Ozone Depleting Substances Project Protocol

Destruction of Ozone Depleting Substances Used as Foam Blowing Agents and Refrigerants

Protocol Version

[Effective Date]

Notes on the draft protocol:

This protocol adaptation is based on the Quebec compliance offset protocol. 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 changes that have been made since the previous stakeholder draft was distributed.

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Abbreviations and Acronyms

A/C	Air conditioning
Aggregation	Grouping together multiple containers of ODS
AHRI	Air-Conditioning, Heating and Refrigeration Institute
CEMS	Continuous emissions monitoring system
Certificate of Destruction	Official document provided by the destruction facility that documents the date, mass, and species of ODS destroyed
CFC	Chlorofluorocarbons
CH_4	Methane
CO_2	Carbon dioxide
DRE	Destruction and removal efficiency
GHG	Greenhouse gas
GJ/h	Gigajoule per hour
GWP	Global Warming Potential
HBFC	Hydrobromofluorocarbons
HLC	Halocarbon
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
HWC	Hazardous waste combustor
K	Kelvin
Kg	Kilogram
kPa	Kilopascal
L	Litres
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
MSW	Municipal Solid Waste
m^3	Cubic meters
ODS	Ozone depleting substances
SSR	Source, sink, and reservoir
t	Metric ton (or tonne)

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1 Introduction

The purpose of the ozone depleting substances (ODS) protocol is to quantify greenhouse gas (GHG) emissions reductions associated with any project designed to reduce GHG emissions by collecting and destroying refrigerant ODS and foam blowing agent ODS from eligible sources.

Project Developers that destroy eligible ODS use this document to register GHG emission reductions with the Ontario Cap and Trade Program[1] and 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 an ODS project.[3]

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, 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, 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, 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, the term "Ministry" shall refer to the Quebec Ministry of Sustainable Development, Environment, and Fight Against Climate Change (MDDELCC).

For the purposes 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. 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."

[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.
[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.

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2 The GHG Reduction Project

2.1 Project Definition

This offset credit protocol covers projects for specific activities associated with the destruction of ODS contained in foam or used as refrigerants either removed from refrigeration, freezer or air-conditioning appliances or commercial installations, or intended for those uses, recovered in Canada.

For the purposes of this protocol, the GHG reduction project is defined as any set of activities undertaken by a single Project Developer resulting in the destruction[5] of eligible ODS at a qualifying destruction facility within a 5-year period. Destruction may take place under one or more Certificates of Destruction. Each Certificate of Destruction must document the ODS destroyed. The ODS destroyed may come from a single origin (e.g., one supermarket) or from numerous sources. However, the entire quantity of eligible ODS destroyed must be documented on one or more Certificates of Destruction issued by a qualifying destruction facility.

In order for multiple Certificates of Destruction to be included under a single project, all of the following conditions must be met:

1. The project developer and owner of emission reductions are the same for all ODS destroyed
2. No Certificate of Destruction is included as part of another project

Project activities for a foam ODS project include the extraction and concentration of ODS blowing agent from recovered appliance foam, as well as the storage, transportation, mixing (where applicable), sampling, analysis, and destruction of the ODS. Project activities for a refrigerant ODS project include the handling, transportation, mixing (where applicable), sampling, analysis, and destruction of the ODS. For the purposes of this protocol, activities occurring prior to the ODS collection at the designated Point of Origin are not considered "project activities."

A single project may incorporate ODS obtained from one or both of these ODS source categories. Tracking procedures and calculation methodologies differ depending on the source of ODS. ODS sources not in one of the above categories, such as ODS that were used as or produced for use as solvents, medical aerosols or other applications are not eligible under this protocol.

For all projects, the end fate of the ODS must be destruction at any transformation or destruction facility which employs one of the approved destruction technologies under the Montreal Protocol.[6] These facilities must meet or exceed the Montreal Protocol's Technology and Economic Assessment Panel (TEAP) standards provided in the *Report of the Task Force on Destruction Technologies*.[7] These facilities must demonstrate destruction and removal

[5] In this protocol, the term "destruction" is used to describe any activity that results in the elimination of ODS with an efficiency of 99.99 percent or higher. This definition incorporates both destruction and transformation technologies as defined by the EPA and the Clean Air Act (40 CFC 82).
[6] Based on the most recent list of approved destruction technologies provided by the Ozone Secretariat of the United Nations Environment Programme: http://ozone.unep.org/.
[7] TEAP. (2002). Report of the Task Force on Destruction Technologies. *Volume 3B*.

efficiency (DRE) of 99.99 percent and emission levels consistent with the guidelines set forth in the aforementioned TEAP report.

2.2 Eligible ODS

Ozone depleting substances contained in foam removed from refrigeration or freezer appliances and ODS used as refrigerants removed from equipment, systems or appliances from industrial, commercial, institutional or residential sources or removed from ODS stored by such sources for their future use are admissible for the purposes of this protocol. ODS extracted from a foam source for use in refrigeration equipment is not considered part of this source category, and must instead be considered as a foam source.

Only the following ODS foam blowing agents are eligible to generate reductions under this protocol:

1. CFC-11
2. CFC-12
3. HCFC-22
4. HCFC-141b

Only destruction of the following ODS refrigerants is eligible for crediting under this protocol:

1. CFC-11
2. CFC-12
3. CFC-13
4. CFC-113
5. CFC-114
6. CFC-115

When ODS used as refrigerants targeted by a project are removed from refrigeration, freezer or air-conditioning appliances that also contain ODS contained in foam, the project must also, for any destruction activity taking place after 22 October 2016, provide for the extraction and destruction of the ODS contained in the foam in accordance with this protocol.

In order for unused (i.e., “virgin”) ODS refrigerant to be considered eligible, the Project Developer must be able to prove that it is not used material, using both of the following methods:

1. Testing results to show that the material meets or exceeds the AHRI-700 standard for that particular chemical; and,
2. Evidence linking the material and the container to its original manufacturer.

2.3 The Project Developer

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

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3 Eligibility Rules

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

3.1 Location

The eligible ODS must be destroyed in a facility located in Canada or the United States. However, recovery of the foam and refrigerants and extraction of the ODS from the foam must be carried out in Canada. Foam, ODS, and appliances recovered outside of Canada are not eligible for the issuance of offset credits under this protocol.

3.2 Project Start Date, Duration, and Crediting Period

The project start date is defined according to the commencement of project activities.

- For non-mixed ODS projects[8] that are not aggregated at the destruction facility, the project start date is the day that the project ODS departs the final storage or aggregation facility for transportation to the destruction facility.
- For non-mixed ODS projects where eligible material is aggregated at the destruction facility, the project start date is the day when destruction commences, as documented by a Certificate of Destruction.
- For mixed ODS projects, the project start date is the day that mixing procedures begin.

A project may cover a maximum period of 5 years. A new project registration application must be made for any ODS destruction activity occurring after that period. A single project may contain multiple destruction events, as long as the final event concludes within 5 years of the start of the earliest event. The crediting period for an ODS project is period of time over which avoided emissions are quantified for the purpose of determining creditable GHG reductions. Specifically, ODS projects will be issued offset credits for the quantity of ODS that would have been released over a ten-year period following a destruction event. With 5 years of destruction events, and 10 years of crediting following each year of destruction, the total crediting period for an ODS project is 14 years. At the time the project is verified, offset credits are issued for all ODS emissions avoided by a project over the 14-year crediting period.

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 Additionality

For the purposes of the additionality requirements of the Regulation, the project is considered to go beyond current practice if it meets the conditions in Sections 2 and 3 of this protocol. Projects must satisfy both of the following tests to be considered additional:

[8] For the purposes of this protocol, “mixed” is defined as a container which contains less than 90% of a single, eligible ODS species, by mass.

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1. The Performance Standard Test
2. The Legal Requirement Test

3.3.1 The Performance Standard Test

End of life destruction of foam and refrigerant ODS from eligible sources is not considered to be common practice in Canada. For this protocol, all ODS destruction activities that meet the project definitions and other eligibility requirements pass the Performance Standard Test. The Performance Standard Test is applied as of the project start date.

3.3.2 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 destruction of ODS. 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.

3.4 Regulatory Compliance

Projects must be in material compliance with all applicable laws (e.g., air, water quality, and safety) at all times during each reporting period. The regulatory compliance requirement extends to the operation of destruction facilities where the ODS is destroyed, as well as the facilities where mixed ODS projects are mixed and sampled, and the transportation of the ODS to the destruction facility. These facilities and transportation events must meet applicable regulatory requirements during implementation of project activities. For example, any upsets or exceedances of permitted emission limits at a destruction facility must be managed in keeping with an authorized startup, shutdown, and malfunction plan (or the equivalent plan for the relevant regulatory authority).

Project developers must attest that the project has met this requirement for each reporting period. Projects are not eligible to receive credits for GHG reductions that occur as the result of project activities that are not in material compliance with regulatory requirements. Non-compliance solely due to administrative or reporting issues, or due to "acts of nature," will not affect crediting.

Project developers are required to disclose in writing to the verifier and the Ministry any and all instances of non-compliance of the project with any law. If a verifier finds that a project is in a state of material non-compliance or non-compliance that is the result of negligence or intent, then credits will not be issued for GHG reductions that occurred during the period of non-compliance. 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 the verifier is unable to assess the materiality of the violation, then the verifier shall consult with the Ministry.

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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 an ODS project.[9]

Figure 4.1 and Figure 4.2 show the SSRs that must be taken into account by the Project Developer when calculating the GHG emission reductions attributable to the project.

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 for all ODS projects.

All the SSRs within the dotted line must be counted for the purposes of this protocol.

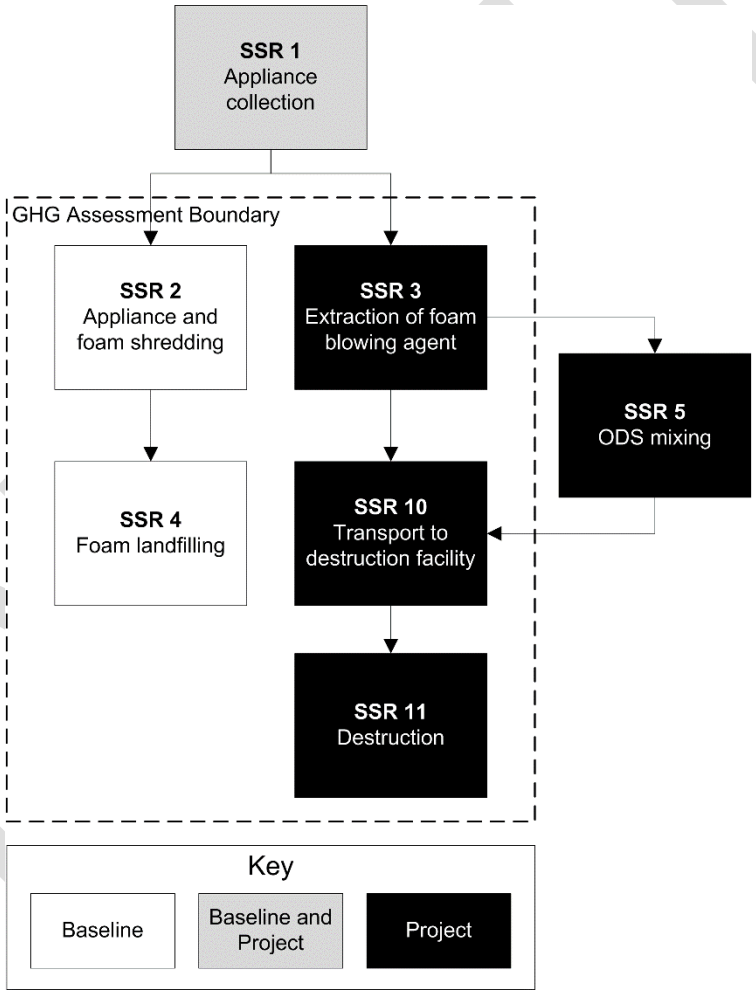

Figure 4.1. General Illustration of the GHG Assessment Boundary for ODS Contained in Foam

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

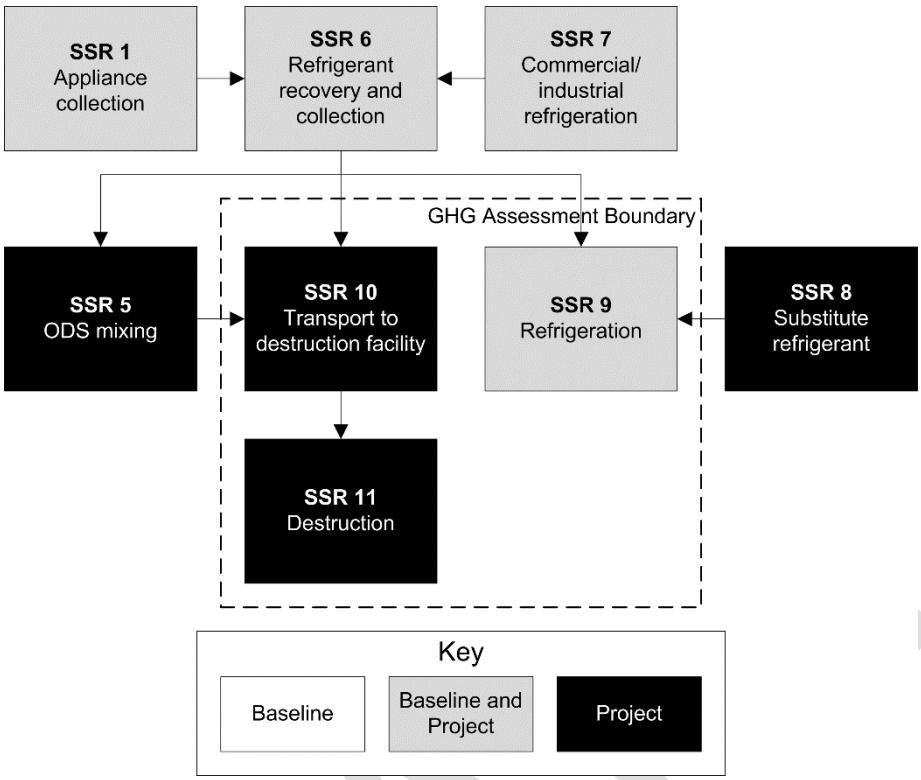

Figure 4.2. General Illustration of the GHG Assessment Boundary for ODS Used as Refrigerants

Table 4.1 Reduction Project SSRs Targeted in the Calculation of GHG Emissions Under the Baseline Scenario and Project Scenario

SSR		Source Description	Type of Emission	Included (I) or Excluded (E)	Relevant to Project Baseline Scenario (B) and/or Project (P)
1	Appliance collection	Fossil fuel emissions attributable to the collection and transportation of end-of-life appliances	CO_2	E	B,P
			CH_4	E	B,P
			N_2O	E	B,P
2	Appliance shredding	Emissions of ODS attributable to the shredding of appliances for materials recovery	ODS	I	B
3	Foam ODS extraction	Emissions of ODS attributable to the removal of foam ODS blowing agent from appliances	ODS	I	P
4	Disposal of foam in landfill	Emissions of ODS attributable to the disposal of foam at a landfill site	ODS	I	B
		Emissions of ODS degradation products attributable to foam disposed of at a landfill site	HFC, HCFC	E	B
		Fossil fuel emissions attributable to the transportation of shredded foam and disposal at a landfill site	CO_2	E	B

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SSR		Source Description	Type of Emission	Included (I) or Excluded (E)	Relevant to Project Baseline Scenario (B) and/or Project (P)
			CH_4	E	B
			N_2O	E	B
5	ODS mixing	Fossil fuel emissions from ODS mixing activities at mixing facility	CO_2	E	P
			CH_4		
			N_2O		
6	Refrigerant recovery and collection	Emissions of ODS attributable to the removal of refrigerant from appliances and installations	ODS	E	P
7	Industrial and commercial refrigeration	ODS emissions attributable to equipment leakage and maintenance	ODS	E	B,P
		Fossil fuel emissions attributable to the operation of refrigeration and air conditioning equipment	CO_2	E	B,P
			CH_4	E	B,P
			N_2O	E	B,P
8	Production of substitute refrigerants	Substitute refrigerant emissions during production	CO_2e	E	P
		Fossil fuel emissions during the production of substitute refrigerants	CO_2	E	P
			CH_4	E	P
			N_2O	E	P
9	Refrigeration	Emissions of ODS attributable to leakage and maintenance during the continuous operation of equipment	ODS	I	B
		Substitute refrigerant emissions attributable to leakage and maintenance during the continuous operation of equipment	CO_2e	I	P
		Indirect emissions attributable to the use of electricity	CO_2	E	B, P
			CH_4	E	B, P
			N_2O	E	B, P

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SSR		Source Description	Type of Emission	Included (I) or Excluded (E)	Relevant to Project Baseline Scenario (B) and/or Project (P)
10	Transportation to the destruction facility	Emissions of fossil fuels attributable to the transportation of ODS from the point of origin to the destruction facility	CO_2	I	P
11	Destruction of ODS	Emissions of ODS attributable to incomplete destruction at destruction facility	ODS	I	P
		Emissions from the oxidation of carbon contained in the destroyed ODS	CO_2e	I	P
		Fossil fuel emissions attributable to the destruction of ODS in a destruction facility	CO_2	I	P
			CH_4	E	P
			N_2O	E	P
		Indirect emissions attributable to the use of electricity	CO_2	I	P
			CH_4	E	P
			N_2O	E	P

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5 Calculation of Emission Reductions

In calculating the GHG emission reductions attributable to a project for the destruction of ODS, the Project Developer must calculate the reductions attributable to the destruction of ODS contained in foam together with from those attributable to the destruction of ODS used as refrigerants.

The Project Developer must calculate the total GHG emission reductions using Equation 5.1:

Equation 5.1. Total Emission Reductions

$$\boldsymbol{ER_t = BE_t + PE_t}$$

Where,

			Units
ER_t	=	Total GHG emission reductions attributable to the project during the project reporting period	tCO_2e
BE_t	=	Total baseline emissions attributable to the destruction of ODS during the project reporting period, calculated using Equation 5.2	tCO_2e
PE_t	=	Total project emissions attributable to the destruction of ODS, calculated using Equation 5.6	tCO_2e

5.1 Calculation of Baseline Emissions

Total baseline emissions must be estimated by calculating and summing the calculated baseline emissions for all relevant SSRs (as indicated in Table 4.1) using Equation 5.2 and the supporting equations presented below. Note that emissions shall be quantified in kilograms throughout this section and converted into metric tonnes in Equation 5.2, below.

Equation 5.2. Total Baseline Emissions

$$\boldsymbol{BE_t = \frac{BE_R + BE_F}{1000} \times (1 - VR)}$$

Where,

			Units
BE_t	=	Total quantity of baseline emissions during the reporting period	tCO_2e
BE_R	=	Baseline emissions attributable to the destruction of refrigerant ODS during the reporting period, calculated using Equation 5.5	$kgCO_2e$
BE_F	=	Project emissions attributable to the destruction of foam ODS during the reporting period, calculated using Equation 5.4	$kgCO_2e$
1000	=	Conversion from kilograms to tonnes	kg/t
VR	=	Deduction for vapour composition risk (see below)	%

For any given container of ODS sent for destruction, a portion of the container will be filled with liquid, and the remaining space will be filled with vapour. To address the risk of inaccurate liquid composition sampling, projects that destroy containers which contain more than one chemical must use Table 5.2 to determine their risk category and applicable value of *VR* to be applied to the calculation of baseline emissions for that container (Equation 5.2). Table 5.1 classifies the eligible ODS species as low or high pressure. For the purposes of this protocol, any ineligible chemical with a boiling point lower than 0°C at 1 atm is considered high pressure.

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The densities of the liquid and vapour phase components of the project container will be determined by the testing laboratory at the time that the composition analysis is carried out. The testing laboratory will calculate the densities of the liquid phase and vapour phase contents within the container. To support this calculation, the project developer shall provide the laboratory with the temperature of the project container (internal temperature if available, otherwise ambient temperature) at the time of sampling, as well as the volumetric capacity of the project container. Once the weight of the contents of the project container is known, the liquid fill level of the container may be determined using Equation 5.3.

Table 5.1. Eligible Low Pressure and High Pressure ODS

Low Pressure ODS	High Pressure ODS
CFC-11	CFC-12
CFC-113	CFC-13
CFC-114	CFC-115
HCFC-141b	HCFC-22
HFC-245fa	HFC-134a

Table 5.2. Determining the Deduction for Vapour Composition Risk

If the value of $Fill_{liquid}$ is:	AND the concentration of eligible low pressure ODS is:	AND the concentration of ineligible high pressure chemical is:	Then the vapour risk deduction factor (VR) for that container shall be:
> 0.70	N/A	N/A	0
0.50 – 0.70	> 1%	> 10%	0.02
< 0.50	> 1%	> 5%	0.05

The presence of eligible, high pressure ODS may mitigate the risk of over-crediting, so there are two scenarios where a container is exempt from a deduction otherwise required in Table 5.2:

1. The container holds an eligible, high pressure ODS (in any concentration) which has a lower boiling point than the ineligible, high pressure chemical, or
2. The container holds an eligible, high pressure ODS in a concentration greater than that of the ineligible, high pressure chemical.

If the container holds multiple eligible, high pressure ODS, the applicability of the above scenarios will be determined based on the ODS with the highest percent concentration. If the container holds multiple ineligible, high-pressure chemicals, the applicability of the above scenarios will be determined based on the chemical with the highest percent concentration.

This deduction applies to both mixed and non-mixed ODS projects. If the project includes multiple containers, with different values for VR, the value of VR shall be pro-rated according to the

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Equation 5.3. Determining Liquid Fill Level in Project Container

$$Fill_{liquid} = \frac{M_{destroyed} - (\rho_{vapour} \times V_{container})}{(\rho_{liquid} - \rho_{vapour}) \times V_{container}}$$

Where,

			Units
$Fill_{liquid}$	=	Fill level of the liquid in the project container	fraction
$V_{container}$	=	Total volume of the project container	L
$M_{destroyed}$	=	Total mass of the contents of the project container	kg
ρ_{liquid}	=	Modeled density of the liquid material in the project container at the measured temperature	kg/L
ρ_{vapour}	=	Modeled density of the vapour material in the project container at the measured temperature	kg/L

The Project Developer must calculate GHG emissions under the baseline scenario attributable to ODS-containing foam using Equation 5.4.

Equation 5.4. Total Baseline Emissions for Foam Projects

$$BE_F = \sum_{i=1}^{n} [BA_{init,i} \times EF_{F,i} \times GWP_i]$$

Where,

			Units
BE_F	=	Baseline emissions attributable to the destruction of ODS contained in foam during the project reporting period	kg CO_2e
i	=	Type of ODS	
$BA_{init,i}$	=	Initial quantity of ODS of type *i* entrained in appliance foam prior to processing, determined in accordance with Appendix C	kg ODS
$EF_{F,i}$	=	GHG emission rate for ODS of type *i* contained in foam, as indicated in the appropriate table in Appendix B	%
GWP_i	=	Global warming potential of ODS of type *i* as indicated in Appendix A	kg CO_2e/kg ODS

Equation 5.5. Total Baseline Emissions for Refrigerant Projects

$$BE_R = \sum_{i} [Q_{R,i} \times EF_{R,i} \times GWP_i]$$

Where,

			Units
BE_R	=	Emissions under the baseline scenario attributable to the destruction of ODS used as refrigerants during the reporting period	kg CO_2e
i	=	Type of ODS	
$Q_{R,i}$	=	Total quantity of ODS of type *i* used as refrigerants recovered and sent for destruction, determined in accordance with Section 6.5	kg CO_2e
$EF_{R,i}$	=	GHG emission factor for ODS of type *i* used as refrigerants, as indicated in the table in Appendix B	%
GWP_i	=	Global warming potential for ODS of type *i*, as indicated in the table in Appendix A	kg CO_2e/kg ODS

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5.2 Calculation of Project Emissions

The Project Developer must calculate GHG emissions under a project for the destruction of ODS using Equation 5.6 to Equation 5.9.

Equation 5.6. Calculation of GHG Emissions Attributable to a Project for the Destruction of ODS

$$PE_t = \frac{BA_{pr} + Sub + TrDest}{1000}$$

Where,

			Units
PE_t	=	GHG emissions under a project for the destruction of ODS contained in foam during the project reporting period	tCO_2e
BA_{pr}	=	Total GHG emissions related to ODS contained in foam that are emitted during extraction, calculated using Equation 5.7	kg CO_2e
Sub	=	Total emissions from substitute refrigerants, calculated using Equation 5.8	kg CO_2e
TrDest	=	GHG emissions attributable to the transportation and destruction of ODS, calculated using Equation 5.9	kg CO_2e
1000	=	Conversion from kilograms to tonnes	kg/t

Equation 5.7. Total Emissions Attributable to the Extraction of ODS Contained in Foam

$$BA_{pr} = \sum_i \left[\left(BA_{init,i} - BA_{final,i} \right) \times GWP_i \right]$$

Where,

			Units
BA_{pr}	=	Total emissions attributable to the extraction of ODS contained in foam removed from appliances	kg CO_2e
i	=	Type of ODS	
n	=	Number of types of ODS	
$BA_{init,i}$	=	Initial quantity of ODS blowing agent of type *i* entrained in appliance foam prior to processing, determined in accordance with Appendix C	kg ODS
$BA_{final,i}$	=	Total quantity of ODS blowing agent of type *i* extracted and sent for destruction, determined in accordance with Section 6.5	kg ODS
GWP_i	=	Global warming potential of ODS of type i as indicated in Appendix A	kg CO_2e/kg ODS

Equation 5.8. Total GHG Emissions Attributable to Substitute Refrigerants

$$Sub = \sum_i \left(Q_{R,i} \times EFS_i \right)$$

Where,

			Units
Sub	=	Total GHG emissions attributable to substitute refrigerants	kg CO_2e
i	=	Type of ODS	kg CO_2e
$Q_{R,i}$	=	Total quantity of ODS of type *i* used as refrigerants recovered and sent for destruction, determined in accordance with Section 6.5	kg ODS
EFS_i	=	Emission factor for substitutes for ODS of type *i* as indicated in the table in Appendix B	kg CO_2e/kg ODS

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Equation 5.9. Project Emissions from Transportation and Destruction

$$TrDest = Q_{dest} \times 7.5$$

Where,			Units
TrDest	=	GHG emissions attributable to the transportation and destruction of ODS contained in foam	kg CO_2e
Q_{dest}	=	Total quantity of material (eligible and ineligible) destroyed during the project, as shown on the official weigh tickets	kg ODS
7.5	=	Default emission factor for ODS transportation and destruction	kg CO_2e/kg ODS

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6 Data Management and Project Surveillance

6.1 Extraction and Destruction

ODS must be extracted and destroyed as follows:

1. ODS contained in foam must be extracted in concentrated form using a negative pressure process;

2. Refrigerant must be collected and handled by individuals with certification appropriate to the relevant jurisdiction;

3. All ODS must be collected, stored and transported in hermetically sealed containers which are approved by Transport Canada for the particular chemicals and usage;

4. All ODS must be destroyed in concentrated form in an ODS destruction facility meeting the requirements in Section 6.6 of this protocol.

6.2 Determining Point of Origin

6.2.1 Point of Origin for Concentrated Foam ODS

The point of origin (POO) for concentrated ODS from appliance foam shall be the facility where the blowing agent is extracted from the foam.

6.2.2 Point of Origin for Refrigerant ODS

The POO for refrigerant ODS shall be the facility where the eligible ODS is aggregated to a quantity greater than 225 kg. In cases where greater than 225 kg of eligible ODS is removed from a single installation or piece of equipment, the POO shall be that specific installation or piece of equipment.

6.3 Data Management

The project developer must record the following information in the Surveillance Plan, and include it in any project reports required by the Regulation, indicating separately the information pertaining to ODS contained in foam and that pertaining to ODS used as refrigerants:

1. A listing of the facilities and entities involved in any project activities (as defined in Section 2.1), from POO to point of destruction of the ODS;

2. Information on the POO, as determined in Section 6.2, specifying:
    a. The physical address of each POO;
    b. The name and contact information for each party responsible for management of a POO, and the quantity of materials, whether foam or ODS, transferred, sold or handled by each party; and
    c. For projects destroying ODS sourced from appliances, the number of appliances recovered and, for each appliance, the type, size, storage capacity and, if available, serial number;
    d. For projects destroying ODS sourced from commercial installations, the number, type, size, and, if available, serial number of the equipment from which the ODS was recovered.

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3. The serial number or identification number of the containers used for ODS storage and transportation;

4. For appliance-sourced ODS, information on ODS extraction, specifying
    a. The number of appliances containing foam from which ODS has been extracted;
    b. The number of appliances containing refrigerants from which ODS have been extracted;
    c. The name and contact information of the facility where the appliances are recycled, if any; and
    d. Processes, training, and quality assurance, quality control and extraction process management processes;

5. One or more certificates of destruction for all the ODS destroyed under the project, issued by the facility that destroyed the ODS, by destruction activity, specifying:
    a. The name of the Project Developer;
    b. The name and contact information of the destruction facilities;
    c. The name and signature of the person responsible for the destruction operations;
    d. The identification number on the certificate of destruction;
    e. The serial, tracking or identification number of all containers for which ODS destruction occurred;
    f. The weight and type of ODS destroyed for each container, in kg, including the weigh tickets generated in accordance with Section 6.5;
    g. The destruction start date and time; and
    h. The destruction end date and time;

6. The surveillance plan referred to in Section 6.4;

7. The certificate of sampling results issued by the laboratory in accordance with Section 6.5.

All required data concerning the point of origin must be obtained at the time of recovery from the point of origin.

6.4 Surveillance Plan

The Project Developer must establish a surveillance plan to measure and monitor project parameters, for each reporting period, in accordance with Table 6.1.

Table 6.1. Parameters for the Surveillance of an ODS Project

Equation	Parameter	Factor Used in Equations	Measurement Unit	Method
Equation 5.1	Total GHG emission reductions attributable to the project during the project reporting period	ER_t	tCO_2e	Calculated
Equation 5.1 Equation 5.2	Total baseline emissions attributable to the destruction of ODS during the project reporting period	BE_t	tCO_2e	Calculated
Equation 5.1	Total project emissions attributable to the destruction of ODS	PE_t	tCO_2e	Calculated
Equation 5.2 Equation 5.5	Baseline emissions attributable to the destruction of refrigerant ODS during the reporting period	BE_R	kg CO_2e	Calculated

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Equation	Parameter	Factor Used in Equations	Measurement Unit	Method
Equation 5.2 Equation 5.4	Project emissions attributable to the destruction of foam ODS during the reporting period	BE_F	kg CO_2e	Calculated
Equation 5.2	Deduction for vapour composition risk	VR	%	Calculated
Equation 5.3	Fill level of the liquid in the project container	$Fill_{liquid}$	fraction	Measured
Equation 5.3	Total volume of the project container	$V_{container}$	L	Measured
Equation 5.3	Total mass of the contents of the project container	$M_{destroyed}$	kg	Measured
Equation 5.3	Modeled density of the liquid material in the project container at the measured temperature	ρ_{liquid}	kg/l	Measured and Calculated
Equation 5.3	Modeled density of the vapour material in the project container at the measured temperature	ρ_{vapour}	Kg/l	Measured and Calculated
Equation 5.4 Equation 5.5 Equation 5.7 Equation 5.8 Equation 9.4	Type of ODS	*i*	kg CO_2e	Calculated
Equation 5.5 Equation 5.8	Total quantity of ODS of type *i* used as refrigerants recovered and sent for destruction	$Q_{R,i}$		Calculated
Equation 5.5	GHG emission factor for ODS of type i used as refrigerants, as indicated in the table in Appendix B	$EF_{R,i}$	%	Calculated
Equation 5.4 Equation 5.5 Equation 5.7	Global warming potential for ODS of type *i*, as indicated in the table in Appendix A	GWP_i	CO_2e/ODS	Calculated
Equation 5.6	GHG emissions under a project for the destruction of ODS contained in foam during the project reporting period	PE_F	tCO_2e	Calculated
Equation 5.7 Equation 9.4	Number of types of ODS	n		Measured
Equation C.2 Equation C.3	Total quantity of ODS contained in foam prior to removal from appliances	BA_{init}	kg ODS	Calculated
	Initial quantity of ODS of type *i* contained in foam appliances prior to removal	$BA_{init,i}$	kg ODS of type *i*	Calculated
Equation 9.2	Total quantity of foam removed prior to extraction of ODS	$Foam_{rec}$	kg of foam	Measured and Calculated
Equation 5.6 Equation 5.7	Total emissions attributable to the extraction of ODS from foam removed from appliances	BA_{pr}	kg CO_2e	Calculated
Equation C.3 Equation C.4	Total quantity of ODS contained in the foam removed and sent for destruction	BA_{final}	kg ODS	Calculated
Equation 5.4 Equation 5.7	Total quantity of ODS of type *i* contained in foam extracted and sent for destruction under the project	$BA_{final,i}$	kg ODS of type i	Calculated
	Mass of each container filled with ODS contained in foam	N/A	kg	Measured
	Mass of each empty container for projects to destroy ODS contained in foam	N/A	kg	Calculated
	Quantity of ODS contained in foam, in container each	N/A	kg	Calculated
	Concentration of each type of ODS contained in foam, in each container	N/A	Percent	Measured
	Quantity of each type of ODS contained in foam, in each container	N/A	kg ODS of type *i*	Calculated

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Equation	Parameter	Factor Used in Equations	Measurement Unit	Method
Equation 5.6 Equation 5.9	Emissions attributable to the transportation and destruction of ODS	TrDest	kg CO_2e	Calculated
Equation 5.9	Total quantity of material destroyed during the project, as shown on the official weigh tickets	Q_{dest}	kg ODS	Calculated
Equation C.2	Concentration of ODS in foam before extraction from appliances	CBA	Percent	Calculated
	Mass of each container filled with ODS used as refrigerants	N/A	kg	Measured
	Mass of each empty container for project to destroy ODS used as refrigerants	N/A	kg	Measured
	Quantity of ODS used as refrigerants, in each container	N/A	kg	Measured
	Concentration of each type of ODS used as a refrigerant, in each container	N/A	Percent	Analyzed in a laboratory
	Quantity of each type of ODS used as a refrigerant, in each container	N/A	kg ODS of type *i*	Calculated
	Total quantity of ODS of type *i* used as refrigerants removed and sent for destruction	Q_i	kg ODS of type *i*	Calculated
	Total quantity of ODS used as refrigerants removed and sent for destruction	Q	kg ODS	Calculated
Equation 5.8	Total quantity of GHG emissions from substitute refrigerants	Sub	kg CO_2e	Calculated

6.5 Concentrated Refrigerant and Blowing Agent Composition and Quantity Analysis Requirements

For each container, the Project Developer must use the method in this Section to calculate, on a mass basis, the total quantity of ODS of type *i* sent for destruction under the project, namely the factor $BA_{final,i}$ for projects for the destruction of ODS contained in foam and the factor $Q_{R,i}$ for projects for the destruction of ODS used as refrigerants.

6.5.1 Determination of the Quantity of ODS in Each Container

The quantity of ODS destroyed must be determined at the destruction facility by an authorized person, by weighing each container when it is full of ODS prior to destruction and after it has been emptied and its contents have been destroyed.

The quantity of ODS is equal to the difference between the mass of the container when full and when empty.

Each ODS container must be weighed at the destruction facility:

1. Using a single scale to generate both full and empty weight tickets;
2. Ensuring that the scale has been calibrated by a measurement Canada inspector or an authorized service provider less than 3 months before the weighing, to an accuracy standard relevant to that specific type of scale, as specified by measurement Canada;
3. Weighing the full container not more than 2 days prior to commencing the destruction of the ODS;
4. Weighing the empty container not more than 2 days after the destruction of the ODS.

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Despite subparagraph 2 above, scales used prior to 31 December 2012 and subject to the Weights and Measures Act (R.S.C. 1985, c. W-6) may have been calibrated at the frequency specified by Measurement Canada provided that frequency does not exceed 2 years. However, if the first calibration after a weighing indicates that the weight of the ODS destroyed was overestimated, the Project Developer must correct the weight by deducting the error percentage recorded during the calibration.

6.5.2 Circulation of Mixed ODS

For each sample that does not contain over 90% of the same type of eligible ODS, the Project Developer must, in addition to the conditions provided for in Section 6.5.1, also meet the following conditions concerning mixed ODS.

The circulation of the ODS mixture must be conducted at the destruction facility or prior to delivery of the ODS to such a facility, by a person who is independent of the Project Developer and of the destruction facility, and who is properly trained to carry out this task.

Prior to sampling, the ODS mixture must be circulated in a container that meets all of the following conditions:

1. The container has no solid interior obstructions other than mesh baffles or other interior structures that do not impede circulation;
2. The container was fully evacuated prior to filling;
3. The container must have mixing ports to circulate liquid and gas phase ODS;
4. The container has ports to sample liquid and gas phase ODS;
5. The sampling ports are located in the middle third of the container and not at one end or the other;
6. The container and associated equipment can circulate the mixture through a closed loop system from the bottom to top.

If the original mixed ODS container does not meet these requirements, the mixed ODS must be transferred into a compliant temporary container.

The mass of the ODS mixture transferred into the temporary container must be calculated and recorded. In addition, transfers of ODS between containers must be carried out at a pressure that meets the applicable standards for the jurisdiction where the project is located and the specific chemicals being handled.

Once the mixed ODS are in a container that meets the above criteria, they must be circulated as follows:

1. Liquid mixtures must be circulated from the liquid port to the vapour port;
2. A volume of the mixture equal to 2 times the volume in the container must be circulated;
3. Circulation must occur at a rate of at least 114 litres per minute unless the liquid mixture has been circulating continuously for at least 8 hours, and has circulated more than twice the volume of the container;
4. The start and end times must be recorded.

6.5.3 Sampling

Sampling must be conducted for each ODS container:

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1. In the case of pure ODS, 1 sample must be taken at the destruction facility;
2. In the case of ODS mixtures that have been circulated at the destruction facility, a minimum of 2 samples must be taken during the last 30 minutes of circulation and the samples must be taken from the bottom liquid port;
3. In the case of ODS mixtures that have been circulated prior to delivery to the destruction facility, a minimum of 2 samples must be taken in accordance with subparagraph 2, and 1 additional sample must be taken at the destruction facility.

If more than one sample is taken for a single container, the Project Developer must use the results from the sample with the weighted ODS concentration with the least global warming potential.

The sampling must be conducted in accordance with the following conditions:

1. The samples must be taken by a person who is independent of the Project Developer and of the destruction facility and has the necessary training to carry out this task;
2. The samples must be taken with a clean, fully evacuated sample bottle with a minimum capacity of 0.454 kg;
3. Each sample must be taken in a liquid state;
4. A minimum sample size of 0.454 kg must be drawn for each sample;
5. Each sample must be individually labeled and tracked according to the container from which it was taken;
6. The following information must be recorded for each sample:
    a. The time and date of the sample;
    b. The name of the Project Developer for whom the sampling is conducted;
    c. The name and contact information of the technician who took the sample, and of the technician's employer;
    d. The volume of the container from which the sample was drawn;
    e. The ambient air temperature at the time of sampling;
    f. The chain of traceability of each sample, from the point of sampling to the accredited laboratory.

Despite subparagraph 3 of the first paragraph, in the case of ODS mixtures circulated before 31 December 2012, a minimum of 1 sample must be taken in accordance with subparagraph 2 of the first paragraph and 1 extra sample must be taken at the destruction facility.

6.5.4 Analysis of Samples

The quantity and type of ODS must be determined by having a sample from each container analyzed by one of the following laboratories:

1. The Centre d'expertise en analyse environnementale du Québec of the department;
2. A laboratory that is independent of the Project Developer and of the destruction facility and accredited for analysis of ODS by the Air-Conditioning, Heating and Refrigeration Institute in accordance with the most recent version of AHRI 700 of that organization.

All the ODS samples for the project must be sampled to determine the following:

1. The type of each ODS;
2. The quantity, in kilograms, and concentration, in kg of ODS of type *i* per kg of gas, in each type of ODS in the gas, using gas chromatography;

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3. The moisture content of each sample in parts per million;
4. The high boiling residue from the ODS sample, which must be below 10% of the total mass of the sample.

The moisture content determined under subparagraph 3 of the second paragraph must be less than 75 percent of the saturation point for the ODS based on the temperature recorded at the time the sample was taken. For containers that hold mixed ODS, the sample's saturation point shall be assumed to be that of the ODS species in the mixture with the lowest saturation point that is at least 10 percent of the mixture by mass. If this threshold is exceeded, the Project Developer must dry the ODS mixture, take the sample again and analyze it in accordance with the method in Section 6.5.4.

Note that the threshold for moisture saturation will be difficult to achieve at very low temperatures, and it is recommended that sampling not occur if the ambient air temperature around the ODS container is below 0°C. Project developers may sample for moisture content and perform any necessary de-watering prior to the sampling and laboratory analysis required by this Section.

In the case of ODS mixtures, the analysis must determine the weighted concentrations of the ODS on the basis of their global warming potential for samples taken in accordance with subparagraph 2 of the first paragraph of Section 6.5.4.

A certificate of the sampling results must be issued by the laboratory that conducted the analysis and a copy of the certificate must be included with the project report.

6.5.5 Determination of the Total Quantity of Foam and Refrigerant ODS Sent for Destruction

Based on the mass of the ODS in each container and the concentration of each sample, the Project Developer must

1. Calculate the quantity of each type of ODS in each container, by deducting the weight of the water and the high boiling residue;
2. Add together the quantities of each type of ODS in each container to obtain the factor $BA_{final,i}$, namely the total quantity of ODS of type *i* contained in the foam, or the factor $Q_{i,R}$, namely the total quantity of ODS of type *i* used as refrigerants extracted and sent for destruction under the project.

6.6 Destruction Facilities

The operating parameters for the facility during ODS destruction must be monitored and recorded in accordance with the Code of Good Housekeeping approved by the Montréal Protocol.[10] Destruction facilities must provide third-party certified results indicating that the facility meets all performance criteria set forth in the Code of Good Housekeeping. Following the initial performance testing, project developers must demonstrate that the facility has conducted comprehensive performance testing at least every three years to validate compliance with the TEAP DRE and emissions limits.

[10] TEAP. (2006). Code of Good Housekeeping. *Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer, 7th Edition*.

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The verifier must use the data to show that, during the ODS destruction process, the facility was operating in conditions that met the requirements of any authorization necessary to pursue activities at that facility.

The Project Developer must continuously monitor the following parameters during the entire ODS destruction process:

1. The ODS feed rate;
2. The operating temperature and pressure of the destruction facility during ODS destruction;
3. Effluent discharges measured in terms of water and pH levels;
4. Continuous data on the carbon monoxide emissions.

Each stage in a project carried out in the United States must be conducted in accordance with the requirements of the most recent version of the protocol entitled “Compliance Offset Protocol Ozone Depleting Substances Projects: Destruction of U.S. Ozone Depleting Substances Banks” and published by the California Air Resources Board and the California Environmental Protection Agency.

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7 Reporting

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 Project Documentation

Project developers must provide the following documentation to the Ministry in order to register an ODS destruction project.

- Certificate(s) of Destruction
- Laboratory analysis of ODS composition from sampling at destruction facility
- Laboratory analysis of ODS composition from sampling at mixing facility, if applicable
- Project Surveillance Plan
- Verification Report
- Verification Statement

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.

System information the project developer should retain includes:

1. The name and contact information for any facilities or enterprises that carried out the following activities, as they apply to the project;
    a. Extraction of foam and blowing agent, as well as refrigerant, from appliances;
    b. Destruction of eligible ODS;
    c. Mixing of eligible ODS;
    d. Laboratory analysis of ODS samples;
2. All data inputs for the calculation of the project emission reductions, including all required sampled data
3. Copies of all permits, Notices of Violations (NOVs), and any relevant administrative or legal consent orders dating back at least three years prior to the project start date
4. Destruction facility monitor information (CEMS data, DRE documentation, scale readings, calibration procedures, and permits)
5. Verification records and results
6. Chain of custody and point of origin documentation
7. ODS composition and quantity lab reports
8. For appliance foam and refrigerant projects, a description of the methods used to remove foam or refrigerants from the appliances, and extract ODS from the foam;

7.3 Reporting Period and Verification Cycle

ODS destruction projects may be no greater than 5 years in duration, measured from the project start date to completion of ODS destruction. Project Developers may choose a shorter time horizon for their project (e.g., 12 months or 3 years), but no project may be longer than 5 years. ODS projects shall report annually, and will thus be verified as many as 5 times during the project lifetime.

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8 Verification Guidance

Only accredited verification bodies, as defined in the Regulation, are eligible to verify ODS project reports.

8.1 Standard of Verification

The Ministry's standard of verification for landfill projects is the ODS Project Protocol (this document) and the Regulation. To verify an ODS project report, verification bodies apply the guidance in the Regulation and this section of the protocol to the standards described in Sections **Error! Reference source not found.** through **Error! Reference source not found.** of th is 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 Plan

The Surveillance Plan serves as the basis for verification bodies to confirm that the monitoring, operational, and reporting requirements in Section 6 and Section 7 have been met, and that consistent, rigorous monitoring and record-keeping has been conducted. Verification bodies shall confirm that the Surveillance Plan covers all aspects of monitoring, operations, and reporting contained in this protocol and specifies how data for all relevant parameters in Section 6 are collected and recorded.

8.3 Verifying Project Eligibility

Verification bodies must affirm an ODS destruction project's eligibility according to the rules described in this protocol. The table below outlines the eligibility criteria for an ODS destruction 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 8.3.

Table 8.1. Summary of Eligibility Criteria

Eligibility Rule	Eligibility Criteria
Start Date	According to the Regulation
Location of Destruction	Canada and its territories or the United States and its territories
Point of Origin of ODS	Canada and its territories
Project Definition	▪ Project developer and GHG ownership is the same for all ODS destroyed ▪ A single destruction facility has been used for all ODS destruction ▪ All project activities span no more than 12 months from the project start date to the conclusion of destruction activities ▪ Eligible refrigerant ODS include CFC-11, CFC-12, CFC-13, CFC-113, CFC-114, CFC-115

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Eligibility Rule	Eligibility Criteria
	▪ Eligible ODS blowing agents include CFC-11, CFC-12, HCFC-22, HCFC-141b
Performance Standard	Project destroys ODS refrigerant or ODS blowing agent that meet project definitions
Legal Requirement Test	Project activities are not required by any law, regulation, court order, or other legally-binding mandate
Regulatory Compliance Test	Project must be in material compliance with all applicable laws
Exclusions	▪ ODS sourced from outside of Canada ▪ ODS destroyed outside of Canada or the U.S. ▪ Solvents and medical aerosols ▪ Destruction of intact appliance foam

8.4 Core Verification Activities

Core verification activities are summarized below in the context of an ODS destruction project, but verification bodies shall 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 emissions sources, sinks and reservoirs
2. Reviewing operations, GHG management systems, and estimation methodologies
3. Verifying emission reductions and estimates

8.4.1 Identifying Emission Sources, Sinks, and Reservoirs

The verification body reviews for completeness the sources, sinks, and reservoirs identified for a project, such as the ODS baseline emissions, substitute emissions, emissions from transportation, and emissions from the destruction of ODS.

8.4.2 Reviewing Operations, GHG Management Systems and Estimation Methodologies

The verification body reviews and assesses the appropriateness of the operations, methodologies and management systems that the ODS project developer employs to perform project activities, to gather data on ODS collected and destroyed and to calculate baseline and project emissions.

8.4.3 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 to ensure the ODS management, sampling and destruction systems on the ground correspond to and are consistent with data provided to the verification body. In addition, the verification body must recalculate a representative sample of the ODS destruction or emissions data for comparison with data reported by the project developer in order to double-check the calculations of GHG emission reductions.

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8.5 Verification Site Visits

The verification process must include a visit:

1. Of the facility where ODS contained in appliances are extracted, at least once during the first project verification; and
2. Of each destruction facility for the project, during each project verification; and

Project verifiers shall conduct one or more site visits for each project to assess operations, management systems, QA/QC procedures, personnel training, and conformance with the requirements of this protocol. Each of the sites identified in Table 8.2 shall be visited at least once every 12 months by the project verification body. Notwithstanding the guidance of this section, if one verification body is contracted by multiple projects that involve the same facility, the verification body must only visit that facility once per 12-month period. However, the verification body may visit a facility more frequently if they deem it necessary. For each reporting period, the site visits required in Table 8.2 must have occurred no more than 12 months prior to the end date of the reporting period.

Table 8.2. Verification Site Visit Requirements

Project	Site Visit(s) Required
Refrigerant recovery and destruction: pure ODS	▪ Destruction facility
Refrigerant recovery and destruction: mixed ODS	▪ Destruction facility ▪ ODS mixing & sampling facility
Appliance foam collection, ODS foam blowing agent extraction, and destruction	▪ Facility where ODS foam blowing agent is extracted ▪ Destruction facility

In addition to the site visits specified above, verification bodies may visit any additional sites deemed necessary to verify the project in the context of the project specific risk assessment. In the instance that multiple sampling facilities or foam processing facilities were employed in a single project, verification bodies must determine the appropriate number of facilities to visit, but a minimum of one visit per type of facility is required.

8.6 ODS Verification Items

The following tables provide lists of items that a verification body needs to address while verifying an ODS destruction project. 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. For more information on the verification process and professional judgment, please see the Regulation.

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

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8.6.1 Project Eligibility and Credit Issuance

Table 8.3 lists the criteria for reasonable assurance with respect to eligibility and credit issuance for ODS destruction projects. These requirements determine if a project is eligible to register with the Ministry and/or have credits issued for the ODS destroyed. If any one requirement is not met, either the project may be determined ineligible or the GHG reductions from the ODS destroyed (or sub-set of the ODS destroyed) may be ineligible for issuance of credits.

Table 8.3. Project Eligibility Verification Items

Protocol Section	Project Eligibility Qualification Item	Apply Professional Judgment?
2.1	Verify that credits for destroyed ODS have not been claimed with the Ministry, or any other registry	No
2.1	Verify that the project meets the definition of an ODS project	No
3.1	Verify that the destroyed ODS is sourced from Canada	Yes
Error! R eference source not found.	Verify that the destroyed refrigerant ODS has been phased out in Canada	No
2.1	Verify that the ODS was not used as or produced for use as solvents, medical aerosols or other ineligible ODS applications	Yes
2.1 2.3	Verify ownership of the reductions	No
2.1	Verify that the project activities involve a single project developer	No
6.6	Verify that the destruction facility meets the requirements of this protocol	No
3.2	Verify eligibility of project start date	No
3.2	Verify project start date based on records	No
2.2	Verify that the project was correctly characterized as a foam or refrigerant project	No
4	Verify that the appropriate baseline scenario was applied for each quantity of ODS destroyed	No
3.3.1	Verify that the project Surveillance Plan contains procedures for ascertaining and demonstrating that the project passes the Legal Requirement Test at all times	Yes
Error! R eference source not found.	Verify that the project meets the Performance Standard Test	No
3.4	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
6	Verify that plans and procedures meet the requirements of the protocol; if they do not, verify that a variance has been approved by the Ministry for monitoring variations	Yes

8.6.2 Conformance with Operational Requirements and ODS Eligibility

Table 8.4 lists the verification items to determine the project's conformance with the operational and surveillance requirements of this protocol, and the eligibility of discrete ODS sources. A subset of destroyed ODS may be deemed ineligible if it was obtained in a manner inconsistent with this protocol, or if documentation is insufficient. If any of Table 8.4 is not met, no credits may be issued for that quantity of ODS.

Table 8.4. Operational Requirement and ODS Eligibility Verification Items

Protocol Section	Operational Requirement and ODS Eligibility Items	Apply Professional Judgment?
2, 6.3	For all ODS, verify the Certificate of Destruction is unique to this project	No
	For all ODS, verify that the point of origin is correctly identified and documented	Yes
6.2, 6.6	For all ODS, verify that the point of origin documentation agrees with the data reported at the destruction facility (weight and composition) with no significant discrepancies	Yes
6.2, 6.6, 6.4	For all ODS, verify that all entities are identified from the Certificate of Destruction back to the point of origin	Yes
6.4, 6.5	For ODS blowing agents, verify that required data has been collected, per Section 6.4 and 6.5	No
6.5.1	Verify that the scales used for measuring mass of ODS destroyed are properly maintained and tested for calibration	No
C.3	Verify that the weight of full and empty ODS containers was measured no more than 48 hours prior to destruction commencing and no more than 48 hours following completion, respectively	No
6.5.3, 6.5.4	Verify that all ODS samples were taken by a third-party technician while in the possession of the destruction facility	No
7.2	Verify the chain of custody by which ODS sample was transferred from the destruction facility to the lab	No
6.4, 6.5	Verify that all ODS was analyzed for composition and concentration at an approved laboratory	No
6.5.4, 6.5.5	Verify that the calculation of ODS composition and mass concentration correctly accounted for moisture, mixing, and high boiling residue	No
6.5	For mixed refrigerants, verify that credits are only claimed for refrigerants eligible under this protocol	No
6.5.2	For mixed refrigerants, verify that proper recirculation occurred	No
6.5.2, 6.5.3	For mixed refrigerants, verify that recirculation and sampling were performed by properly trained technicians	Yes
6.6	Verify that all permits are current at the destruction facility	No
6.6	Verify that the destruction facility where the ODS was destroyed has a documented destruction and removal efficiency greater than 99.99 percent, and that CPT was conducted with a material less combustible than the ODS destroyed	No
6.6	Verify that the destruction facility operated within the parameters under which it was tested to achieve a 99.99 percent or greater destruction and removal efficiency	No
6.6	Verify that the destruction facility monitored the parameters identified in Section 6.6	No
6.3	Verify that the Certificate of Destruction contains all required information	No

8.6.3 Quantification of GHG Emission Reductions

Table 8.5 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.

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Table 8.5. 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 documentation	No
2.1, 6.3	Verify that all destroyed ODS for which credits are claimed appear on a valid Certificate of Destruction	No
5.1, Appendix B	Verify that the baseline emissions were calculated with the appropriate emission rate(s) and aggregated correctly	No
5.2, Appendix B	Verify that the substitute emissions have been properly characterized, calculated, and aggregated correctly	No

8.6.4 Risk Assessment

Verification bodies will review the following items in Table 8.6 to guide and prioritize their assessment of data used in determining eligibility and quantifying GHG emission reductions.

Table 8.6. Risk Assessment Verification Items

Protocol Section	Item that Informs Risk Assessment	Apply Professional Judgment?
8.2	Verify that the project Surveillance Plan is sufficiently rigorous to support the requirements of the protocol and proper operation of the project	Yes
6.4	Verify that appropriate monitoring equipment is in place to meet the requirements of the protocol	Yes
6.4	Verify that the individual or team responsible for managing and reporting project activities are qualified to perform these functions	Yes
6.4	Verify that the required data on appliances from which foam was sourced has been collected and managed correctly	Yes
6.4, 7.2	Verify that appropriate training was provided to personnel assigned to operations, record-keeping, sample-taking, and other project activities	Yes
6.4, 8.5, 8.6.4	Verify that all contractors are qualified for managing and reporting greenhouse gas emissions if relied upon by the project developer and that there is internal oversight to assure the quality of the contractor's work	Yes
7.2	Verify that all required records have been retained by the project developer	No

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 Statement, submitting the necessary documents to the Ministry, and notifying the Ministry of the project's verified status.

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9 Glossary of Terms

Certificate of Destruction	An official document provided by the destruction facility certifying the date, quantity, and type of ODS destroyed.
Commencement of destruction process	When the ODS waste-stream is hooked up to the destruction chamber.
Commercial refrigeration equipment	The refrigeration appliances used in the retail food, cold storage warehouse or any other sector that requires cold storage. Retail food includes the refrigeration equipment found in supermarkets, grocery and convenience stores, restaurants, and other food service establishments. Cold storage includes the refrigeration equipment used to house perishable goods or any manufactured product requiring refrigerated storage.
Container	An air- and water-tight unit for storing and/or transporting ODS material without leakage or escape of ODS.
Destruction	Destruction of ODS by qualified destruction, transformation or conversion plants achieving greater than 99.99 percent destruction and removal efficiency, in order to avoid their emissions. Destruction may be performed using any technology, including transformation, that results in the complete breakdown of the ODS into either a waste or usable by-product.
Destruction facility	A facility that destroys, transforms or converts ODS using a technology that meets the standards defined by the UN Environment Programme Technology and Economic Assessment Panel Task Force on Destruction Technologies.[11]
Emission rate	The rate at which refrigerant is lost to the atmosphere, including emissions from leaks during operation and servicing events.
Generator	The facility from which the ODS material on a single Certificate of Destruction departed prior to receipt by the destruction facility. If the material on a single Certificate of Destruction was aggregated as multiple shipments to the destruction facility, then the destruction facility shall be the Generator.
Halocarbon (HLC)	A chemical compound containing both carbon and one or more halogen atoms, including chlorofluorocarbons, hydrochlorofluorocarbons, and hydrofluorocarbons, among others. Certain HLC have a high ozone depleting potential, and are known as ozone depleting substances. Certain HLC have a high global warming potential, and are considered greenhouse gases. All HLC targeted by this protocol are GHGs, but may or may not be ODS.
Ozone Depleting Substances (ODS)	Ozone depleting substances are substances known to deplete the stratospheric ozone layer. The ODS controlled under the Montreal Protocol and its Amendments are chlorofluorocarbons (CFC),

[11] United Nations Environment Programme. (2003). Report of the Fifteenth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer. *OzL.Pro.15/9.* Nairobi, November 11, 2003.

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	hydrochlorofluorocarbons (HCFC), halons, methyl bromide (CH_3Br), carbon tetrachloride (CCl_4), methyl chloroform (CH_3CCl_3), hydrobromofluorocarbons (HBFC) and bromochloromethane (CHBrCl). [12]
Recovery efficiency	The percent of total ODS blowing agent that is recovered during the process of ODS blowing agent extraction.
Recharge	Replenishment of refrigerant agent (using reclaimed or virgin material) into equipment that is below its full capacity because of leakage or because it has been evacuated for servicing or other maintenance.
Reclaim	Reprocessing and upgrading of a recovered ODS through mechanisms such as filtering, drying, distillation and chemical treatment in order to restore the ODS to a specified standard of performance. Chemical analysis is required to determine that appropriate product specifications are met. It often involves processing off-site at a central facility.
Recovery	The removal of ODS from machinery, equipment, containment vessels, etc., into an external container during servicing or prior to disposal without necessarily testing or processing it in any way.
Reuse/recycle	Reuse of a recovered ODS following a basic cleaning process such as filtering and drying. For refrigerants, recycling normally involves recharge back into equipment and it often occurs 'on-site'.
Startup, shutdown, and malfunction plan	A plan, as specified under 40 CFR 63.1206, that includes a description of potential causes of malfunctions, including releases from emergency safety vents, that may result in significant releases of hazardous air pollutants, and actions the source is taking to minimize the frequency and severity of those malfunctions.
Stockpile	ODS stored for future use or disposal in bulk quantities at a single location. These quantities may be composed of many small containers or a single large container.
Substitute refrigerant	Those refrigerants that will be used to fulfill the function that would have been filled by the destroyed ODS refrigerants. These refrigerants may be drop-in replacements used in equipment that previously used the type of ODS destroyed or may be used in new equipment that fulfills the same market function.
Substitute emissions	A term used in this protocol to describe the greenhouse gases emitted from the use of substitute refrigerants in technologies that are used to replace the ODS destroyed in a project.
Transportation system	A term used to encompass the entirety of the system that moves the ODS from the point of aggregation to the destruction facility.

[12] Source: IPCC - http://www.mnp.nl/ipcc/pages_media/SROC-final/SROC_A2.pdf

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Appendix A Global Warming Potential of ODS

Table A.1. Global Warming Potential of Eligible ODS

Type of ODS	Global Warming Potential (mass unit of CO_2 equivalent per same unit of ODS)
CFC-11	4,750
CFC-12	10,900
CFC-13	14,400
CFC-113	6,130
CFC-114	10,000
CFC-115	7,370
HCFC-22	1,810
HCFC-141b	725

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Appendix B Emission Factors

Table B.1. Baseline Emission Rates for Foam Blowing Agents

Type of ODS	Emission Rate for Each Type of ODS Contained in Foam Removed from Appliances ($EF_{F,i}$)
CFC-11	0.44
CFC-12	0.55
HCFC-22	0.75
HCFC-141b	0.50

Table B.2. Emission Factor for each Type of ODS Used as a Refrigerant

Type of ODS	Emission Rate for Each Type of ODS Contained in Foam Removed from Appliances ($EF_{F,i}$)
CFC-11	0.89
CFC-12	0.95
CFC-13	0.61
CFC-113	0.89
CFC-114	0.78
CFC-115	0.61

Table B.3. Emission Factors for Substitute Refrigerants

ODS Used as Refrigerants	Emission Factors for Substitute Refrigerants (EFS_i) (CO_2e/ODS)
CFC-11	223
CFC-12	686
CFC-13	7,144
CFC-113	220
CFC-114	659
CFC-115	1,139

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Appendix C Calculations Related to Appliance Foam Blowing Agent Recovery

In order to calculate baseline and project emissions related to recovery of foam blowing agent, in accordance with Section 5, the project developer must first calculate the quantity of ODS contained in foam prior to removal from appliances.

C.1 Calculation Methods for the Initial Quantity of ODS Contained in Foam

Project Developers shall determine the initial quantity of ODS contained in appliance foam using one of two options:

1. Estimation based on the storage capacity and number of appliances from which the eligible ODS was sourced; or,
2. Estimation based on analysis of samples of project foam.

C.2 Calculation of the Initial Quantity of ODS Contained in Foam Based on the Storage Capacity of the Appliances

The Project Developer may calculate the initial quantity of ODS contained in foam using Equation C.1 and data from Table C.1.

Equation C.1. Initial Quantity of ODS Contained in Foam Prior to Removal (default values)

$$BA_{init,i} = \sum_{n=1}^{4} (N_n \times M_n)$$

Where,

			Units
$BA_{init,i}$	=	Initial quantity of ODS of type *i* contained in foam prior to removal from appliances	kg ODS
N_n	=	Number of appliances of type *n* containing ODS of type *i*	
M_n	=	Mass of ODS per appliance of type *n* containing ODS of type *i*	kg

Table C.1. Quantity of ODS by Type of Appliance

Type of Appliance	Storage Capacity (SC)	Mass of ODS per appliance (kg)
Type 1	SC < 180 litres	0.24
Type 2	180 litres ≤ SC < 350 litres	0.32
Type 3	350 litres ≤ SC < 500 litres	0.4
Type 4	SC ≥ 500 litres	0.48

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C.3 Calculation of the Initial Quantity of ODS Contained in Foam Based on Samples

Appliance foam projects have the option of calculating the initial quantity of blowing agent in appliances by determining a project-specific recovery efficiency. This is done once per project[13] based on a run of a minimum ten appliances. Basing this analysis on a number of appliances greater than ten will likely result in a higher calculated recovery efficiency due to the 90 percent upper confidence limit used for calculating the concentration of ODS blowing agent in the foam. A larger sample size will decrease uncertainty and thus lower the estimated blowing agent concentration and increase recovery efficiency; however, sampling of additional appliances will also increase testing costs. The procedures below shall be used to calculate recovery efficiency.

The initial quantity of ODS contained in foam may be calculated using samples from at least 10 appliances and the following method:

1. Have the initial concentration of ODS in the foam determined by a laboratory independent of the Project Developer in accordance with Section 6.5 and in the following manner:
    a. by cutting 4 foam samples from each appliance (left side, right side, top, bottom) using a reciprocating saw, each sample being at least 10 cm^2 and the full thickness of the insulation;
    b. by sealing the cut edges of each foam sample using aluminum tape or a similar product that prevents off gassing;
    c. by individually labelling each sample to record appliance model and site of sample (left, right, top, bottom);
    d. by analyzing the samples using the procedure outlined below; the samples may be analyzed individually (4 analyses per appliance) or a single analysis may be done using equal masses of foam from each sample (1 analysis per appliance);
    e. based on the average concentration of ODS in the samples from each appliance, by calculating the 90% upper confidence limit of the ODS concentration in the foam, and using that value as the "CBA" factor in Equation C.2 to calculate initial quantity of ODS contained in foam from appliances;

2. Determine the quantity of foam removed from the appliances processed, namely the factor "$Foam_{rec}$" in Equation C.2 using a default value of 5.85 kg per appliance and multiplying by the number of appliances processed or using the following method:
    a. by separating and collecting all foam residual, which may be in a fluff, power or pelletized form, and documenting the processed to demonstrate that no significant quantity of foam residual is lost in the air or other waste streams;
    b. by separating non-foam components in the residual (such as metal or plastic);
    c. by weighing the recovered foam residual prior to ODS extraction to calculate the total mass of foam recovered;

3. Calculate the initial quantity of ODS contained in foam prior to removal from appliances (BA_{init}) using Equation C.2:

[13] The project-specific recovery efficiency may be applied to other projects as long as the appliance processing and blowing agent recovery are carried out at the same facility.

Equation C.2 Initial Quantity of ODS Contained in Foam Prior to Removal (site specific)

$$BA_{init,i} = Foam_{rec} \times CBA$$

Where,			Units
$BA_{init,i}$	=	Initial quantity of ODS of type *i* contained in foam prior to removal from appliances	kg ODS
$Foam_{rec}$	=	Total quantity of foam recovered prior to ODS extraction	kg ODS
CBA	=	Concentration of ODS in the foam prior to removal from appliances	kg ODS/kg foam

Requirements for laboratory analysis of ODS concentration from appliance foam samples:

1. the analysis of the content and mass ratio of the ODS from foam must be done at an independent laboratory in accordance with Section 6.5
2. the analysis must be done using the heating method to extract ODS from the foam in the foam samples, as described in the article "Release of fluorocarbons from Insulation foam in Home Appliance during Shredding" published by Scheutz, Fredenslund, Kjeldsen and Tant in the Journal of the Air & Waste Management Association (December 2007, Vol. 57, pages 1452-1460), and set out below:
    a. each sample must be prepared to a thickness no greater than 1 cm, placed in a 1123 ml glass bottle, weighed using a calibrated scale, and sealed with Teflon-coated septa and aluminum caps;
    b. to release the ODS, the sample must be incubated in an oven for 48 hours at 140 °C
    c. when cooled to room temperature, gas samples must be redrawn from the headspace and analyzed by gas chromatography in accordance with Section 6.5
    d. the lids must be removed after analysis, and the headspace must be flushed with atmospheric air for approximately 5 minutes using a compressor; afterwards, the septa and caps must be replaced and the bottles subjected to a second 48-hour heating step to drive out the remaining ODS from the sampled foam
    e. when cooled down to room temperature after the second heating step, gas samples must be redrawn from the headspace and analyzed by gas chromatography in accordance with Section 6.5
3. the quantity of each type of ODS recovered must then de divided by the total mass of the initial foam samples prior to analysis to determine the mass ratio of ODS present, in metric tonnes of ODS per metric tonne of foam

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