

METHODOLOGY FOR THE QUANTIFICATION,
MONITORING, REPORTING AND VERIFICATION
OF GREENHOUSE GAS EMISSIONS
REDUCTIONS AND REMOVALS FROM

THE DESTRUCTION OF OZONE
DEPLETING SUBSTANCES AND
HIGH-GWP FOAM FROM
INTERNATIONAL SOURCES

VERSION 1.0

July 2019

Public Comment Draft

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American Carbon Registry®

WASHINGTON DC OFFICE

c/o Winrock International

2121 Crystal Drive, Suite 500

Arlington, Virginia 22202 USA

ph +1 703 302 6500

CALIFORNIA OFFICE

800 J Street, Suite 539

Sacramento, California 95814 USA

ACR@winrock.org

americancarbonregistry.org

ABOUT AMERICAN CARBON REGISTRY® (ACR)

A leading carbon offset program founded in 1996 as the first private voluntary GHG registry in the world, ACR operates in the voluntary and regulated carbon markets. ACR has unparalleled experience in the development of environmentally rigorous, science-based offset methodologies as well as operational experience in the oversight of offset project verification, registration, offset issuance and retirement reporting through its online registry system.

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ACRONYMS

A/C	Air conditioning
AHRI	Air-Conditioning, Heating and Refrigeration Institute
ANSI	American National Standards Institute
CAA	Clean Air Act
CFC	Chlorofluorocarbon
CH ₄	Methane
CO ₂	Carbon dioxide
CPT	Comprehensive Performance Test
DRE	Destruction and removal efficiency
EPA	United States Environmental Protection Agency
FTIR	Fourier transform infrared spectroscopy
GWP	Global warming potential
HBFC	Hydrobromofluorocarbon
HBR	High Boiling Residue
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HWC	Hazardous waste combustor
ISO	International Organization for Standardization
MT	Metric ton
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
ODS	Ozone depleting substances
PU	Polyurethane
RCRA	Resource Conservation and Recovery Act
SSR	GHG Sources, GHG Sinks, and GHG Reservoirs

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TEAP Technology and Economic Assessment Panel to the Montreal
Protocol Parties

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1 INTRODUCTION

1.1 PURPOSE

The purpose of the Methodology is to quantify greenhouse gas (GHG) emission reductions associated with the destruction of: 1) high global warming potential (GWP) ozone depleting substances (ODS) that would have otherwise been released to the atmosphere; 2) high-GWP foam blowing agents that are extracted from insulation foam; and 3) insulation foam that contains blowing agent(s) with high GWP. All eligible ODS and foam must be obtained from sources outside of the United States and its territories.

2 ELIGIBLE ACTIVITIES: QUANTIFICATION METHODOLOGY

This Methodology defines a set of activities designed to reduce GHG emissions by the destruction of eligible ODS, high-GWP foam blowing agents, or high-GWP insulation foam at a single qualifying destruction facility.

2.1 ELIGIBLE DESTRUCTION FACILITIES

- I. The end fate of the ODS, high-GWP foam blowing agent, or high-GWP insulation foam must be destruction at either:
 - A. An approved HWC subject to the RCRA and with a RCRA permit for the ODS destruction facility stating an ODS destruction efficiency of at least 99.99% (only applicable to destruction facilities located in the United States); or
 - B. A transformation or destruction facility that meets or exceeds the Montreal Protocol's TEAP standards provided in the *Report of the Task Force on Destruction Technologies*, including DRE of 99.99% and emission levels consistent with the guidelines set forth in the TEAP report. Compliance can be demonstrated through the existence of appropriate permits or other regulatory documentation issued by a party to the Montreal Protocol documenting compliance with DRE and facility operational requirements.
- II. A destruction facility must meet all applicable monitoring and operational requirements under relevant environmental laws, as well as all applicable regulatory requirements that apply directly to ODS, high-GWP foam blowing agent, and high-GWP insulation foam destruction activities during the time the ODS, high-GWP foam blowing agent or high-GWP foam destruction occurs.

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2.2 ELIGIBLE ODS, HIGH-GWP FOAM BLOWING AGENTS AND HIGH-GWP INSULATION FOAM

- I. ODS, high-GWP foam blowing agents and high-GWP insulation foam destroyed under this Methodology must be from one or more of the eligible sources listed in subchapters 2.2.1 or 2.2.2 of this Methodology.
- II. Eligible ODS, high-GWP foam blowing agents, or high-GWP insulation foam may not be combined within the same container.
- III. ODS produced exclusively for use as solvents or other applications not listed in Sections 2.2.1 or 2.2.2, are not eligible.
- IV. A single offset project may incorporate ODS, high-GWP foam blowing agents, or high-GWP insulation foam obtained from one or more of the source categories listed in subchapters 2.2.1 or 2.2.2 of this Methodology.
- V. Destruction activity must take place under one or more Certificates of Destruction.
- VI. All the following conditions must be met for multiple Certificates of Destruction to be eligible as a single project:
 - A. The project proponent is the same for all ODS, high-GWP foam blowing agents, or high-GWP insulation foam destroyed;
 - B. All ODS, high-GWP foam blowing agents, or high-GWP insulation foam must be destroyed at the same eligible destruction facility; and
 - C. The destruction activities must occur during one reporting period.
- VII. A Certificate of Destruction may be used for only one offset project.
- VIII. Each Certificate of Destruction must be issued by the qualifying destruction facility and must include the following information:
 - A. Project Proponent;
 - B. Destruction facility;
 - C. Certificate of destruction ID number;
 - D. If applicable, serial, tracking, or ID number of all containers for which ODS destruction occurred;
 - E. If applicable, serial, tracking or ID number of all containers for which high-GWP insulation foam destruction occurred;
 - F. If applicable, serial, tracking or ID number of all appliances from which high-GWP foam blowing agents are extracted and destroyed in an enclosed equipment de-manufacturing system;

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- G. For ODS, extracted high-GWP foam blowing agent, and high-GWP insulation foam in containers, mass and type of material destroyed from each container;
- H. For high-GWP foam blowing agent extracted and destroyed in an enclosed equipment de-manufacturing system, mass of each high-GWP foam blowing agent destroyed.
- I. Start and end destruction dates.
- IX. The ODS destroyed may originate from a single source or from numerous sources.
- X. The high-GWP foam blowing agents may originate from a single source or from numerous sources.
- XI. The high-GWP insulation foam may originate from a single source or from numerous sources.
- XII. The handling, recovery, and disposal of ODS refrigerants must be performed by qualified technicians. Qualified technicians may only service refrigeration or air conditioning equipment they are certified to service if a refrigerant handling, recovery, and disposal certification program exists in the ODS source country. Technician name and certification type(s) (if applicable) must be retained as part of the documentation retention requirements of this Methodology.

2.2.1 ODS Refrigerant Sources

- I. Eligible refrigerants must originate from equipment, refrigeration systems, or other supplies, including but not limited to cans, cylinders, and other containers of recovered, reclaimed or unused ODS.
- II. Only destruction of the following ODS refrigerants is eligible to generate ACR Emission Reduction Tonnes (ERTs) under this Methodology:
 - A. CFC-11;
 - B. CFC-12;
 - C. CFC-13;
 - D. CFC-113;
 - E. CFC-114;
 - F. CFC-115;
 - G. HCFC-22
- III. HCFC-22 is eligible under this Methodology when sourced from countries where there are bans or quotas on the importation and/or production of HCFCs as follows:
 - A. If the country is not a producer of HCFC-22 (or there is a ban on the production of HCFC-22), at the time the ODS is obtained by the project proponent:

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- i. There is a ban on the importation of HCFC-22 (including importation of equipment containing HCFC-22); or
- ii. There is a quota on the importation of HCFC-22 and either:
 - a. For the two calendar years prior to the earliest date that HCFC-22 included in a particular project is obtained by the project proponent, the country imported HCFC-22 equal to 95% or more of the quota;
 - b. The quota is combined with additional rules or regulations that prohibit a country from importing in the same calendar year as the project period more HCFC-22 than was imported during the calendar year prior to the year of the project period; or
 - c. The project proponent can demonstrate that the HCFC-22 was imported into the country prior to the date of adoption of version 1.0 of this methodology.
 - d. If neither, a., b., or c., apply, the HCFC-22 was obtained by the project proponent “in the stream of commerce” as that term is defined in subsection 2.2.1 II.I C. below, and
 - 1. Using data reported to the United Nations Environment Programme Ozone Secretariat (“U.N. Data”), the project proponent quantifies the average total mass of HCFC-22 imported into the source country during the two calendar years preceding the year of adoption of version 1.0 of this methodology (“Import Baseline”), and
 - 2. Using U.N. Data for the most recent year available, it is demonstrated by the project proponent that the total mass of imported HCFC-22 in the source country has not increased by greater than 5% over the Import Baseline. For purposes of clarity, the most recent available U.N. Data shall be the U.N. Data available on the earliest date HCFC-22 included in a particular project is obtained by the project proponent.
- B. If the country is a producer of HCFC-22 at the time the ODS is obtained by the project proponent and:
 - i. There is a quota on the production of HCFC-22 and on the importation of HCFC-22 (including importation of equipment containing HCFC-22) and either:
 - a. For the two calendar years prior to the earliest date that HCFC-22 included in a particular project is obtained by the project proponent, the country imported HCFC-22 equal to 95% or more of the quota;
 - b. The quotas are combined with additional rules or regulations that prohibit a country from producing and importing in the same calendar year as the

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- project period more HCFC-22 than was produced during the calendar year prior to the year of the project period;
- c. The project proponent can demonstrate that the HCFC-22 was produced and, if applicable, imported into the country prior to the date of adoption of version 1.0 of this methodology.
 - d. If neither, a., b., or c., apply, the HCFC-22 was obtained by the project proponent “in the stream of commerce” as that term is defined in subsection 2.2.1 III. C. below, and
 1. Using data reported to the United Nations Environment Programme Ozone Secretariat (“U.N. Data”), the project proponent quantifies the average total combined mass of HCFC-22 produced by and imported into the source country during the two calendar years preceding the year of adoption of version 1.0 of this methodology (“Production and Import Baseline”), and
 2. Using U.N. Data for the most recent year available, it is demonstrated by the project proponent that the total mass of produced and imported HCFC-22 in the source country has not increased by greater than 5% over the Production and Import Baseline. For purposes of clarity, the most recent available U.N. Data shall be the U.N. Data available on the earliest date HCFC-22 included in a particular project is obtained by the project proponent.
- C. For purposes of this section, the term “in the stream of commerce” means the material was, prior to acquisition by the project proponent:
- i. In operating equipment or equipment that was being decommissioned or retired from service;
 - ii. For sale in a retail store that is in the business of selling refrigerant, and is not also a manufacturer of refrigerant, importer of refrigerant, or wholesale distributor of refrigerant; or
 - iii. Owned by an individual or company, other than a manufacturer, importer or wholesale distributor of refrigerant, or a carbon offset developer, who possessed the material for use in a refrigerant trade or refrigerant-related business.
- IV. 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 high-GWP insulation foam source.

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2.2.2 High-GWP Insulation Foam Sources¹

- I. Eligible high-GWP insulation foam must originate from appliance foam, building foam, or other foam. Only destruction of the following high-GWP insulation foam blowing agents is eligible to generate ACR ERTs under this Methodology:
 - A. CFC-11;
 - B. CFC-12;
- II. To be eligible, the high-GWP blowing agent must be destroyed in one of three ways:
 - A. If high-GWP blowing agent is extracted from insulation foam and subsequently destroyed at a separate destruction facility, the blowing agent must be extracted from the insulation foam under negative pressure and collected, stored, and transported in hermetically sealed containers;
 - B. If high-GWP blowing agent is extracted from foam and destroyed within an enclosed equipment de-manufacturing system, the blowing agent must be extracted from the foam and destroyed under negative pressure; or
 - C. If high-GWP insulation foam is destroyed, the intact foam (i.e., foam that is not shredded or compacted prior to destruction) must be separated from the application from which it originated (i.e. those applications cited in subchapter 2.2.2 I) and must be stored, transported, and destroyed in sealed containers (see section 6.6 I).

¹ Inclusive of high-GWP blowing agents extracted from insulation foam.

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3 ELIGIBILITY

ODS and high-GWP insulation foam (intact foam or extracted blowing agents) offset projects must adhere to the eligibility requirements below as well as general ACR program requirements included in the ACR Standard.

ACR may require revisions to this Methodology to ensure that monitoring, reporting, and verification systems adequately reflect changes to project activities. This Methodology may also be periodically updated to reflect regulatory changes, emission factor revisions, or expanded applicability criteria. Before beginning a project, the project proponent should ensure that they are using the latest version of the Methodology.

3.1 GENERAL ELIGIBILITY REQUIREMENTS

- I. Offset projects that use this Methodology must:
 - A. Collect and destroy ODS, high-GWP foam blowing agents, or high-GWP insulation foam that would otherwise be emitted to the atmosphere;
 - B. Destroy the recovered ODS, high-GWP foam blowing agents, or high-GWP insulation foam through an eligible end-use management option pursuant to subchapter 2.1 of this Methodology;
 - C. Conform with the source documentation requirements, as specified in chapter 6 of this Methodology; and
 - D. Conform to the chain of custody documentation requirements, as specified in chapter 6 of this Methodology.
- II. A project proponent that uses this Methodology must:
 - A. Monitor SSRs within the GHG Assessment Boundary as delineated in chapter 4 pursuant to the requirements of chapter 6 in this Methodology;
 - B. Quantify GHG emission reductions pursuant to chapter 5 of this Methodology;
 - C. Prepare and submit a GHG Project Plan in accordance with ACR Standard requirements; and
 - D. Obtain validation and verification services from an ANSI-accredited offset verification body approved by ACR.

3.2 LOCATION

- I. All ODS and high-GWP insulation foam must be obtained from eligible sources located outside the United States and its territories.

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- II. Destruction of ODS refrigerants, high-GWP foam blowing agents, and high-GWP insulation foam must occur at an eligible destruction facility per the requirements found in Section 2.1.

3.3 ADDITIONALITY

Offset projects must meet the additionality requirements included below. Eligible offsets must be generated by projects that yield additional GHG reductions that exceed any GHG reductions otherwise required by law or regulation or any GHG reduction that would otherwise occur in a conservative business-as-usual scenario. These requirements are assessed through the Legal Requirement Test in subchapter 3.3.1 and the Performance Standard Evaluation in subchapter 3.3.2 of this Methodology.

3.3.1 Legal Requirement Test

- I. Emission reductions achieved by a project using this Methodology must exceed those required by any law, regulation, or legally binding mandate.
- II. The following legal requirement test applies to all ODS and high-GWP insulation foam projects:
 - A. If no law, regulation, or legally binding mandate requires the destruction of ODS stocks, high-GWP foam blowing agent, or high-GWP insulation foam, all emission reductions resulting from the recovery and destruction of ODS and high-GWP insulation foam are considered to not be legally required, and therefore eligible for crediting under this Methodology.
 - B. If any law, regulation, or legally binding mandate requires the destruction of ODS stocks, high-GWP foam blowing agent, or high-GWP insulation foam, only emission reductions resulting from the recovery and destruction of ODS, high-GWP foam blowing agent, and high-GWP insulation foam that are in excess of what is required to comply with those laws, regulations, and legally binding mandates are eligible for crediting under this Methodology.
- III. For projects involving HCFC-22, the rules or regulations establishing the bans or quotas set forth in Section 2.2.1, III, must include published, enforceable limits on the volume of HCFC-22 that can be imported or produced.

3.3.2 Performance Standard Evaluation

- I. Emission reductions achieved by a project using this Methodology must exceed those likely to occur in a conservative business-as-usual scenario.

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- II. The performance standard evaluation is satisfied if the ODS or high-GWP insulation foam project activities meet the project definition and all other eligibility requirements in the Methodology.

3.4 START DATE

- I. An offset project must meet the start date requirements set forth in the ACR Standard.
- II. For this Methodology, the project start date is defined as the date on which the earliest destruction activity of a project commences, as documented on a Certificate of Destruction.
- III. Offset project activities (i.e. collection of ODS or high-GWP insulation foam, transportation of ODS or high-GWP insulation foam, etc.) will occur prior to offset project commencement.

3.5 REPORTING PERIODS

- I. An ODS or high-GWP insulation foam project can only have a single reporting period.
- II. Multiple destruction events may be combined within a single reporting period subject to the requirements in subchapter 2.2 V of this Methodology.
- III. The reporting period must not exceed 12 consecutive months. The project proponent may choose a reporting period shorter than 12 consecutive months.
- IV. The project reporting period begins on the project start date.

3.6 CREDITING PERIODS

- I. The project crediting period is the period of time over which emission reductions are quantified for the purpose of determining creditable GHG reductions.
- II. The project crediting period for this Methodology is ten years.
- III. The project crediting period begins on the project start date.

3.7 REGULATORY COMPLIANCE

- I. An offset project must meet the regulatory compliance requirements set forth in the ACR Standard.

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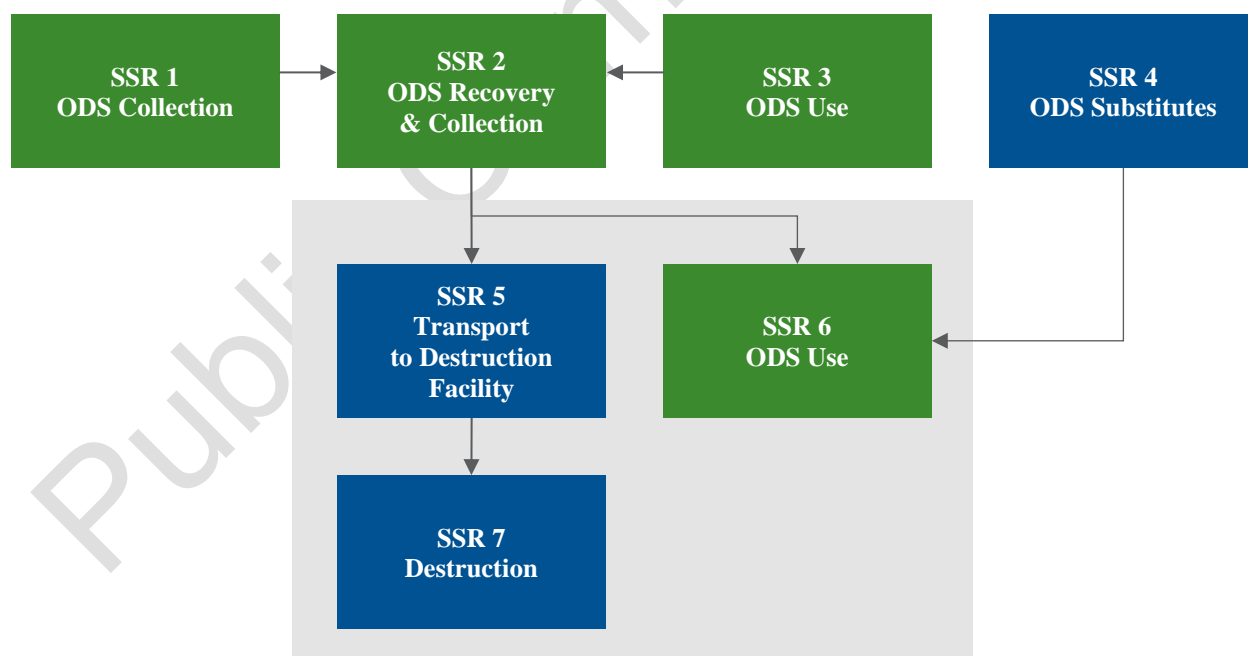
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- II. The regulatory compliance requirements for a project apply to the collection, recovery, storage, transportation, mixing, and destruction of ODS, high-GWP foam blowing agents, or high-GWP insulation foam, including disposal of the post-destruction waste products that are directly applicable to the destruction activities. The regulatory compliance requirements in this section apply to the incinerator and any other unit or operation at the destruction facility, directly related to the destruction activities, during the time destruction occurs.
- III. Any instances of non-compliance resulting from administrative or other issues not related to the project (those specific activities stated in Section 3.7 II) shall not be considered in a determination of project-related regulatory compliance. Further, in order to be deemed out of compliance, a regulatory body must have issued a notice of violation (or similar notification) stating specifically that a violation has occurred.

4 OFFSET PROJECT BOUNDARY: QUANTIFICATION METHODOLOGY

- I. The GHG assessment boundary, or offset project boundary, delineates the SSRs that must be included or excluded when quantifying the net changes in emissions associated with the recovery and destruction ODS and high-GWP insulation foam.
- II. Figure 1 illustrates the GHG assessment boundary for refrigerant ODS projects.
 - A. All SSRs inside the grey box are included and must be accounted for under this Methodology.
 - B. SSRs in green boxes are relevant to the baseline and project emissions.
 - C. SSRs in blue boxes are relevant only to project emissions.

Figure 1: Illustration of the Offset Project Boundary for Refrigerant ODS Projects



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III. Table 1 lists the SSRs for refrigerant ODS projects indicating which gases are included or excluded from the offset project boundary.

Table 1: List of Identified SSRs for Refrigerant ODS Projects

SSR	SOURCE DESCRIPTION	GAS	INCLUDED (I) OR EXCLUDED (E)
1 ODS Collection	Fossil fuel emissions from the collection and transport of ODS sources	CO ₂	E
		CH ₄	E
		N ₂ O	E
2 ODS Recovery and Collection	Emissions of ODS from the recovery and collection of ODS at end-of-life or servicing	ODS	E
	Fossil fuel emissions from the recovery and collection of refrigerant at end-of-life or servicing	CO ₂	E
		CH ₄	E
3 ODS Use	Emissions of ODS from equipment use, leaks, and servicing	ODS	E
	Fossil fuel emissions from the operation of refrigeration and A/C equipment	CO ₂	E
		CH ₄	E
		N ₂ O	E
4 Substitute Refrigerant Production	Emissions of substitute refrigerant production	CO ₂ e	E
	Fossil fuel emissions from the production of substitute refrigerant	CO ₂	E
CH ₄		E	

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SSR	SOURCE DESCRIPTION	GAS	INCLUDED (I) OR EXCLUDED (E)
		N ₂ O	E
5 Transport to Destruction Facility	Fossil fuel emissions from the vehicular transport of ODS from aggregation point to final destruction facility	CO ₂	I
		CH ₄	E
		N ₂ O	E
6 ODS Use	Emissions of ODS from use, leaks and servicing through continued operation of equipment	ODS	I
	Emissions of substitute from use, leaks and servicing through continued operation of equipment	CO ₂ e	I
	Indirect emissions from grid-delivered electricity	CO ₂	E
		CH ₄	E
		N ₂ O	E
	7 Destruction	Emissions of ODS from incomplete destruction at destruction facility	ODS
Emissions from the oxidation of carbon contained in destroyed ODS		CO ₂	I
Fossil fuel emissions from the destruction of ODS at destruction facility		CO ₂	I
		CH ₄	E
		N ₂ O	E
Indirect emissions from the use of grid-delivered electricity		CO ₂	I
		CH ₄	E

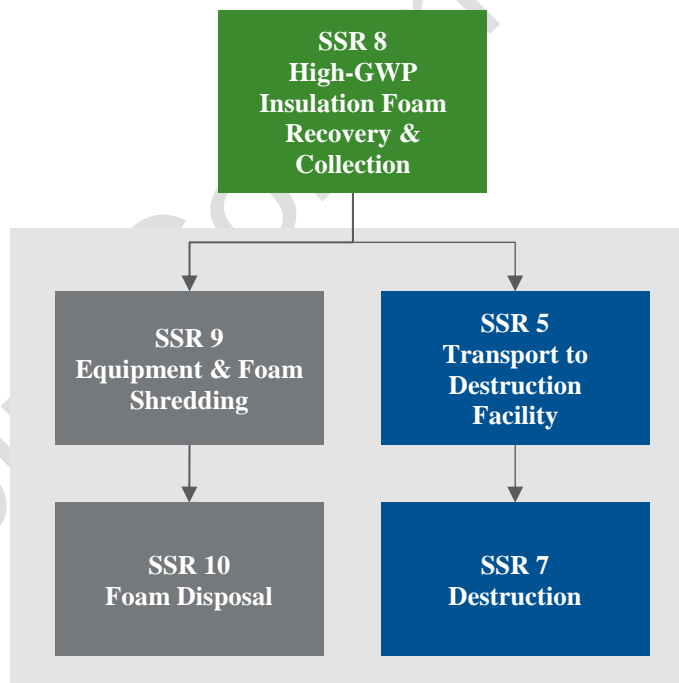
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SSR	SOURCE DESCRIPTION	GAS	INCLUDED (I) OR EXCLUDED (E)
		N ₂ O	E

- IV. Figure 2 illustrates the GHG assessment boundary for high-GWP insulation foam projects.
 - A. All SSRs inside the grey box are included and must be accounted for under this Methodology.
 - B. SSRs in dark grey boxes are relevant only to baseline emissions.
 - C. SSRs in blue boxes are relevant only to project emissions.
 - D. SSRs in green boxes are relevant to the baseline and project emissions.

Figure 2: Illustration of the Offset Project Boundary for High-GWP Insulation Foam Projects



- V. Table 2 lists the SSRs for high-GWP insulation foam projects indicating which gases are included or excluded from the offset project boundary.

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Table 2: List of Identified SSRs for High-GWP Insulation Foam Projects

SSR	SOURCE DESCRIPTION	GAS	INCLUDED (I) OR EXCLUDED (E)
5 ODS Collection	Fossil fuel emissions from the vehicular transport of high-GWP insulation foam or extracted blowing agent from aggregation point to final destruction facility	CO ₂	I
		CH ₄	E
		N ₂ O	E
7 Destruction	Emissions from incomplete destruction at destruction facility	ODS	I
	Emissions from the oxidation of carbon contained in destroyed foam or blowing agent	CO ₂	I
	Fossil fuel emissions from the destruction of foam or blowing agent at destruction facility	CO ₂	I
		CH ₄	E
		N ₂ O	E
	Indirect emissions from the use of grid-delivered electricity	CO ₂	I
		CH ₄	E
		N ₂ O	E
	8 High-GWP Insulation Foam Recovery and Collection	Emissions of ODS/HFC from demolition, deconstruction, or other damage to foam sources	ODS
Fossil fuel emissions from demolition or deconstruction of foam sources		CO ₂	E
		CH ₄	
		N ₂ O	

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SSR	SOURCE DESCRIPTION	GAS	INCLUDED (I) OR EXCLUDED (E)
	Fossil fuel emissions from the collection and transport of high-GWP foam sources	CO ₂	E
		CH ₄	
		N ₂ O	
9 Equipment and Foam Shredding ²	Emissions of ODS/HFC from the removal of foam from equipment for materials recovery, releasing ODS/HFC from foam	ODS	I
10 Foam Disposal	Emissions of ODS/HFC released from foam disposed of in landfills	ODS	I
	Fossil fuel emissions from the transport and placement of shredded foam waste in landfill	CO ₂	E
		CH ₄	E
		N ₂ O	E

² SSR 9 is only relevant to projects that manually remove foam in a non-enclosed equipment de-manufacturing system. For projects that destroy extracted high-GWP blowing agent from foam in an enclosed equipment de-manufacturing system, quantification of project emissions from foam removal is not required.

5 QUANTIFYING GHG EMISSION REDUCTIONS: QUANTIFICATION METHODOLOGY

- I. GHG emission reductions from an ODS or high-GWP insulation foam³ project are quantified by comparing actual project emissions to calculated project baseline emissions.
- II. A project proponent must use the calculation methods provided in this methodology to determine baseline and project GHG emissions.
- III. GHG emissions must be quantified using the GWP values in Tables 4 and 5.
- IV. GHG emission reductions (ER) must be quantified by subtracting the project emissions (PE) from the baseline emissions (BE) using Equation 1.

Equation 1: Total Emission Reductions

$$ER_t = BE_t - PE_t$$

WHERE		UNITS
ER_t	Total quantity of GHG emission reductions during the reporting period	MT CO ₂ e
BE_t	Total quantity of project baseline emissions during the reporting period	MT CO ₂ e
PE_t	Total quantity of project emissions during the reporting period	MT CO ₂ e

³ Whether intact high-GWP insulation foam or blowing agent extracted from high-GWP insulation foam

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5.1 QUANTIFYING BASELINE EMISSIONS

- I. Baseline emissions (BE) must be estimated by using Equation 2 and by summing the baseline emissions for all SSRs identified as included in the baseline in Tables 1 and 2.

Equation 2: Total Baseline Emissions

$$BE_t = BE_{refr} + BE_{foam}$$

WHERE		UNITS
BE_t	Total quantity of project baseline emissions during the reporting period	MT CO ₂ e
BE_{refr}	Total quantity of project baseline emissions from refrigerant ODS	MT CO ₂ e
BE_{foam}	Total quantity of project baseline emissions from high-GWP blowing agent	MT CO ₂ e

- II. Baseline emissions from refrigerant ODS (BE_{refr}) must be quantified using Equation 3.
- III. BE_{refr} must include the estimated CO₂e emissions that would have occurred over the ten-year crediting period had the destroyed ODS been used in existing refrigeration or air conditioning equipment.
- IV. The total mass of refrigerant ODS sent for destruction ($Q_{refr,i}$) includes eligible ODS and excludes the mass of HBR, moisture, ineligible ODS, and other ineligible material. Mass and composition of refrigerant ODS are determined per the procedures provided in Appendix C.
- V. The GWP values for refrigerant ODS (GWP_i) must be taken from Table 4.
- VI. The 10-year cumulative emission rate for refrigerant ODS ($ER_{refr,i}$) must be taken from Table 4.
- VII. If the project did not destroy any refrigerant ODS, then $BE_{refr} = 0$.

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Equation 3: Baseline Emissions from Refrigerant ODS

$$BE_{\text{refr}} = \sum_i (Q_{\text{refr},i} \times ER_{\text{refr},i} \times GWP_i)$$

WHERE		UNITS
BE_{refr}	Total quantity of refrigerant project baseline emissions during the reporting period	MT CO ₂ e
$Q_{\text{refr},i}$	Total quantity of refrigerant ODS i sent for destruction by the offset_project	MT ODS
$ER_{\text{refr},i}$	10-year cumulative emission rate of refrigerant ODS i (see Table 4)	%
GWP_i	Global warming potential of ODS i (see Table 4)	MT CO ₂ e/ MT ODS

- VIII. Baseline emissions from high-GWP foam blowing agents (BE_{foam}) (blowing agent extracted from foam or intact foam) must be quantified using Equation 4.
- IX. BE_{foam} must include the estimated CO₂e emissions that would have occurred over ten years as the result of foam disposal.
- X. The 10-year cumulative emission rate for high-GWP blowing agents must be taken from Table 5.
- XI. The mass and composition of extracted blowing agent from high-GWP foam (EBA_i) must be calculated per the procedures in Appendix C.
- XII. The mass of intact high-GWP foam ($Q_{\text{intf}, i}$) must be calculated using the scales of the eligible destruction facility as specified in Appendix B.
- XIII. The mass fraction of intact high-GWP blowing agent ($BA\%_{\text{intf}, i}$) must be calculated per Appendix B II.
- XIV. If the project did not destroy any high-GWP blowing agent, then $BE_{\text{foam}} = 0$

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Equation 4: Baseline Emissions from High-GWP Insulation Foam

$$BE_{\text{foam}} = \sum_{i,j} [(EBA_i + BA_{\text{intf},i}) \times ER_{i,j} \times GWP_i]$$

WHERE		UNITS
BE_{foam}	Total quantity of high-GWP blowing agent project baseline emissions	MT CO ₂ e
EBA_i	Total quantity of high-GWP blowing agent i extracted from foam and destroyed (as determined through the procedures provided in Appendix C)	MT BA
$BA_{\text{intf},i}$	Total quantity of high-GWP blowing agent i in intact foam sent for destruction (as determined through Equation 5)	MT BA
$ER_{i,j}$	10-year emission rate of high-GWP blowing agent i from application j (see Table 5)	%
GWP_i	Global warming potential of high GWP blowing agent i (see Table 5)	MT CO ₂ e/ MT BA

Equation 5: Quantity of high-GWP blowing agent from intact foam

$$BA_{\text{intf},i} = Q_{\text{intf},i} \times BA\%_{\text{intf},i}$$

WHERE		UNITS
$BA_{\text{intf},i}$	Total quantity of high-GWP blowing agent i from intact foam sent for destruction	MT BA
$Q_{\text{intf},i}$	Total mass of intact foam, i , with entrained high-GWP blowing agent sent for destruction (as determined through procedures in Appendix B I)	MT
$BA\%_{\text{intf},i}$	Mass ratio of high-GWP blowing agent, i , entrained in intact foam (as determined per the procedures in Appendix B II)	% (0-1)

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5.2 QUANTIFYING PROJECT EMISSIONS

- I. Project emissions (PE) must be quantified by summing the emissions for all SSRs identified as included in the project in Tables 1 and 2 using Equation 6.

Equation 6: Total Project Emissions

$$PE_t = Sub_{refr} + Rem_f + Tr\&Dest$$

WHERE		UNITS
PE_t	Total quantity of project emissions during the reporting period	MT CO _{2e}
Sub_{refr}	Total GHG emissions from substitute refrigerant	MT CO _{2e}
Rem_f	Total GHG emissions from removal of high GWP foam in a non-enclosed equipment de-manufacturing system	MT CO _{2e}
$Tr\&Dest$	Total GHG emissions from transportation and destruction of ODS and high-GWP insulation foam/blowing agents	MT CO _{2e}

- II. Project emissions from substitute refrigerants (Sub_{refr}) must be quantified using Equation 7.
- III. Sub_{refr} must include the estimated CO_{2e} emissions over a ten-year period from non-ODS substitute refrigerants that are used. The emission factors for substitute refrigerants in Table 4 must be used.
- IV. The total mass of refrigerant ODS sent for destruction ($Q_{ref,i}$) excludes the mass of HBR, moisture, and ineligible ODS. Mass and composition of refrigerant ODS are determined per the procedures provided in Appendix C.
- V. If the project did not destroy any refrigerant, then $Sub_{refr} = 0$.

Equation 7: Project Emissions from the Use of Non-ODS Refrigerants

$$Sub_{refr} = \sum_i Q_{ref,i} \times SE_i$$

WHERE

UNITS

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Sub_{refr}	Total quantity of refrigerant substitute emissions	MT CO ₂ e
Q_{ref,i}	Total quantity of refrigerant i sent for destruction	MT ODS
SE_i	Emission factor for substitute(s) for refrigerant i , per Table 4	MT CO ₂ e/ MT ODS destroyed

- VI. If high-GWP foam is manually removed in a non-enclosed equipment de-manufacturing system, project emissions from removal of the foam (Rem_f) must be quantified using Equation 8.
 - A. The default percentage of blowing agent that is lost when foam is removed from appliances in a non-enclosed manufacturing facility is 10% (Lfr).
- VII. If the project did not destroy any high-GWP blowing agent, then Rem_f = 0.

Equation 8: Project Emissions from Removal of Foam in a Non-Enclosed Equipment De-Manufacturing System

$$Rem_f = (BE_{foam} \times Lfr)$$

WHERE		UNITS
Rem_f	Total GHG emissions from removal of high GWP foam in a non-enclosed equipment de-manufacturing system	MT CO ₂ e
BE_{foam}	Total quantity of high-GWP blowing agent project baseline emissions (as determined through Equation 4) ⁴	MT CO ₂ e
Lfr	Default percentage of blowing agent that is lost in removal of foam from appliances in a non-enclosed equipment de-manufacturing system	10%

⁴ Note that, for purposes of quantifying project foam removal emissions, project baseline emissions used in this equation shall only include the proportion of emissions associated with foam that is manually removed in a non-enclosed manufacturing facility.

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- VIII. Project emission from the transportation and destruction of ODS and high-GWP insulation foam/blowing agent shall be quantified using default emission factors in Equation 13.
- A. The default emission factor for ODS transportation and destruction is 7.5 MT CO₂e per MT ODS for refrigerant, medical aerosol, fire suppressant or blowing agent extracted from high-GWP foam.
 - B. The default emission factor for transportation and destruction is 75 MT CO₂e per MT of high-GWP foam for intact foam projects.
 - C. Q_{ODS} and Q_{BA} include the mass of all eligible and ineligible ODS and high-GWP blowing agent, moisture, HBR, and other accompanying material.

Equation 9: Project Emissions from Transportation and Destruction Using the Default Emission Factors

$$Tr\&Dest = (Q_{ODS} \times EF) + (Q_{BA} \times EF) + (Q_{intf} \times EF)$$

WHERE		UNITS
Tr&Dest	Total GHG emissions from ODS and high-GWP insulation foam/blowing agent transportation and destruction, as calculated using default emission factors	MT CO ₂ e
Q _{ODS}	Total quantity of refrigerant ODS sent for destruction in the project	MT ODS
Q _{BA}	Total quantity of high-GWP blowing agent extracted from insulation foam and sent for destruction in the project	MT BA
Q _{intf}	Total mass of intact foam with entrained high-GWP blowing agent sent for destruction	MT
EF	Default emission factor for transportation and destruction of ODS or High-GWP Blowing Agent foam (7.5 for refrigerant, medical aerosol, fire suppressant or extracted blowing agent projects, 75 for intact high-GWP foam projects)	MT CO ₂ e/ MT ODS/ MT BA or MT

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5.3 ACCOUNTING FOR DISQUALIFIED ODS MATERIAL AND HIGH-GWP FOAM AFTER DESTRUCTION

ERTs may only be generated for the destruction of eligible ODS, high-GWP foam blowing agents, and high-GWP insulation foam that meet the sourcing and chain of custody requirements specified in chapter 6 of this Methodology. Any disqualified ODS, high-GWP foam blowing agents, or high-GWP insulation foam must be removed from baseline emission calculations using the following method to determine the mass and species of the disqualified ODS, high-GWP foam blowing agents, or high-GWP insulation foam:

- I. The total mass of each container of disqualified ODS (from refrigerant, medical aerosol, or fire suppressant ODS or high-GWP blowing agent) or high-GWP insulation foam shall be considered as the original container when the ODS or high-GWP foam was acquired. Documentation of the acquired ODS, high-GWP blowing agent, or high-GWP insulation foam must identify the capacity of the disqualified ODS, high-GWP blowing agent or high-GWP insulation foam container or the entire destruction event is not eligible for crediting. If a container's capacity is labelled in volume rather than in mass, the densities in Table 8 must be used to convert the volume to mass.
 - A. For refrigerant ODS or high-GWP foam blowing agent: If converting between mass and volume, the ODS or blowing agent must be in a liquid state.
- II. The species of each disqualified ODS or high-GWP blowing agent shall be the species with the highest GWP of the destruction event.
- III. The determined mass of disqualified ODS or high-GWP blowing agent shall be subtracted from the total mass of that ODS or high-GWP blowing agent species destroyed in the project.
 - A. The total mass of refrigerant ODS sent for destruction ($Q_{\text{refr},i}$) shall be adjusted in Equation 3.
 - B. The total quantity of blowing agent extracted from high-GWP foam and sent for destruction ($EBA_{,i}$) shall be adjusted in Equation 4.
 - C. The total mass of high-GWP blowing agent from intact high-GWP foam sent for destruction ($BA_{\text{intf},i}$) shall be adjusted in Equation 5.

5.4 CONVERSION FACTORS AND ROUNDING PRACTICES

- I. For the purpose of this Methodology, 1 pound (lb) equals 0.45359 kilogram (Kg).
- II. The following rounding practices shall be applied for the purpose of this Methodology:
 - A. At least five significant digits shall be maintained.
 - B. There shall be no rounding to the left side of the decimal.

6 MONITORING

6.1 GENERAL MONITORING REQUIREMENTS

- I. The project proponent is responsible for monitoring all project activities to ensure compliance with this Methodology.
- II. The source of all ODS and high-GWP foam must be documented. Source documentation must include all of the following:
 - A. Owner of the ODS prior to acquisition by the project proponent;
 - B. Physical address of the ODS prior to acquisition by the project proponent and facility name (if applicable);
 - C. Additional information as follows:
 - i. If sourced from equipment or refrigeration system: identification of any refrigeration or air conditioning equipment or system by serial number, if available, or description, location, and function, if serial number is unavailable (for refrigerant ODS quantities greater than 500 pounds that originate in equipment that is not processed at an enclosed equipment de-manufacturing facility); or
 - ii. If sourced from other supplies: an affidavit, certification, or attestation by the prior owner asserting the date the owner transferred title of the ODS to the project proponent and the reason for the owner's original acquisition;
 - D. Serial or ID number of any containers used for storage and transport.
- III. For refrigerant ODS, the project proponent must collect and maintain documentation on the chain of custody and ownership of the ODS beginning at the location it is first acquired by the project proponent through destruction, including all the following:
 - A. Names, addresses, and contact information of all entities buying and selling ODS for destruction; and
 - B. The mass of ODS including ineligible ODS and contaminants, at each transaction.
- IV. For projects destroying refrigerant ODS sourced from government stockpiles or inventories, the project proponent must maintain documentation that the ODS is not required to be destroyed or converted.
- V. For intact high-GWP foam sources (i.e. those where blowing agent is not extracted prior to destruction), the project proponent must collect and maintain all the following information:
 - A. For intact high-GWP building and intact other foams:

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- i. Total quantity of foam from each foam type (i.e. differentiated by building and specific allowable other foams) that is the source of the high-GWP blowing agent in the project;
 - ii. Type and amount of blowing agent in the foam determined through procedures in Appendix BII; and
 - B. For intact appliance high-GWP foams:
 - i. Numbers of units containing high-GWP foam that are processed;
 - ii. Type and amount of blowing agent(s) in the foam, determined through the procedures in Appendix B II, as applicable.
- VI. For refrigerant ODS and extracted high-GWP foam blowing agent that is not destroyed in an enclosed equipment de-manufacturing process, the project proponent must collect and maintain all the following information from the composition and mass analysis:
 - A. Time and date of sample;
 - B. Name of project proponent;
 - C. Name of technician taking sample;
 - D. Employer of technician taking sample;
 - E. Volume of container from which sample was extracted;
 - F. Ambient air temperature at time of sampling; and
 - G. Chain of custody for each sample from the point of sampling to the AHRI-certified lab.
- VII. For refrigerant ODS and extracted high-GWP foam blowing agent, the destruction facility must track continuously during the destruction process the following parameters and provide the data about these parameters to the project proponent. The project proponent must collect and maintain all the following information from the destruction facility:
 - A. The feed rate;
 - B. Operating temperature and pressure of the destruction unit during destruction;
 - C. Effluent discharges measured in terms of water and pH levels (if applicable);
 - D. Destruction system monitoring data on the emissions of carbon monoxide during destruction (if applicable); and
 - E. If applicable, for an enclosed equipment de-manufacturing system:
 - i. Mass and composition of ODS and high-GWP blowing agent(s) entering the destruction unit,
 - ii. Time and date(s) of chemical analyses,
 - iii. Number of appliances that are de-manufactured in the system, and

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- iv. Date(s) appliances enter equipment de-manufacturing system.
- VIII. For intact high-GWP insulation foam, the destruction facility must track during the destruction process the following parameters and provide the data about these parameters to the project proponent. The project proponent must collect and maintain all the following information from the destruction facility:
- A. Mass of high-GWP foam fed into the destruction unit;
 - B. Operating temperature and pressure of the destruction unit during foam destruction;
 - C. Effluent discharges measured in terms of water and pH levels (if applicable); and
 - D. Destruction system monitoring data on the emissions of carbon monoxide during foam destruction (if applicable).
- IX. For HCFC-22 ODS eligible for inclusion under Sections 2.2.1 III A ii.d. and 2.2.1 III B i.d., the project proponent must provide documentation sufficient to substantiate that the material was “in the stream of commerce” as defined in Section 2.2.1 C.
- X. For ODS destroyed in a country other than the country from which it was sourced, the project proponent must collect and maintain:
- A. Records establishing a right to export the ODS from the source country and the name, department, regulatory body, and contact information of the governmental authority granting permission to export; and
 - B. Records establishing a right to import the ODS to the country of destruction and the name, department, regulatory body, and contact information of the governmental authority granting permission to import.

6.2 INSTRUMENT QA/QC

- I. For a destruction facility that is not part of an enclosed equipment de-manufacturing system, the scales used to determine the mass of ODS, high-GWP foam blowing agent, or high-GWP insulation foam used in calculating emission reductions must be:
 - A. Inspected at least quarterly; and
 - B. Properly calibrated per the destruction facility’s RCRA permit, or for non-RCRA facilities, calibrated at least quarterly to 5% or better accuracy. RCRA facilities that do not have calibration requirements defined in their RCRA permits must calibrate scales quarterly to 5% or better accuracy.
- II. For a destruction facility that is part of an enclosed equipment de-manufacturing system, the following requirements apply:

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- A. FTIR must be used to determine the mass and composition of ODS or high-GWP blowing agent and:
- i. No more than one day prior to the commencement of the destruction event, conduct a check for calibration accuracy using a gas of known quality:
 - a. This check must demonstrate that the FTIR equipment is accurate to within +/- 1% relative to the reference gas;
 - ii. Conduct and record a daily zero validation of the FTIR equipment output;
 - iii. No more than one day prior to the end of the destruction event, conduct a check for calibration accuracy using a gas of known quality:
 - a. This check must demonstrate that the FTIR equipment is accurate to within +/- 1% relative to the reference gas
 - iv. The FTIR equipment must be calibrated by the manufacturer or a certified calibration service per manufacturer's specifications or every 5 years, whichever is more frequent. Instruments are exempted from calibration requirements if the manufacturer's specifications state that no calibration is required.
 - v. If a check on the FTIR equipment reveals accuracy less than +/- 1% threshold (reading relative to the reference gas), corrective action such as calibration by the manufacturer or a certified service provider is required for the FTIR equipment.
 - vi. If the check on the FTIR equipment reveals accuracy less than +/- 1% threshold during the check stipulated in Section 6.3 II A i, the destruction event may not commence until corrective action is performed and a subsequent check reveals accuracy within a +/-1% threshold
 - vii. If the check on the FTIR equipment reveals accuracy less than +/- 1% of threshold during the check stipulated in Section 6.3 II A iii, the mass and composition data from the FTIR equipment must be scaled per the following procedure. These adjustments must be made for the entire period from the check required in Section 6.3 II A i through to the end of the reporting period.
 - a. The project proponent shall calculate total emission reductions using:
 1. The monitored values without correction; and
 2. The monitored values adjusted based on the calibration drift recorded at the time of the check as required in Section 6.3 II A iii.
 - b. The lower of the two emission reduction estimates shall be reported as the emission reductions claimed for the reporting period.
- B. If a catalyst is used in the destruction process, maintenance procedures related to catalyst replacement, carbon filter cleaning or other system controls needed

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to ensure the required 99.99% destruction efficiency is maintained must be implemented in accordance with manufacturer’s guidance and specifications.

6.3 DOCUMENT RETENTION

- I. The project proponent is required to keep all documentation and information outlined in this methodology.
- II. Information that must be retained by the project proponent includes:
 - A. All data inputs for the calculation of the offset project emission reductions, including all required sampled data;
 - B. Copies of all regulatory permits, for project related collection, recovery, transportation, and destruction activities;
 - C. Destruction facility monitoring and maintenance information (destruction system monitoring data, DRE documentation, scale readings, calibration procedures, calibration checks and daily zero validations (if applicable), manufacturer guidance pertaining to facility or technology maintenance, and permits);
 - D. Chain of custody and sourcing documentation; and
 - E. ODS and high-GWP blowing agent composition and mass determinations (i.e., from laboratory reports or other procedures included in this Methodology).

6.4 MONITORING PARAMETERS: QUANTIFICATION METHODOLOGY

The project proponent must monitor the parameters described in Table 3.

Table 3: Project Monitoring Parameters – Quantification Methodology

EQUATION #	PARAMETER	DESCRIPTION	DATA UNIT	MEASUREMENT FREQUENCY	CALCULATED (C) MEASURED (M) REFERENCE (R) OPERATING RECORDS (O)	COMMENT
		Legal Requirement Test	N/A	For each off-set project		Must be monitored and determined for each project

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EQUATION #	PARAMETER	DESCRIPTION	DATA UNIT	MEASUREMENT FREQUENCY	CALCULATED (C) MEASURED (M) REFERENCE (R) OPERATING RECORDS (O)	COMMENT
		Mass of ODS (or ODS mixture) in each container	Mass of mixture	Per container	M	Must be determined for each container
		Concentration of ODS (or ODS mixture) in each container	Mass ODS / Mass of mixture	Per container	M	Must be determined for each container
		Mass of ODS destroyed in an enclosed equipment de-manufacturing system	Mass of mixture	Continuous	M	Readings taken and recorded every two minutes
		Concentration of ODS destroyed in an enclosed equipment de-manufacturing system	Concentration of ODS	Continuous	M	Readings taken and recorded every two minutes
		Mass of building foam used as source of ODS and high GWP blowing agent	Mass of building foam	For each off-set project	M	Must be monitored for each project
1	ER _t	Total quantity of GHG emission reductions during the reporting period	MT CO ₂ e	For each off-set project	C	
1 2	BE _t	Total quantity of baseline emissions during the reporting period	MT CO ₂ e	For each off-set project	C	

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EQUATION #	PARAMETER	DESCRIPTION	DATA UNIT	MEASUREMENT FREQUENCY	CALCULATED (C) MEASURED (M) REFERENCE (R) OPERATING RECORDS (O)	COMMENT
1 6	PE _t	Total quantity of project emissions during the reporting period	MT CO ₂ e	For each off-set project	C	
2 3	BE _{refr}	Total quantity of baseline emissions from refrigerant ODS	MT CO ₂ e	For each off-set project	C	
2 4 8	BE _{foam}	Total quantity of baseline emissions from high-GWP blowing agent	MT CO ₂ e	For each off-set project	C	
3 7	Q _{refr,i}	Total quantity of refrigerant ODS <i>i</i> sent for destruction	MT ODS	For each off-set project	M	
3	ER _{refr,i}	10-year cumulative emission rate of refrigerant ODS <i>i</i>	0 - 1.0	N/A	R	See Table 4
3 4	GWP _i	Global warming potential of ODS <i>i</i>	MT CO ₂ e/ MT ODS or MT BA	N/A	R	See Tables 4 and 5
4	EBA _i	Total quantity of high-GWP blowing agent <i>i</i> extracted from foam and destroyed	MT BA	For each off-set project	C	

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EQUATION #	PARAMETER	DESCRIPTION	DATA UNIT	MEASUREMENT FREQUENCY	CALCULATED (C) MEASURED (M) REFERENCE (R) OPERATING RECORDS (O)	COMMENT
4 5	$BA_{\text{intf},i}$	Total quantity of high-GWP blowing agent i in intact foam sent for destruction	MT BA	For each off-set project	C	
4	$ER_{i,j}$	10-year emission rate of high-GWP blowing agent i from application j	% (0-1)	N/A	R	See Table 5
5	$Q_{\text{intf},i}$	Total mass of intact foam, i , with entrained high-GWP blowing agent sent for destruction	MT	For each off-set project	M	
5	$BA\%_{\text{intf},i}$	Mass ratio of high-GWP blowing agent, i , entrained in intact foam	% (0-1)	For each off-set project	M	
6 7	Sub_{refr}	Total GHG emissions from substitute refrigerant	MT CO ₂ e	For each off-set project	C	
6 8	Rem_r	Total quantity of high-GWP blowing agent project baseline emissions from destruction of intact foam manually removed in a non-enclosed equipment de-	MT CO ₂ e	For each off-set project	C	

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EQUATION #	PARAMETER	DESCRIPTION	DATA UNIT	MEASUREMENT FREQUENCY	CALCULATED (C) MEASURED (M) REFERENCE (R) OPERATING RECORDS (O)	COMMENT
		manufacturing system				
8	Lfr	Default percentage of blowing agent that is lost in manual removal of intact foam in a non-enclosed equipment de-manufacturing system	% (0-1)	For each off-set project	R	Equal to 10% for foam removed in a non-enclosed equipment de-manufacturing system
69	Tr&Des _t	Total GHG emissions from ODS and high-GWP insulation foam/blowing agent transportation and destruction	MT CO ₂ e	For each off-set project	C	
7	SE _i	Emission factor for substitute emissions of refrigerant <i>i</i>	MT CO ₂ e/ MT ODS destroyed	Per container	R	See Tables 4
9	Q _{ODS}	Total quantity of refrigerant ODS sent for destruction	MT ODS	For each off-set project	M/C	
9	Q _{BA}	Total quantity of high-GWP blowing agent extracted from insulation foam	MT BA	For each off-set project	M/C	

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EQUATION #	PARAMETER	DESCRIPTION	DATA UNIT	MEASUREMENT FREQUENCY	CALCULATED (C) MEASURED (M) REFERENCE (R) OPERATING RECORDS (O)	COMMENT
		and sent for destruction in the project				
9	Q _{intf}	Total mass of intact foam, <i>i</i> , with entrained high-GWP blowing agent sent for destruction	MT	For each off-set project	M/C	
9	EF	Default emission factor for transportation and destruction of ODS or High-GWP Blowing Agent foam	MT CO ₂ e/ MT ODS/ MT BA or MT	N/A	R	Equal to 7.5 MT CO ₂ e per MT for refrigerant and blowing agent extracted from high-GWP foam Equal to 75 MT CO ₂ e per MT for intact foam projects

6.5 OTHER MONITORING REQUIREMENTS: QUANTIFICATION METHODOLOGY

This subchapter provides monitoring requirements in addition to the general requirements in subchapter 6.1.

- I. When transporting intact high-GWP insulation foam, all recovered foam pieces must be placed in air-tight and water-tight storage until arrival at the destruction facility.
- II. Projects using this Methodology to quantify emission reductions from extracted high-GWP foam blowing agent must meet all the following requirements:
 - A. The blowing agent must be extracted from the foam to a concentrated form prior to destruction.

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- B. The extraction must occur under negative pressure.
 - C. If the recovered blowing agent is not destroyed in an enclosed equipment de-manufacturing system, the recovered blowing agent must be collected, stored, and transported in containers meeting ISO standards for refrigerants and analyzed prior to destruction as specified in Appendix C.
 - D. The processes, training, QA/QC, and management systems relevant to the collection, storage, and transport of the blowing agent must be documented.
 - E. If the recovered blowing agent is destroyed in a destruction unit that is within an enclosed equipment de-manufacturing system, the blowing agent must be analyzed prior to destruction as specified in Appendix C.
- III. Projects destroying high-GWP blowing agent from intact foam must follow the procedures in Appendix B. The project proponent must collect and maintain documentation showing conformance with the procedures in Appendix B.
- IV. Projects destroying refrigerant ODS or extracted high-GWP foam blowing agent must follow the procedures in Appendix C. The project proponent must collect and maintain information showing conformance with the procedures in Appendix C.

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7 VERIFICATION REQUIREMENTS

- I. See the ACR Standard for guidance on project validation and verification requirements.
- II. An ODS or high-GWP insulation foam offset project requires only one site visit regardless of the number of destruction events within that reporting period.
- III. For the purpose of this Methodology, the site visit must include a visit to the destruction facility. The site visit may also include a visit to the project proponent's office(s) where all project-related documents and data were produced, managed, and retained. The site visit may also include a visit to any facility in the chain of custody, such as an aggregation facility or other source from which refrigerant was obtained.

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DEFINITIONS

If not explicitly defined here, the current definitions in the most recent version of the American Carbon Registry (ACR) Standard apply.

- Aggregation** The grouping together of multiple containers of ODS, high-GWP foam blowing agents, or high-GWP insulation foam into a single shipment or single container. Aggregation does not require the collected ODS to be combined into a single container. Multiple containers shipped together are considered an aggregate.
- Appliance Foam** Insulation foam in domestic appliances such as refrigerators and freezers, water heaters, and in commercial appliances such as refrigerator display cases and vending machines.
- Building Foam** Insulation foam used in roofing, flooring, or walls.
- Certificate of Destruction** An official document provided by the destruction facility certifying the date, mass, and species of ODS or high-GWP foam blowing agents destroyed.
- Container** An air-tight and water-tight unit for storing or transporting ODS, high-GWP foam blowing agents, or high-GWP insulation foam material without leakage or escape. Containers used in transporting project material must meet relevant ISO container standard requirements.
- Destruction** The destruction of ODS, high-GWP foam blowing agents, or high-GWP insulation foam by qualified destruction, transformation or conversion plants achieving greater than 99.99% destruction and removal efficiency (DRE), so that the destroyed ODS, high-GWP foam blowing agents, or high-GWP insulation foam are not emitted to the atmosphere. Destruction may be performed using any technology, including transformation, that results in the complete breakdown of ODS, high-GWP foam blowing agents, or high-GWP

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insulation foam into a waste product, a usable by-product, or end product.

Destruction facility

A facility that destroys, transforms, or converts ODS, high-GWP foam blowing agents, or high-GWP insulation foam and conforms with the description in either subchapter 2.1 I A or 2.1 I B in this Methodology.

Disqualified ODS, high-GWP foam blowing agents, or high-GWP insulation foam

ODS, high-GWP foam blowing agents, or high-GWP insulation foam that does not conform, or cannot be determined to conform, to the sourcing or chain of custody documentation requirements specified in chapter 6 of this Methodology and must be removed from baseline emission calculations pursuant to subchapter 5.3 in this Methodology.

Eligible ODS, high-GWP foam blowing agents, or high-GWP insulation foam

Those ODS, high-GWP foam blowing agents, or high-GWP insulation foam included in subchapter 2.2.1. or 2.2.2 in this Methodology.

Emission rate

The rate at which refrigerant, fire suppressant, medical aerosol, or foam blowing agent is released to the atmosphere.

Enclosed equipment de-manufacturing system

A system involving the disassembly and recycling of refrigerators and other appliances in which the cabinet, including insulation foam, is shredded and materials are recovered, measured, and destroyed in one or more enclosed, self-contained unit or units operating under negative pressure.

High-GWP Foam Blowing Agent

ODS or HFC entrained in insulation foam that was used in manufacture of the foam to provide insulation, structural and other performance properties. When reclaimed, ODS or HFC blowing agents have identical chemical properties as ODS or HFC refrigerants and may be sold and used as refrigerants. Unless they are reclaimed to virgin specifications, they cannot be sold on the market.

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Ineligible ODS	Those ODS, high-GWP foam blowing agents, or high-GWP insulation foam not included in subchapter 2.2.1 or 2.2.2 in this Methodology.
Intact foam	Insulation foam that is not shredded or compacted prior to destruction.
Mixed ODS or high-GWP foam blowing agent	Less than or equal to 90% composition of a single ODS or high-GWP foam blowing agent species.
Non-enclosed equipment de-manufacturing system	A system in which insulation foam in refrigerators and other appliances is removed manually in an open space that is not under negative pressure.
Non-mixed ODS or high-GWP foam blowing agent	Greater than 90% composition of a single ODS or high-GWP foam blowing agent species.
Other Foam	Insulation foam used in refrigerated transportation, marine applications (such as boats and buoys), walk-in cooling units, and pipe-in-pipe/preformed pipe applications.
Ozone Depleting Substances (ODS)	Substances known to deplete the stratospheric ozone layer. The ODS controlled under the Montreal Protocol and its Amendments are chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, methyl bromide (CH ₃ Br), carbon tetrachloride (CCl ₄), methyl chloroform (CH ₃ CCl ₃), hydrobromofluorocarbons (HBFC) and bromochloromethane (CHBrCl).
ODS or high-GWP foam blowing agent species	Any individual type of ODS or high-GWP foam blowing agent (e.g., CFC-11, CFC-113, HCFC-22, etc.).

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Refrigeration or air conditioning equipment	A refrigeration or air conditioning appliance or system used in any sector (including commercial, industrial, or residential).
Stockpile	ODS stored for future use or disposal in bulk quantities at a single facility. The ODS may be stored in multiple containers or a single 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 or may be used in new equipment or devices that fulfill the same market function.
Substitute emissions	GHG emitted from the use of substitute refrigerants in technologies that are used to replace the ODS destroyed in a project.
Transformation or Conversion	The breakdown of a substance into a waste product, a usable by-product, or end-product.

APPENDIX A: EMISSION FACTOR TABLES – QUANTIFICATION METHODOLOGY

Table 4: Parameters for ODS Refrigerants

ODS	100-YR GLOBAL WARMING POTENTIAL (MT CO ₂ E/MT ODS) (GWP ₁₀₀)	10-YEAR CUMULATIVE EMISSION RATE (%/10 YEARS) (ER _{REFR,10})	SUBSTITUTE EMISSIONS (MT CO ₂ E/MT ODS) (SE _i)
CFC-11	4,750	89%	223
CFC-12	10,900	95%	686
CFC-13	14,400	61%	7,144
CFC-113	6,130	89%	220
CFC-114	10,000	78%	659
CFC-115	7,370	61%	1,139
HCFC-22	1,810	72%	389

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Table 5: Parameters for High-GWP Foam Blowing Agents

HIGH-GWP BLOWING AGENT	100-YR GLOBAL WARMING POTENTIAL (MT CO ₂ E/MT ODS OR BA) (GWP ₁₀₀)	APPLIANCE HIGH-GWP BLOWING AGENT 10-YEAR EMISSION RATE (ER ₁₀)	BUILDING HIGH-GWP BLOWING AGENT 10-YEAR EMISSION RATE (ER ₁₀)	“OTHER FOAM” HIGH-GWP BLOWING AGENT 10-YEAR EMISSION RATE (ER ₁₀)
CFC-11	4,750	70%	88%	88%
CFC-12	10,900	n/a	88%	88%

Table 6: ODS Carbon Ratio and Density

ODS	CARBON RATIO (CR _i)	DENSITY (G/CM ³)
CFC-11	12/137	1.494
CFC-12	12/121	1.486
CFC-13	12/104	1.526
CFC-113	24/187	1.560
CFC-114	24/171	1.455
CFC-115	24/154	1.568

APPENDIX B: MASS AND COMPOSITION FROM INTACT HIGH-GWP FOAM PROJECTS – QUANTIFICATION METHODOLOGY

- I. Prior to destruction, the precise mass and composition of intact high-GWP foam must be determined following the procedures described in this appendix.
 - A. The foam's mass shall be determined on scales at the destruction facility. The scales must be calibrated at least quarterly with a demonstrated +/- 5% or better accuracy.
 - B. Prior to determining building foam mass, any construction debris (e.g., wood, metal, glass) or any other non-foam material shall be separated from the foam.
- II. To determine the composition and mass ratio of the high-GWP foam blowing agent(s) present in the intact foam, the following sampling requirements apply:
 - A. For foams removed from buildings, at least two samples per building surface (e.g., wall, roof) must be taken;
 - B. For foams removed from walk-in coolers or refrigerated transportation, one sample from each unit must be taken;
 - C. For foams removed from pipes or marine applications, one sample must be taken from one unit from which foam will be taken for purposes of destruction (i.e. for projects that will aggregate multiple pipe sections or multiple units from marine sources such as buoys, one sample is required for each source type).
 - D. The samples must conform to all the following requirements:
 - i. Each sample must be at least 2 inches in length, 2 inches in width, and 2 inches thick;
 - ii. For storage and transport, each sample must be placed and sealed in a separate air-tight and water-tight container that is at least 2 millimeters thick;
 - iii. The analysis of high-GWP foam blowing agent content and mass ratio shall be performed at an independent laboratory unaffiliated with the project proponent. The analysis shall be done using one of the two following methods: (1) ASTM Method D 7132-14 Standard Test Method for Determination of Retained Blowing Agent in Extruded Polystyrene Foam or (2) the heating method to extract ODS blowing agent from the foam samples described in

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Scheutz *et al.* (2007). The Scheutz method must include all the following steps:

- a. Each sample shall be prepared to a thickness no greater than 1 cm, placed in a 1123 mL glass bottle, weighed using a calibrated scale⁵, and sealed with Teflon-coated septa and aluminum caps;
 - b. To release the high-GWP blowing agent from the foam, the samples must be incubated in an oven for 48 hours at 140 degrees C;
 - c. When cooled to room temperature, gas samples must be redrawn from the headspace and analyzed by gas chromatography⁶;
 - 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, septa and caps must be replaced and the bottles subjected to a second 48-hr heating step to drive out the remaining high-GWP blowing agent from the sampled foam; and
 - e. When cooled down to room temperature after the second heating step, gas samples must be redrawn from the headspace and analyzed by gas chromatography⁸.
- E. The mass of high-GWP blowing agent(s) recovered shall then be divided by the total mass of the initial foam samples prior to analysis to determine the mass ratio of each high-GWP foam blowing agent present; and
- F. For foams removed from buildings, the results from all samples from a single building shall be averaged to determine the mass fraction of blowing agent in foam ($BA\%_{\text{intf},i}$) used in Equation 5.

⁵ The scale must be calibrated at least quarterly with a demonstrated +/- 1% or better accuracy

⁶ Room temperature is defined as a range between 20 and 25 degrees Celsius. Room temperature shall be recorded and documented at time of sampling.

APPENDIX C: MASS AND COMPOSITION FROM REFRIGERANT AND EXTRACTED HIGH-GWP FOAM BLOWING AGENT PROJECTS – QUANTIFICATION METHODOLOGY

Prior to destruction, the precise mass and composition of ODS refrigerant and extracted high-GWP blowing agent must be determined.

- I. For ODS and high-GWP blowing agent extracted into containers prior to destruction, the following analysis must be conducted:
 - A. Mass must be determined by individually measuring the mass of each container first when it is full prior to destruction and then after destruction is complete. The mass of ODS or high-GWP blowing agent and any contaminants is equal to the difference between the full and empty mass, as measured. To be eligible to receive ERTs, all the following requirements must be met when weighing the containers:
 - i. A single scale conforming with the requirements in (subchapter 6.3) of this Methodology must be used for generating both the full and empty mass tickets at the destruction facility;
 - ii. The full mass must be measured no more than 48 hours prior to commencement of destruction per the destruction system monitoring data, if available, or the Certificate of Destruction;
 - iii. The empty mass must be measured no more than 48 hours after the conclusion of destruction per the destruction system monitoring data, if available, or, the Certificate of Destruction; and

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- iv. Each single compartment, cylinder, drum, or any other eligible ODS or high-GWP blowing agent container that has been identified and destined for destruction must be weighed separately, sampled separately, and treated as a separate destruction event.
 - v. Recovery, collection, and aggregation activities may occur until the container has been identified and destined for destruction. After the ODS or high-GWP blowing agent container has been identified and destined for destruction, ODS or high-GWP blowing agent must not be added or removed, except for the purpose of sampling and analysis.
- B. The following procedures must be applied for the full and empty masses required within 48 hours of both the commencement and conclusion of destruction, pursuant to subsections I A ii and I A iii in Appendix C of this Methodology:
- i. For containers permanently affixed to a detachable trailer:
 - a. The trailer must be detached from its transportation vehicle, and the trailer must be weighed separately from its transportation vehicle;
 - b. Any accessories, such as spare tires or tire chains, or any part of the trailer's load other than the ODS or high-GWP blowing agent which are included in the trailer's full mass prior to ODS or high-GWP blowing agent destruction must be included in the trailer's empty mass after destruction; and
 - c. A container with a capacity over 1,000 pounds must be placed on the scale motionless for at least 3 minutes to allow the mass to stabilize before the mass measurement is recorded.
 - ii. For containers not permanently affixed to a truck or detachable trailer:
 - a. Each container may be weighed by placing it individually on the scale prescribed in subsection I A i in Appendix C of this Methodology; and;
 - b. A container with a capacity over 1,000 pounds must be placed on the scale motionless for at least 3 minutes to allow the mass to stabilize before the mass measurement is recorded.
 - iii. For containers weighed with the transportation vehicle included:
 - a. The driver and any other passengers must exit the vehicle such that their mass is not included;
 - b. Any accessories, such as spare tires or tire chains, or any part of the truck's load other than the ODS or high-GWP blowing agent which are included in the truck's full mass prior to ODS or high-GWP blowing agent destruction must be included in the truck's empty mass after destruction;

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- c. If more than 1,000 pounds of ODS or high-GWP blowing agent is being transported for destruction, then the truck must be situated motionless on the scale for at least 3 minutes to allow the mass to stabilize before the mass measurement is recorded.
 - d. The transportation vehicle's weight classification and load rating must be recorded;
 - e. The transportation vehicle's fuel capacity must be recorded. Its fuel level at the time of each scale recording must also be recorded. Fuel level must be recorded in an increment of one eighth of the fuel tank capacity. If the fuel level is in between two increments, the fuel level prior to ODS or high-GWP blowing agent destruction must be rounded down and the fuel level after ODS or high-GWP blowing agent destruction must be rounded up;
 - f. If the transportation vehicle's fuel level is lower after destruction than the fuel level before destruction, the difference in fuel mass must be subtracted, as applicable from $Q_{refr,i}$ in Equations 3 and 9, $EBA_{,i}$ and $BA_{intf,i}$ in Equation 5, Q_{aer} in Equations 6 and 11, $Q_{fs,i}$ in Equation 7 and Equation 12, and Q_{ODS} , Q_{BA} , and Q_{intf} in Equation 13. The following fuel densities shall be used to adjust for mass:
 - 7.0851 lb/gal for diesel; or
 - 6.0023 lb/gal for gasoline; and
 - g. If different transportation vehicles are used to transport containers to a destruction facility and to pick up the empty containers after destruction, each transport vehicle shall be weighed both upon its arrival and departure from the destruction facility. If the vehicle transporting the full ODS containers to the destruction facility weighs more than the vehicle carrying the empty ODS containers from the facility, the mass discrepancy must be subtracted, as applicable from $Q_{refr,i}$ in Equations 3 and 9, $EBA_{,i}$ and $BA_{intf,i}$ in Equation 5, Q_{aer} in Equations 6 and 11, $Q_{fs,i}$ in Equations 7 and Equation 12, and Q_{ODS} , Q_{BA} , and Q_{intf} in Equation 13.
- C. Composition and concentration of ODS or high-GWP blowing agent must be established for each individual container by taking a sample from each container of ODS or high-GWP blowing agent and having it analyzed for composition and concentration at an AHRI-certified laboratory, a laboratory accredited to ISO/IEC 17025, or a laboratory licensed and regulated by the federal government, and using the AHRI Standard 700 – Specifications for Refrigerants (AHRI 700). The laboratory performing the composition analysis must not be affiliated with the project proponent. All the following requirements must be met for each sample:

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- i. The sample must be taken while ODS or high-GWP blowing agent is in the possession of the company that will destroy the ODS or high-GWP blowing agent;
 - ii. Samples must be taken by a technician unaffiliated with the project proponent; if the destruction facility is the project proponent, an outside technician must perform this task;
 - iii. Samples must be taken with a clean, fully evacuated sample bottle that meets applicable DOT requirements with a minimum capacity of one pound;
 - iv. Each sample must be taken in liquid state;
 - v. A minimum sample size of one pound must be drawn for each sample;
 - vi. Each sample must be individually labeled and tracked according to the container from which it was taken, and all the following information recorded:
 - a. Time and date of sample;
 - b. Name of project proponent;
 - c. Name of technician taking sample;
 - d. Employer of technician taking sample;
 - e. Volume of container from which sample was extracted; and
 - f. Ambient air temperature at time of sampling; and
 - g. Chain of custody for each sample from the point of sampling to the AHRI-certified lab must be documented by paper bills of lading or electronic, third-party tracking that includes proof of delivery.
- D. All project samples shall be analyzed using AHRI 700 to confirm the mass percentage and identification of each component of the sample. The analysis shall provide:
- i. Identification of the ODS or high-GWP blowing agent;
 - ii. Purity (%) of the ODS or high-GWP blowing agent mixture by mass using gas chromatography;
 - iii. Moisture level in parts per million. The moisture content of each sample must be less than 75% of the saturation point for the ODS or high-GWP blowing agent based on the temperature recorded at the time the sample was taken;
 - a. For non-mixed ODS or high-GWP blowing agent, the saturation point is the saturation point of the major ODS or high-GWP blowing agent species;
 - b. For mixed ODS or high-GWP blowing agent, the saturation point is the lowest saturation value of any species that makes up at least 10% of the composition;

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- iv. Analysis of HBR, which must be less than 10% by mass; and
 - v. Analysis of other ODS or high-GWP blowing agent in the case of mixtures of ODS or high-GWP blowing agent, and their percentage by mass.
- E. If any of the requirements in sections I A through I C of this appendix are not met, no GHG reductions may be verified for ODS or high-GWP blowing agent destruction associated with that container.
- F. If a container holds non-mixed ODS or high-GWP blowing agent, no further information or sampling is required to determine the mass and composition of the ODS or high-GWP blowing agent. For non-mixed ODS or high-GWP blowing agent, the analysis conducted for the sample taken at the destruction facility must be used for quantifying GHG emissions.
- G. If the container holds mixed ODS or high-GWP blowing agent, the project proponent must meet all the following additional requirements:
- i. The required sampling may be conducted at the final destruction facility or prior to delivery to the destruction facility;
 - ii. Circulation and sampling activities must be conducted by a contracted third-party and by individuals who have been properly trained for the functions they perform;
 - iii. The offset project documentation must specify the procedures by which mixed ODS or high-GWP blowing agent are analyzed;
 - iv. Prior to sampling, the ODS or high-GWP blowing agent mixture must be circulated in a single container or two connected containers that meet all the following criteria:
 - a. The containers have no solid interior obstructions;
 - b. The containers were fully evacuated prior to filling;
 - c. The containers must have sampling ports to sample liquid and gas phase ODS or high-GWP blowing agent;
 - d. The sampling ports must be located in the middle third of all of the containers (i.e., not at one end or the other); and
 - e. The containers and associated equipment can circulate the mixture via a closed loop system from the bottom to top for a single container, or from the bottom of one tank to the top of another tank if two connected containers are used.
 - v. If the original mixed ODS or high-GWP blowing agent container or two connected containers do not meet these requirements, the mixed ODS or high-GWP blowing agent must be transferred into a temporary holding tank or container or two connected containers that meet all the above criteria. The

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- mass of the contents placed into the temporary container or two connected containers shall be calculated and recorded. During transfer of ODS or high-GWP blowing agent into and out of the temporary container or two connected containers, ODS or high-GWP blowing agent shall be recovered to the vacuum levels required by the U.S. EPA for that ODS or high-GWP blowing agent (see 40 CFR 82.156);
- vi. Once the mixed ODS or high-GWP blowing agent is in a container, two connected containers, or temporary storage unit that meets the criteria above, circulation of mixed ODS or high-GWP blowing agent must be conducted as follows:
 - a. Liquid mixture shall be circulated from the liquid port to the vapor port for a single container, or from the liquid port of one tank into the vapor port for another tank if two connected containers are used;
 - b. A volume of the mixture equal to two times the volume in the container shall be circulated;
 - c. Calculations converting between mass and volume shall use the densities provided in Table 8; if converting between mass and volume, the mixed ODS or high-GWP blowing agent must be in a liquid state;
 - d. Circulation must occur at a rate of at least 30 gallons/minute; and
 - e. Start and end times shall be recorded;
 - vii. Within 30 minutes of the completion of circulation, a minimum of two samples shall be taken from the bottom liquid port for a single container, or minimum of two samples must be taken from the liquid port of each tank if two connected tanks are used and both samples must be analyzed at an AHRI-certified laboratory; and
 - viii. The project proponent must calculate the project GHG emission reductions using both sample results, and choose the sample resulting in the lower project emission reductions.
- II. Refrigerant and extracted high-GWP blowing agents destroyed in enclosed equipment de-manufacturing systems shall be analyzed using FTIR. FTIR shall be used to determine the mass and composition of each ODS refrigerant and extracted high-GWP blowing agent destroyed.

APPENDIX D: INTERNATIONAL ODS DESTRUCTION AND HCFC-22 ELIGIBILITY

The destruction of ODS refrigerants and high GWP insulation foams is an important strategy to combat climate change. In the United States, incentive programs for the destruction of ODS refrigerants and high GWP insulation foams have been in existence for over 10 years in various forms. Currently, most of the ODS destruction that is eligible for carbon offset credits in the United States occurs under the California cap and trade program where ODS destruction credits are eligible. However, the California ODS destruction methodology and the ACR ODS destruction methodology (for use in ACR's voluntary offset program) both restrict the source eligibility to the United States and its territories.

Moving forward, the majority of recoverable ODS refrigerant and high GWP insulation foam is likely to originate in countries other than the United States. In fact, in its recent report on ODS destruction, ICF concludes that the majority of recoverable ODS refrigerant will originate from Montreal Protocol Article 5 countries⁷.

This methodology includes the requirements that must be followed in order to earn carbon offset credits for destruction of ODS refrigerant and high GWP insulation foam that is recovered from non-U.S. sources. An important component of the methodology is the performance standard for additionality. This appendix provides additional information on ODS destruction in an international context and describes the approach for HCFC-22 eligibility adopted in the methodology.

A.1 INTERNATIONAL ODS DESTRUCTION

While the Montreal Protocol established a global ban on the production and manufacture of CFC refrigerants (except for some limited production for essential or critical uses otherwise approved by the Parties), it did not provide for the destruction or elimination of existing supplies of ODS refrigerants. ODS, for instance, may still be used in chillers, air conditioners, and other refrigeration systems and are still prevalent and randomly dis-

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tributed throughout the world – both in operating equipment manufactured before deadlines to cease production, and on the shelves of repair contractors and others who own or operate older refrigeration or cooling equipment.

These ODS are at risk of being released into the atmosphere during operation and maintenance or at end of product life, or from untended, rusting or leaking cans, cylinders and other containers. Few if any mandates exist to destroy ODS refrigerants at end of life. Moreover, few if any incentive programs exist to encourage or help defray the otherwise prohibitive cost to aggregate, collect, and destroy these substances. Indeed, even if funds were available, in many parts of the world there is limited or no access to disposal options that prevent the release of ODS to the atmosphere, let alone provide for its destruction.

There are numerous reports identifying efforts to fund pilot projects or establish national product stewardship schemes, taxes and levies to incentivize the destruction of ODS refrigerants around the world. The small number of successful programs from among this list, and their limited reach, prove that business as usual is the release of ODS into the atmosphere. By way of example:

- Australia has a product stewardship scheme operated as a rebate program by the non-profit, Refrigerant Reclaim Australia (RRA) under a government mandate for the collection and destruction of unwanted ODS refrigerant. The program is open to all refrigeration and air conditioning sectors (i.e., commercial, industrial, automotive, household appliances, etc.); however, the rebate offered by RRA inherently incentivizes the recovery of refrigerant from larger systems and there is a notable void in the responsible management of small quantities of ODS refrigerant recovered from household appliances and vehicle end-of-life (ICF, 2008, p67). RRA estimates based on 2014 – 2015 collection data (available on their website) that their program accepted between 15 – 20 percent of all refrigerants available for recovery from automotive, commercial, industrial, and household refrigeration and air conditioning equipment and appliances in Australia. The majority of the remaining refrigerant is recovered for reuse by the technicians and contractors servicing the equipment. There is no nationwide program for recovering ODS refrigerant from vehicles or household appliances at end-of-life. Additionally, the RRA program does not include sources of ODS refrigerant beyond what is recovered by service technicians and contractors in recovery cylinders, i.e., unused or otherwise saleable quantities of ODS refrigerant remain on the market or stored in stockpiles.
- The Canadian product stewardship scheme is operated by the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) as a voluntary industry-led program. The program does not provide a rebate, but it does accept ODS refrigerant

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erant recovered from commercial/industrial stationary refrigeration and air conditioning equipment as well as household window air conditioners on a no-fee basis. Other recovered ODS refrigerant in small quantities from the household appliance and automotive sectors requires a disposal fee, and thus does not directly benefit from the incentive program. As such, program participation is primarily seen from the commercial/industrial stationary refrigeration and air conditioning industry. According to the 2008 ICF report, 95 percent of the commercial stationary refrigeration and air conditioning industry participates in the voluntary program. As in Australia, the HRAI program does not include ODS refrigerant beyond what is recovered by service technicians and contractors, i.e., unused or otherwise saleable quantities of ODS refrigerant remain on the market or stored in stockpiles.

- An industry-led program in Japan provides ODS refrigerant recovery, recycling, and/or destruction. ODS refrigerants are recovered from household appliances and vehicles at end-of-life as well as from the commercial refrigeration and air conditioning service sector. The costs associated with the program are shared by equipment manufacturers, importers, and consumers. In 2015 approximately 965 metric tonnes of ODS refrigerants were recycled and another 4,800 metric tonnes were destroyed (with ODS refrigerants making up a small portion of both) (OFCP, 2016).
- A voluntary product stewardship scheme is also in place in New Zealand. The program collects CFCs, HCFCs, HFCs, and other synthetic refrigerants from the refrigeration and air conditioning industries. The program is operated by a charitable trust that is funded through a wholesale levy placed on imported refrigerant and paid by participating companies. Unwanted refrigerant is collected from industry participants at no charge, aggregated at one of three collection depots, and shipped overseas for destruction. Since 1999 more than 347 metric tonnes of refrigerants have been collected and destroyed by the program. (Recovery, 2016)

There are essential distinctions between the project activities described in this methodology and the ODS refrigerant destruction programs established in Australia, Canada, Japan, and New Zealand. For one, none of these existing programs readily facilitate the collection of small quantity ODS refrigerants, such as that recovered from household appliances or vehicles, or widely dispersed in disposable cylinders and cans. Nor do the programs prevent the continued use and reuse of ODS refrigerant as an alternative to destruction.

A.2 ADDITIONALITY OF HCFC-22 DESTRUCTION

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The case for including HCFC-22 in this Methodology is no different than the case for other ODS. While the parties to the Montreal Protocol have agreed to a global phase down and ultimate prohibition on production of HCFC-22, the Montreal Protocol does not provide for the destruction or elimination of HCFC-22 at end of life. Consequently, under business as usual, all HCFC-22 that has been or will be produced will ultimately leak into the atmosphere, either directly from equipment, after recovery and re-use in leaky equipment, or from cans, cylinders and containers circulating through commerce or stockpiled in warehouses and commercial establishments.

The only question regarding additionality is whether allowing for the destruction of HCFC-22 during the phase down period – as opposed to waiting for the global ban on production – would trigger the production of additional HCFC-22 during the phase down period that would otherwise not have been produced, or to increase importation of ODS due to a lack of supply stemming from destruction.

This Methodology guards against this risk by limiting eligible HCFC-22 to countries that have either banned the importation and production of HCFC-22, or set published absolute, and enforceable quotas on the importation and production of HCFC-22, and certain additional conditions are present to ensure that nobody will import or produce additional HCFC-22 solely for the purpose of inclusion in a carbon offset project. See Appendix E for further discussion.

APPENDIX E: PREVENTING PERVERSE INCENTIVES

The Montreal Protocol has proven wildly effective at phasing out the production of ODS. It does not, however, address end of life solutions for ODS that have already been produced and distributed throughout the world. ODS manufactured and sold prior to applicable production bans, including HCFC-22 that is being produced during the current phase out period, will only be collected and destroyed at end of life, instead of released into the atmosphere, if new legislation is adopted – or if thoughtful and rigorous carbon offset methodologies are developed. This methodology is designed to support these efforts and accelerate the phase out of HCFCs by facilitating their destruction effective immediately.

Importantly, this methodology has been specifically designed to ensure that it does not unintentionally create an incentive to produce additional HCFC-22 solely for the purpose of destroying it to generate revenue from the sale of carbon offset credits.

As widely reported, the Clean Development Mechanism's HFC-23 carbon offset protocol (AM0001 Incineration of HFC 23 Waste Streams) created an unintended perverse incentive whereby producers of refrigerant benefitted financially by manufacturing additional HCFC-22 for the sole purpose of destroying the HFC-23 byproduct and generating carbon credits. By contrast, this methodology adopts the following provisions that work in combination to make HCFC-22 eligible for destruction only if sourced from countries in which production and importation bans and quotas work together to ensure that the destruction is additional to the business as usual scenario.

1. Under Section 2.2.1 III., no refrigerant can be sourced from a country unless that country has an enforceable limit on the amount of HCFC-22 that can be produced and/or imported. The limit can be a ban or a quota, but in either event, this requirement ensures that any refrigerant generated above and beyond the established, enforceable limit, will be unlawful.
2. Under Section 2.2.1 III. A. and B., HCFC-22 refrigerant can be sourced from countries that have quotas in place (as opposed to bans) only where one of the following additional conditions is present:
 - a. In the business as usual scenario, as defined as the two years prior to the date that HCFC-22 for use in the project is first obtained by the project

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- proponent, the country is already importing and/or producing up to 95% or more of the quota, ensuring that the initiation of a carbon offset project will not increase in any significant way the amount of HCFC-22 that can be produced or imported under the quota.
- b. There are additional rules or regulations in place, beyond the quotas, that ensure a country importing and/or producing less refrigerant than allowed under a quota cannot increase the levels of importation and/or production in a subsequent year, preventing a carbon offset project from leading to an increase in production or importation.⁸
 - c. The project proponent can sufficiently demonstrate that the HCFC-22 was manufactured prior to the date of adoption of version 1.0 of this methodology, guaranteeing that no additional production occurred as a result of this methodology.
 - d. The material is obtained by the project proponent while “in the stream of commerce,” ensuring that the original manufacturer or producer or importer of the refrigerant had a separate, independent commercial reason to sell the HCFC-22 to a third-party prior to a project proponent obtaining the refrigerant. In order to use this option, neither option a., b., or c. may apply and additional requirements regarding the quantified total mass of imported and produced (if applicable) HCFC-22 shall apply. The documentation requirements for refrigerant sources in Section 6.1 further ensures that any verifier will have a paper trail sufficient, when appropriate, to investigate the source of refrigerant.

⁸ Costa Rica is an illustration of the latter scenario in that, an importer who imports less than the full amount of his quota in Year 1 (e.g. 80%) has his quota capped in Year 2 at the actual amount he imported in Year 1 (e.g. 80% of the Year 1 quota). See Reglamento para implementar un mecanismo de cuotas de importación para la eliminación gradual el uso de limitados en el grupo del Anexo C del protocolo de Montreal. [N° 37614-MINAET](#).

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