i}$) to add up the results of the multiple uses of Equation 2 for the annual GHG emissions of each pre-existing system corresponding to the new system, j, in the project scenario. It must be noted that in this case n_j represents the number of pre-existing systems corresponding to the new refrigeration system, j (and not the total number of all pre-existing refrigeration systems in the project should there be more than one new system).

[7] Equation 4 is designed to accommodate all possible configurations of eligible project activities. However, for a project where one pre-existing system is retrofitted, or where one new system is installed either to replace one pre-existing system or none, the equation can be simplified as follows: $BE_C = \frac{BE_{Annual}}{365} \times T_C$.

Equation 4: Baseline scenario GHG emissions for a calendar year covered by the reporting period

$$BE_C = \sum_{j}^{m} \left[\frac{\sum_{i}^{n_j} BE_{Annual,i}}{365} \times T_{C,j} \right]$$

Parameter	Description	Units
BE_C	GHG emissions from all baseline scenario refrigeration systems for a calendar year covered by the reporting period	t CO_2e
$BE_{Annual,i}$	Annual GHG emissions for a refrigeration system, i, used in the baseline scenario corresponding to the refrigeration system, j, in the project scenario, as per Equation 2	t CO_2e
$T_{C,j}$	Number of days in a calendar year covered by the reporting period that the corresponding project scenario refrigeration system, j, was operated	days
i	Refrigeration system in the baseline scenario corresponding to the refrigeration system, j, in the project scenario	unitless
j	Refrigeration system in the project scenario corresponding to refrigeration system, i, in the baseline scenario	unitless
n_j	Number of refrigeration systems in the baseline scenario corresponding to the refrigeration system, j, in the project scenario	unitless
m	Number of refrigeration systems in the project scenario	unitless

8.2 Project scenario GHG emissions

The proponent must use Equations 5[8] and 6 to quantify project scenario GHG emissions for each full or partial calendar year covered by the reporting period, based on the SSRs outlined in Table 3.

To quantify annual GHG emissions from a refrigeration system used in the project scenario, the proponent must use Equation 5. For each pre-existing refrigeration system being retrofitted and each new refrigeration system being installed in the project scenario, Equation 5 must be used and repeated for each system to quantify the total annual GHG emissions of the project scenario.

[8] Equation 5 is derived from the methodology in Chapter 7 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Equation 5: Annual GHG emissions from a project scenario refrigeration system

$$\mathrm{PE_{Annual}} = \mathrm{GWP_{PRefrig}} \times \frac{\mathrm{Q}}{1000} \times \left[\mathrm{AARL} + \left(\frac{\mathrm{IL} + \mathrm{QRD} \times (1 - \mathrm{RRE})}{\mathrm{LT}}\right)\right]$$

Parameter	Description	Units
$\mathrm{PE_{Annual}}$	Annual GHG emissions from a refrigeration system used in the project scenario (SSR P4 or P5, SSR P6 and SSR P8)	t CO_2e
$\mathrm{GWP_{PRefrig}}$	GWP of the eligible refrigerant in the project scenario refrigeration system, as per Equation 1	t CO_2e/t refrigerant
Q	Amount of eligible refrigerant in the project scenario refrigeration system (charge size), as per the system's manufacturer specifications	kg
1000	Conversion factor, kilograms to tonnes	kg/t
AARL	Average annual refrigerant leakage for the refrigeration system type, as per Table 4	%/yr
IL	Releases of eligible refrigerant when installing the new refrigeration system, or charging the retrofitted refrigeration system, for the refrigeration system type, as per Table 4	%
QRD	Amount of eligible refrigerant remaining at disposal for the refrigeration system type, as per Table 4	%
RRE	Refrigerant recovery efficiency. RRE = 99% for the project scenario	%
LT	Lifetime of the refrigeration system type, as per Table 4	years

For system retrofit project activities, installation losses (IL) in the project scenario represent any releases that might occur when extracting high-GWP refrigerant from a pre-existing refrigeration system and re-charging with the eligible refrigerant.

Annual GHG emissions from refrigeration systems used in the project scenario quantified in Equation 5 must then be adjusted using Equation 6 to match the length of any full or partial calendar year covered by the reporting period.

Equation 6: Project scenario GHG emissions for a calendar year covered by the reporting period

$$PE_C = \sum_{j}^{m} \left[\frac{PE_{Annual,j}}{365} \times T_{C,j} \right]$$

Parameter	Description	Units
PE_C	GHG emissions from all refrigeration systems used in the project scenario for a calendar year covered by the reporting period	t CO_2e
$PE_{Annual,j}$	Annual GHG emissions from a refrigeration system, j, used in the project scenario, as per Equation 5	t CO_2e
$T_{C,j}$	Number of days in a calendar year covered by the reporting period that each refrigeration system, j, used in the project scenario was operated	days
j	Refrigeration system in the project scenario	unitless
m	Number of refrigeration systems in the project scenario	unitless

8.3 Leakage

HFC imports are regulated in Canada and projects undertaken under this protocol are not expected to have a significant impact on domestic or international refrigerant markets. Therefore, leakage was determined to not be applicable for this project type.

As a result, there is no leakage discount factor (which corresponds to variable C_i in the formula in subsection 20(2) of the Regulations) to be applied for the quantification of GHG emission reductions generated by a project undertaken under this protocol.

8.4 Project GHG emission reductions

The proponent must use Equation 7 to quantify the GHG emission reductions (ER_C) generated by the project, which correspond to the GHG reductions determined in accordance with section 20 of the Regulations.

Equation 7: Project GHG emission reductions

$$\mathrm{ER_C} = \mathrm{BE_C} - \mathrm{PE_C}$$

Parameter	Description	Units
$\mathrm{ER_C}$	Project GHG emission reductions for a calendar year covered by the reporting period	t CO_2e
$\mathrm{BE_C}$	Baseline scenario GHG emissions for a calendar year covered by the reporting period, as per Equation 4	t CO_2e
$\mathrm{PE_C}$	Project scenario GHG emissions for a calendar year covered by the reporting period, as per Equation 6	t CO_2e
C	Calendar year	unitless

9.0 Measurement and data

9.1 Quality assurance and quality control

The proponent must have documented quality assurance / quality control (QA/QC) procedures and must implement them to ensure that all measurements and calculations are made in accordance with this protocol and can be verified.

9.2 Missing data

In the event that data is missing, data may not be substituted using alternative estimation methods.

10.0 Records

10.1 General Records

In addition to the record keeping requirements specified in the Regulations, the proponent must keep records that support the implementation of a project, including invoices, contracts, refrigeration system equipment maintenance records, calculations, databases, photographs and chain of custody records for HFC transportation, at the location and for the period of time specified in the Regulations. These records apply to refrigeration system equipment at the project site and high-GWP refrigerant sent for disposal off-site.

10.2 Baseline scenario

For a project where a pre-existing refrigeration system is retrofitted or where a new refrigeration system is installed to replace a pre-existing system, the proponent must keep a record of the information about the system and refrigerant used in baseline scenario, including:

- manufacturer specifications regarding cooling capacity, charge size, installation procedures, operating conditions and/or maintenance requirements for all refrigeration system equipment included in the baseline scenario
- identification of the refrigerant service provider, their service contract and description of their qualifications, or if a company, minimum qualifications of the company's refrigerant service technicians

For a project where a new refrigeration system is installed and where there is no pre-existing refrigeration system, the proponent must keep a record of the information that provides justification for the selection of the baseline scenario refrigeration system.

10.3 Additionality

In instances where the province or territory where the project is located has set a GWP limit for refrigeration systems that differ from the values in Table 2, the proponent must keep a record of the information regarding this limit, including the name of the regulation or legal requirement that applies.

10.4 Project scenario

For a project where a pre-existing refrigeration system is retrofitted, the proponent must keep a record of the following information:

- contracts, invoices or certificates of completion from the contractor conducting system retrofit
- evidence to show which high-GWP refrigerant was used in the pre-existing system for more than three years preceding the system retrofit
- supporting documentation to demonstrate the last day the pre-existing system was in operation and the first day on which the retrofitted refrigeration system using an eligible refrigerant was used for refrigeration or air conditioning purposes

For a project where a new refrigeration system is installed, the proponent must keep a record of the following information:

- contracts, invoices or certificates of completion from the contractor conducting new system installation
- where the new system replaces a pre-existing refrigeration system, evidence to show that the pre-existing system was in operation, with the same refrigerant, for more than three years preceding the installation of the new system
- supporting documentation to demonstrate the first day on which refrigeration or air conditioning is provided at the project site from the new system installation
- identification of the manufacturer and the retailer from which the new system was purchased
- date of purchase of the new system and if pre-charged, identification of the refrigerant contained within it at that time

For a project where the high-GWP refrigerant is extracted from a pre-existing refrigeration system, the proponent must keep a record of the information showing the complete chain of custody of high-GWP

refrigerant from the point at which it is extracted from a pre-existing system to the point at which it arrives at an authorized reclamation facility or authorized destruction facility. The information includes:

- names, addresses and contact information of all parties in possession of the high-GWP refrigerant sent for reclamation or destruction, if applicable
- the amount (in kg) of the high-GWP refrigerant at each transfer in the chain of custody
- details on the facility's authorization from the relevant provincial or territorial government to handle and reclaim or destroy HFCs

11.0 Reporting

In addition to the reporting requirements specified in the Regulations, the proponent must include the following in project reports.

In the initial project report, the proponent must include:

- If there are pre-existing refrigeration systems at the project site:
  - the type and model of each system, their cooling capacity and manufacturer recommended charge size, the refrigerants they were charged with and using as well as the time and duration each system was in service
  - the amount (in kg) of the high-GWP refrigerant extracted from each system and the amount and type of HFCs contained in each refrigerant, and sent for reclamation or destruction as well as the name and location of the authorized reclamation facility or authorized destruction facility
  - if HFCs in high-GWP refrigerant from a system were destroyed, the HFC destruction certificate that indicates the amount (in kg) and type of each HFC that has been destroyed
- If a pre-existing refrigeration system is retrofitted at the project site:
  - the amount (in kg) and type of eligible refrigerant used for the retrofitted system
- If a new refrigeration system is installed at the project site:
  - the type and model of the new system, its cooling capacity, and manufacturer recommended charge size
  - the amount (in kg) and type of eligible refrigerant used in the new system
  - if the new system being installed is subject to a regulatory GWP limit (e.g., federal, provincial or territorial limit), the GWP value set out by the limit and details regarding the limit, including the name of the regulation or legal requirement that applies

For an aggregation of projects for which a new project that includes destruction of HFCs in high-GWP refrigerant from a pre-existing refrigeration system has been added during the crediting period of the aggregation, the proponent must include in the initial project report for the aggregation that includes the new added project the HFC destruction certificate that indicates the amount (in kg) and type of each HFC that has been destroyed.

In any project report, the proponent must include:

- the dates, duration and reason for each instance in which a refrigeration system used in the project scenario is not operating for a period of more than 10 consecutive days within a calendar year covered by the reporting period

- if a retrofitted pre-existing refrigeration system or a new refrigeration system installed has become subject to a revised or new regulatory GWP limit (e.g., federal, provincial or territorial limit) during the reporting period, the GWP value set out by the limit and details regarding the limit, including the name of the regulation or legal requirement that applies and the date on which the new limit came into effect