



California Environmental Protection Agency

AIR RESOURCES BOARD

**Compliance Offset Protocol
Ozone Depleting
Substances Projects**

Destruction of U.S.
Ozone Depleting Substances Banks

Adopted: November 14, 2014

Note: All text is new. As permitted by title 2, California Code of Regulations, section 8, for ease of review, underline to indicate adoption has been omitted.

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Chapter 1. Purpose and Definitions

1.1. Purpose.

- (a) The purpose of the Compliance Offset Protocol Ozone Depleting Substances Projects (protocol) is to quantify greenhouse gas emission reductions associated with the destruction of high global warming potential ozone depleting substances sourced from and destroyed within the United States that would have otherwise been released to the atmosphere. This project category includes ODS used in both foam blowing agent and in refrigeration or air conditioning equipment.
- (b) AB 32 exempts quantification methodologies from the Administrative Procedure Act;¹ however, those elements of the protocol are still regulatory. The exemption allows future updates to the quantification methodologies to be made through a public review and Board adoption process but without the need for rulemaking documents. Each protocol identifies sections that are considered quantification methodologies and exempt from APA requirements. Any changes to the non-quantification elements of the offset protocols would be considered a regulatory update subject to the full regulatory development process. Those sections that are considered to be a quantification methodology are clearly indicated in the title of the chapter or subchapter if only a portion of that chapter is considered part of the quantification methodology of the protocol.

1.2. Definitions.

- (a) For the purposes of this protocol, the following definitions apply:
 - (1) “Aggregation” means the grouping together of multiple containers of ODS 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.
 - (2) “Cap-and-Trade Regulation” or “Regulation” means ARB’s regulation establishing the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms set forth in title 17, California

¹ Health and Safety Code section 38571

Code of Regulations, chapter 1, subchapter 10, article 5 (commencing with section 95800).

- (3) “Certificate of Destruction” means an official document provided by the destruction facility certifying the date, mass, and species of ODS destroyed.
- (4) “Container” means an air-tight and water-tight unit for storing or transporting ODS material without leakage or escape of ODS. Containers used in transporting ODS material must comply with all applicable U.S. Department of Transportation (DOT) requirements.
- (5) “Destruction” means the destruction of ODS by qualified destruction, transformation or conversion plants achieving greater than 99.99% destruction and removal efficiency, so that the destroyed ODS are not emitted to the atmosphere. Destruction may be performed using any technology, including transformation, that results in the complete breakdown of ODS into a waste product, a usable by-product, or end-product.
- (6) “Destruction facility” means a facility that destroys, transforms, or converts ODS and conforms with the description in either subchapter 2.1(a)(1) or 2.1(a)(2) in this protocol.
- (7) “Disqualified ODS” means ODS that does not conform, or cannot be determined to conform, to the point of origin or chain of custody documentation requirements specified in chapter 6 of this protocol and must be removed from baseline emission calculations pursuant to subchapter 5.3 in this protocol.
- (8) “Eligible ODS” means those ODS included in subchapter 2.2.1.(b) and subchapter 2.2.2.(b) in this protocol.
- (9) “Emission rate” means the rate at which refrigerant is lost to the atmosphere, including emissions from leaks during operation and servicing events.
- (10) “Ineligible ODS” means those ODS not included in subchapter 2.2.1.(b) or subchapter 2.2.2.(b) in this protocol.

- (11) “Intermediate Aggregation Facility” means a transitional facility for eligible ODS to be stored, aggregated, and processed in between a point of origin and the destruction facility.
- (12) “Mixed ODS” means less than or equal to 90% composition of a single ODS species.
- (13) “Non-mixed ODS” means greater than 90% composition of a single ODS species.
- (14) “Ozone Depleting Substances” or “ODS” means substances known to deplete the stratospheric ozone layer. The ODS controlled under the Montreal Protocol and its Amendments are chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC), halons, methyl bromide (CH₃Br), carbon tetrachloride (CCl₄), methyl chloroform (CH₃CCl₃), hydrobromofluorocarbons (HBFC) and bromochloromethane (CHBrCl).
- (15) “ODS blowing agent” means ODS entrained in insulation foam that was used in manufacture of the foam to provide insulation, structural, and other performance properties.
- (16) “ODS species” means any individual type of ODS (e.g., CFC-11, CFC-113, HCFC-22).
- (17) “Recovery efficiency” means the percent of total ODS blowing agent that is recovered during the process of ODS blowing agent extraction.
- (18) “Refrigeration or air conditioning equipment” means a refrigeration or air conditioning appliance or system used in any sector (including commercial, industrial, or residential).
- (19) “Registry offset credits” means the offset credits defined in section 95802 of the Regulation and whose issuance is described in section 95980 and section 95980.1 of the Regulation.
- (20) “Startup, shutdown, and malfunction plan” or “SSMP” means a plan, as specified under 40 CFR 63.1206, that includes a description of potential causes of malfunctions, including releases from emergency safety vents, that may result in significant releases of hazardous air pollutants, and

actions the source is taking to minimize the frequency and severity of those malfunctions.

- (21) "Stockpile" means 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.
 - (22) "Substitute refrigerant" means those refrigerants that will be used to fulfill the function that would have been filled by the destroyed ODS refrigerants. These refrigerants may be drop-in replacements used in refrigeration or air conditioning equipment that previously used the ODS species destroyed or may be used in new equipment that fulfills the same market function.
 - (23) "Substitute emissions" means a term used in this protocol to describe the GHG emitted from the use of substitute refrigerants in technologies that are used to replace the ODS destroyed in a project.
 - (24) "Transformation" or "conversion" means the breakdown of a substance into a waste product, a usable by-product, or end-product.
- (b) For terms not defined in subchapter 1.2(a), the definitions in section 95802 of the Regulation apply.
- (c) Acronyms. For purposes of this protocol, the following acronyms apply:
- (1) "AB 32" means the California Global Warming Solutions Act of 2006.
 - (2) "AHRI" means Air-Conditioning, Heating and Refrigeration Institute.
 - (3) "APA" means California's Administrative Procedure Act.
 - (4) "ARB" means the California Air Resources Board.
 - (5) "CAA" means Clean Air Act.
 - (6) "CEMS" means continuous emissions monitoring system.
 - (7) "CFC" means chlorofluorocarbons.
 - (8) "CH₄" means methane.
 - (9) "CITSS" means Compliance Instrument Tracking System Service.
 - (10) "CO₂" means carbon dioxide.
 - (11) "CO₂e" means carbon dioxide equivalent.
 - (12) "DOT" means U.S. Department of Transportation.

- (13) "DRE" means destruction and removal efficiency.
- (14) "GHG" means greenhouse gas.
- (15) "GWP" means global warming potential.
- (16) "HBFC" means hydrobromofluorocarbons.
- (17) "HBR" means high boiling residue.
- (18) "HCFC" means hydrochlorofluorocarbons.
- (19) "HFC" means hydrofluorocarbons.
- (20) "HWC" means hazardous waste combustor.
- (21) "ID" means identification.
- (22) "kg" means kilogram.
- (23) "lb" means pound.
- (24) "mt" means metric ton.
- (25) "MWh" means megawatt hour.
- (26) "NESHAP" means National Emissions Standards for Hazardous Air Pollutants.
- (27) "N₂O" means nitrous oxide.
- (28) "ODS" means ozone depleting substances.
- (29) "PU" means polyurethane.
- (30) "QA/QC" means quality assurance and quality control.
- (31) "RCRA" means Resource Conservation and Recovery Act.
- (32) "SSMP" means startup, shutdown, and malfunction plan.
- (33) "SSR" means GHG sources, GHG sinks, and GHG reservoirs.
- (34) "TEAP" means Technology & Economic Assessment Panel.
- (35) "UN" means United Nations.
- (36) "U.S." means United States.
- (37) "U.S. EPA" means United States Environmental Protection Agency.

Chapter 2. Eligible Activities – Quantification Methodology

This protocol defines a set of activities designed to reduce GHG emissions by the destruction of eligible ODS at a single qualifying destruction facility.

2.1. Eligible Destruction Facilities

- (a) The end fate of the ODS must be destruction at either:
 - (1) 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%; or
 - (2) 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*.
 - (A) A facility must demonstrate DRE of 99.99% and emission levels consistent with the guidelines set forth in the TEAP report.
 - (B) A facility must have been certified by a third party no more than three years prior to the offset project commencement date and must show that it maintains its operational status as stated in the certification.
- (b) A destruction facility must meet any applicable requirements under CAA and NESHAP standards, as well as all applicable federal, state, and local laws.
- (c) At the time of ODS destruction the destruction facility must have a valid Title V air permit, if applicable, and any other air or water permits required by local, state or federal law to destroy ODS and document compliance with all monitoring and operational requirements.
- (d) Any upsets or exceedances must be managed in accordance with an authorized SSMP.

2.2. Eligible ODS

- (a) ODS destroyed under this protocol must be from one or more of the eligible sources listed below:
 - (1) Refrigerants from industrial, commercial or residential equipment, systems, and appliances or stockpiles;
 - (2) ODS blowing agents extracted and concentrated from appliance foams; or
 - (3) Intact foam sourced from building insulation.

- (b) ODS refrigerants and ODS blowing agents extracted and concentrated from appliance foams may not be combined within the same container.
- (c) ODS produced or used as solvents, medical aerosols, or applications not listed above are not eligible.
- (d) A single offset project may incorporate ODS obtained from one or more of the ODS source categories in subchapter 2.2(a).
- (e) Destruction activity must take place under one or more Certificates of Destruction.
- (f) All of the following conditions must be met for multiple Certificates of Destruction to be eligible as a single project:
 - (1) The Offset Project Operator and, if applicable, Authorized Project Designee are the same for all ODS destroyed;
 - (2) All ODS destroyed must be at the same eligible destruction facility; and
 - (3) The destruction activities must occur during one reporting period.
- (g) A Certificate of Destruction may be used for only one offset project.
- (h) Each Certificate of Destruction must be issued by the qualifying destruction facility and must include the following information:
 - (1) Offset Project Operator or Authorized Project Designee;
 - (2) Destruction facility;
 - (3) Certificate of destruction ID number;
 - (4) Serial, tracking, or ID number of all containers for which ODS destruction occurred;
 - (5) Weight and type of material destroyed from each container; and
 - (6) Start and end destruction dates.
- (i) The ODS destroyed may originate from a single source or from numerous sources.
- (j) The handling, recovery, and disposal of ODS refrigerants must be performed by technicians certified by the U.S. EPA under CAA, sections 608 and 609, as applicable. Technicians may only service refrigeration or air conditioning equipment they are certified to service. Technician name and certification type(s)

must be retained as part of the documentation retention requirements of this protocol and the Regulation.

2.2.1. Refrigerant Sources

- (a) Eligible refrigerants must originate from domestic U.S. supplies. Imported refrigerant is not eligible under this protocol.
- (b) Only destruction of the following ODS refrigerants is eligible to generate ARB or registry offset credits under this protocol:
 - (1) CFC-11;
 - (2) CFC-12;
 - (3) CFC-13;
 - (4) CFC-113;
 - (5) CFC-114; and
 - (6) CFC-115.
- (c) ODS extracted from a foam source for use in refrigeration equipment is not part of this source category and must be considered as a foam source.
- (d) ODS sourced from federal government installations or stockpiles is not eligible under this protocol.

2.2.2. Foam Sources

- (a) Eligible ODS foam blowing agent must originate from U.S. foam sources. Imported foams are not eligible under this protocol.
- (b) Only the destruction of the following ODS foam blowing agents are eligible to generate ARB or registry offset credits under this protocol:
 - (1) CFC-11;
 - (2) CFC-12;
 - (3) HCFC-22; and
 - (4) HCFC-141b.
- (c) The only foam sources eligible under this protocol are building and appliance insulation foams. Other sources, such as transport refrigeration units, are not eligible.

- (d) To be eligible to generate ARB or registry offset credits, the ODS blowing agent must be destroyed in one of two ways:
 - (1) The ODS blowing agent must be extracted from the foam under negative pressure and collected, stored, and transported in hermetically sealed containers; or
 - (2) Intact foam must be separated from the building panels and must be stored, transported, and destroyed in sealed containers.

Chapter 3. Eligibility

Ozone depleting substances offset projects must adhere to the eligibility requirements below, in addition to the offset project eligibility criteria and regulatory program requirements set forth in subarticle 13 of the Regulation.

3.1. General Eligibility Requirements

- (a) Offset projects that use this protocol must:
 - (1) Collect and destroy ODS that would otherwise be emitted to the atmosphere;
 - (2) Destroy the recovered ODS through an eligible end-use management option pursuant to subchapter 2.1 of this protocol;
 - (3) Conform with the point of origin documentation requirements, as specified in chapter 6 of this protocol; and
 - (4) Conform to the chain of custody documentation requirements, as specified in chapter 6 of this protocol.
- (b) An Offset Project Operator or Authorized Project Designee that uses this protocol must:
 - (1) Provide the listing information required by section 95975 of the Regulation and subchapter 7.1 of this protocol;
 - (2) Monitor SSRs within the GHG Assessment Boundary as delineated in chapter 4 pursuant to the requirements of chapter 6 in this protocol;
 - (3) Quantify GHG emission reductions pursuant to chapter 5 of this protocol;

- (4) Prepare and submit an Offset Project Data Report (OPDR) in accordance with section 95976 of the Regulation and subchapter 7.2 of this protocol; and
- (5) Obtain offset verification services from an ARB-accredited offset verification body in accordance with section 95977 of the Regulation and chapter 8 of this protocol.

3.2. Location

- (a) Only projects located in the United States or its territories are eligible under this protocol.
- (b) All ODS must be sourced from stocks in the United States or its territories.
- (c) All ODS must be destroyed within the United States or its territories.
- (d) Offset projects situated on the following categories of land are only eligible under this protocol if they meet the requirements of this protocol and the Regulation, including the waiver of sovereign immunity requirements of section 95975(l) of the Regulation:
 - (1) Land that is owned by, or subject to an ownership or possessory interest of a Tribe;
 - (2) Land that is “Indian lands” of a Tribe, as defined by 25 U.S.C. §81(a)(1); or
 - (3) Land that is owned by any person, entity, or Tribe, within the external borders of such Indian lands.

3.3. Offset Project Operator or Authorized Project Designee

- (a) The Offset Project Operator or Authorized Project Designee is responsible for project listing, monitoring, reporting, and verification.
- (b) The Offset Project Operator or Authorized Project Designee must submit the information required by subarticle 13 of the Regulation and in chapter 7 of this protocol.
- (c) The Offset Project Operator must have legal authority to implement the offset project.

3.4. Additionality

Offset projects must meet the additionality requirements of section 95973(a)(2) of the Regulation, in addition to the requirements in this protocol. 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 3.4.1 and the Performance Standard Evaluation in subchapter 3.4.2 of this protocol.

3.4.1. Legal Requirement Test

- (a) Emission reductions achieved by a project using this protocol must exceed those required by any law, regulation, or legally binding mandate, as required in sections 95973(a)(2)(A) and 95975(n) of the Regulation.
- (b) The following legal requirement test applies to all ODS projects:
 - (1) If no law, regulation, or legally binding mandate requires the destruction of ODS stocks, all emission reductions resulting from the recovery and destruction of ODS are considered to not be legally required, and therefore eligible for crediting under this protocol.
 - (2) If any law, regulation, or legally binding mandate requires the destruction of ODS stocks, only emission reductions resulting from the recovery and destruction of ODS that are in excess of what is required to comply with those laws, regulations, and legally binding mandates are eligible for crediting under this protocol.

3.4.2. Performance Standard Evaluation

- (a) Emission reductions achieved by a project using this protocol must exceed those likely to occur in a conservative business-as-usual scenario.
- (b) The destruction of ODS sourced from the U.S. government is ineligible for crediting under this protocol.
- (c) The performance standard evaluation is satisfied if the ODS project activities meet the project definition and all other eligibility requirements in the protocol.

3.5. Offset Project Commencement

- (a) For this protocol, offset project commencement is defined as the date on which the earliest destruction activity of a project commences, as documented on a Certificate of Destruction.
- (b) Offset project activities will occur prior to offset project commencement.
- (c) Pursuant to section 95973(a)(2)(B) of the Regulation, compliance offset projects must have an offset project commencement date after December 31, 2006.

3.6. Offset Project Reporting Period

- (a) An ODS project can only have a single reporting period.
- (b) Multiple destruction events may be combined within a single reporting period subject to the requirements in subchapter 2.2.(e) of this protocol.
- (c) The reporting period must not exceed 12 consecutive months. The Offset Project Operator or Authorized Project Designee may choose a reporting period shorter than 12 consecutive months.
- (d) The offset project reporting period begins on the offset project commencement date.

3.7. Offset Project Crediting Period

- (a) The offset project crediting period is the period of time over which emission reductions are quantified for the purpose of determining creditable GHG reductions.
- (b) The offset project crediting period for this protocol is ten years.
- (c) The offset project crediting period begins on the offset project commencement date.

3.8. Regulatory Compliance

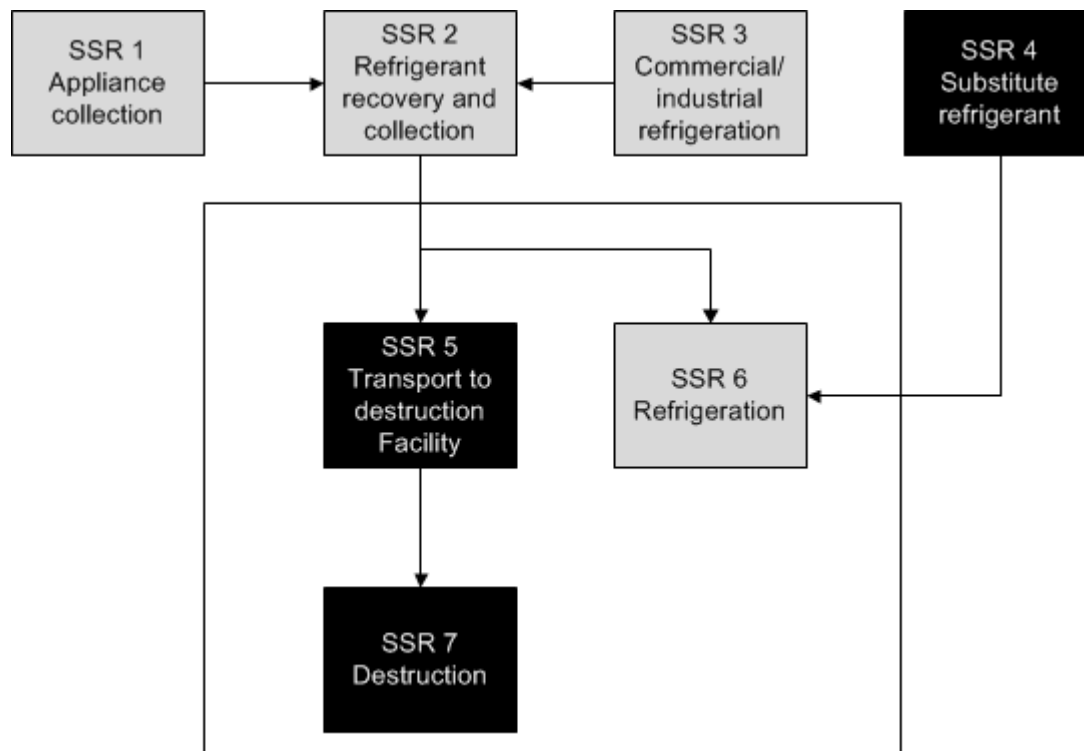
- (a) An offset project must meet the regulatory compliance requirements set forth in section 95973(b) of the Regulation.
- (b) The regulatory compliance requirements for a project apply to the collection, recovery, storage, transportation, mixing, and destruction of ODS, including disposal of the associated post-destruction waste products. The regulatory

compliance requirements extend to the destruction facility during the time ODS destruction occurs.

Chapter 4. Offset Project Boundary – Quantification Methodology

- (a) 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.
- (b) Figure 4.1 illustrates the GHG assessment boundary for refrigerant ODS projects.
 - (1) All SSRs within the bold line are included and must be accounted for under this protocol.
 - (2) SSRs in lightly shaded boxes are relevant to the baseline and project emissions.
 - (3) SSRs in darkly shaded boxes are relevant only to project emissions.

Figure 4.1: Illustration of the Offset Project Boundary for Refrigerant Projects



- (c) Table 4.1 lists the SSRs for refrigerant projects indicating which gases are included or excluded from the offset project boundary.

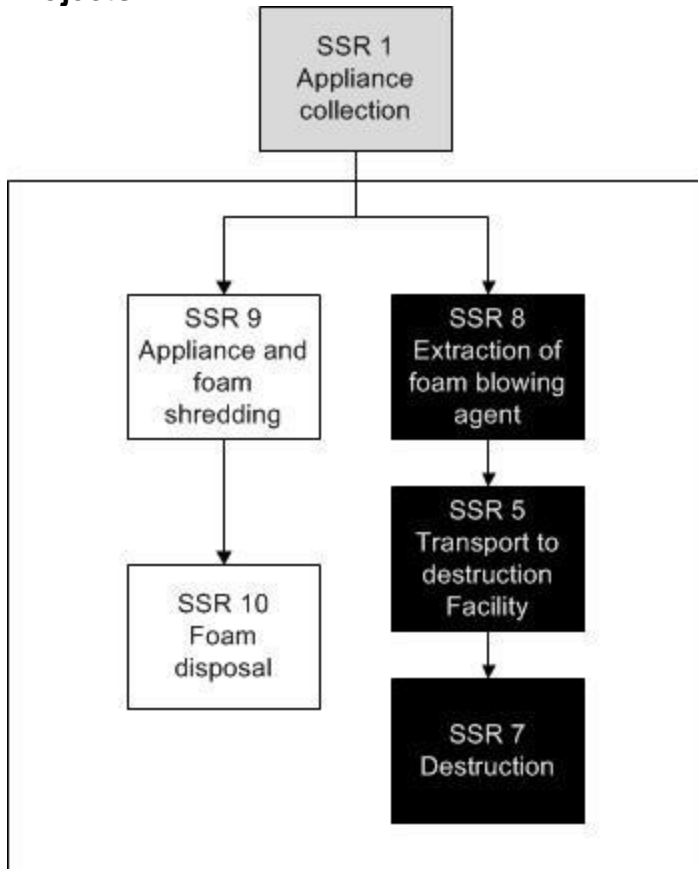
Table 4.1. List of identified SSRs for refrigerant projects

SSR	Source Description	Gas	Included (I) or Excluded (E)
1	Fossil fuel emissions from the collection and transport of end-of-life residential appliances	CO ₂	E
		CH ₄	E
		N ₂ O	E
2	Emissions of ODS from the recovery and collection of refrigerant 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
		N ₂ O	E
3	Emissions of ODS from equipment leak and servicing	ODS	E
	Fossil fuel emissions from the operation of refrigeration or air conditioning equipment	CO ₂	E
		CH ₄	E
		N ₂ O	E
4	<ul style="list-style-type: none"> ▪ Emissions of substitute refrigerant occurring during production ▪ Fossil fuel emissions from the production of substitute refrigerants 	CO ₂ e	E
		CO ₂	E
		CH ₄	E
		N ₂ O	E
5	Emissions of ODS released during transport and handling	ODS	E
	Fossil fuel emissions from the vehicular transport of ODS from point of origin to final destruction facility	CO ₂	I
		CH ₄	E
		N ₂ O	E
6	Emissions of ODS from leaks and servicing through continued operation of equipment	ODS	I
	Emissions of substitute refrigerants from 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	Emissions of ODS from incomplete destruction at destruction facility	ODS	I
	Emissions from the oxidation of carbon contained in destroyed ODS	CO ₂	I

SSR	Source Description	Gas	Included (I) or Excluded (E)
	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
		N ₂ O	E

- (d) Figure 4.2 illustrates the GHG assessment boundary for appliance foam blowing agent recovery ODS projects.
- (1) All SSRs within the bold line are included and must be accounted for under this protocol.
 - (2) SSRs in unshaded boxes are relevant only to baseline emissions.
 - (3) SSRs in lightly shaded boxes are relevant to the baseline and project emissions.
 - (4) SSRs in darkly shaded boxes are relevant only to project emissions.

Figure 4.2: Illustration of the Offset Project Boundary for Appliance Foam Projects



(e) Table 4.2 lists the SSRs for appliance foam projects indicating which gases are included or excluded from the offset project boundary.

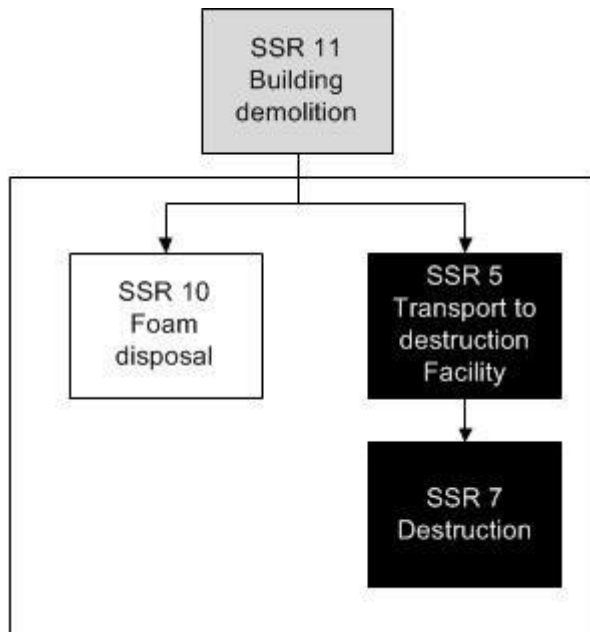
Table 4.2. List of identified SSRs for appliance foam projects

SSR	Source Description	Gas	Included (I) or Excluded (E)
1	Fossil fuel emissions from the collection and transport of end-of-life residential appliances	CO ₂	E
		CH ₄	E
		N ₂ O	E
5	Emissions of ODS released during transport and handling	ODS	E
	Fossil fuel emissions from the vehicular transport of ODS from point of origin to final destruction facility	CO ₂	I
		CH ₄	E
		N ₂ O	E
7	Emissions of ODS from incomplete destruction at destruction facility	ODS	I

SSR	Source Description	Gas	Included (I) or Excluded (E)	
	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	
		N ₂ O	E	
	8	Emissions of ODS released during the separation of foam from appliance	ODS	I
	9	Emissions of ODS from the shredding of appliances for materials recovery, releasing ODS from foam	ODS	I
10	Emissions of ODS released from foam disposal	ODS	I	
	Emissions of ODS degradation products from foam disposal	HFC, HCFC	E	
	Fossil fuel emissions from the transport and disposal of foam waste	CO ₂	E	
		CH ₄	E	
		N ₂ O	E	

- (f) Figure 4.3 illustrates the GHG assessment boundary of building foam ODS projects.
- (1) All SSRs within the bold line are included and must be accounted for under this protocol.
 - (2) SSRs in unshaded boxes are relevant only to baseline emissions.
 - (3) SSRs in lightly shaded boxes are relevant to the baseline and project emissions.
 - (4) SSRs in darkly shaded boxes are relevant only to project emissions.

Figure 4.3: Illustration of the Offset Project Boundary for Building Foam Projects



(g) Table 4.3 lists the SSRs for building foam projects indicating which gases are included or excluded from the offset project boundary.

Table 4.3. List of identified SSRs for building foam projects

SSR	Source Description	Gas	Included (I) or Excluded (E)
5	Emissions of ODS released during transport and handling	ODS	E
		CO ₂	I
	Fossil fuel emissions from the vehicular transport of ODS from point of origin to final destruction facility	CH ₄	E
		N ₂ O	E
7	Emissions of ODS from incomplete destruction at destruction facility	ODS	I
	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
N ₂ O		E	

SSR	Source Description	Gas	Included (I) or Excluded (E)
10	Emissions of ODS released from foam disposal	ODS	I
	Emissions of ODS degradation products from foam disposal	HFC, HCFC	E
	Fossil fuel emissions from the transport and disposal of foam waste	CO ₂	E
		CH ₄	E
		N ₂ O	E
11	Emissions of ODS from the demolition of buildings and damage to foam insulation panels	ODS	E
	Fossil fuel emissions from the demolition of buildings	CO ₂	E
		CH ₄	E
		N ₂ O	E

Chapter 5. Quantifying GHG Emission Reductions - Quantification Methodology

- (a) GHG emission reductions from an ODS project are quantified by comparing actual project emissions to calculated project baseline emissions.
- (b) An Offset Project Operator or, if applicable, Authorized Project Designee must use the calculation methods provided in this protocol to determine baseline and project GHG emissions.
- (c) GHG emissions must be quantified using the GWP values in tables B.1 and B.2.
- (d) GHG emission reductions (ER) must be quantified by subtracting the project emissions (PE) from the baseline emissions (BE) using equation 5.1.

Equation 5.1. GHG Emission Reductions

$ER = BE - PE$		
<i>Where,</i>		<u>Units</u>
ER	= Total mass of GHG emission reductions	mtCO ₂ e
BE	= Total mass of project baseline emissions	mtCO ₂ e
PE	= Total mass of project emissions	mtCO ₂ e

5.1. Quantifying Project Baseline Emissions

- (a) Baseline emissions (BE) must be estimated by using equation 5.2 and by summing the baseline emissions for all SSRs identified as included in the baseline in tables 4.1, 4.2, and 4.3.

Equation 5.2. Total Project Baseline Emissions

$BE = BE_{refr} + BE_{foam}$		
<i>Where,</i>		
		<u>Units</u>
BE	= Total mass of project baseline emissions	mtCO ₂ e
BE _{refr}	= Total mass of project baseline emissions from refrigerant ODS	mtCO ₂ e
BE _{foam}	= Total mass of project baseline emissions from ODS blowing agent	mtCO ₂ e

- (b) Baseline emissions from refrigerant ODS (BE_{refr}) must be quantified using equation 5.3.
- (c) 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.
- (d) 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.
- (e) The GWP values for refrigerant ODS (GWP_i) must be taken from table B.1.
- (f) The 10-year cumulative emission rate for refrigerant ODS (ER_{refr,i}) must be taken from table B.1.
- (g) If the project did not destroy any refrigerant ODS, then BE_{refr} = 0.

Equation 5.3. Project Baseline Emissions from Refrigerant ODS

$BE_{refr} = \sum_i (Q_{refr,i} \times ER_{refr,i} \times GWP_i)$		
<i>Where,</i>		
		<u>Units</u>
BE _{refr}	= Total mass of refrigerant project baseline emissions	mtCO ₂ e
Q _{refr,i}	= Total mass of refrigerant ODS <i>i</i> sent for destruction by the offset project	mtODS
ER _{refr,i}	= 10-year cumulative emission rate of refrigerant ODS <i>i</i> from table B.1	%

GWP_i = The GWP value for ODS i from table B.1	mtCO ₂ e/ mtODS
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- (h) Baseline emissions from foam ODS (BE_{foam}) must be quantified using equation 5.4.
- (i) BE_{foam} must include the estimated CO₂e emissions that would have occurred over ten years as the result of foam disposal.
- (j) The GWP values for refrigerant ODS (GWP_i) must be taken from table B.2.
- (k) The 10-year cumulative emission rate for appliance and building ODS ($ER_{i,app}$, $ER_{i,build}$) must be taken from table B.2.
- (l) The mass of the recovered and concentrated ODS blowing agent ($Q_{recover}$) from appliance foam must be calculated according to the procedures in appendix D.
- (m) The recovery efficiency (RE) of appliance foam ODS blowing agent must be calculated according to equation A.2.
- (n) The weight of intact building foam (Q_{foam}) must be calculated on the scales of the eligible destruction facility as specified in appendix C.
- (o) The mass fraction of ODS blowing agent in building foam (BA%) must be calculated according to appendix C.
- (p) If the project did not destroy any foam ODS, then $BE_{foam} = 0$.

Equation 5.4. Project Baseline Emissions from ODS Blowing Agent

$BE_{foam} = \sum_i (BA_{i,app} \times ER_{i,app} + BA_{i,build} \times ER_{i,build} \times GWP_i)$		
Where,		
BE_{foam}	= Total mass of ODS blowing agent project baseline emissions	mtCO ₂ e
$BA_{app,i}$	= Total mass of ODS blowing agent i from appliance foam prior to treatment or processing, including blowing agent lost during processing	mtODS
$BA_{build,i}$	= Total mass of ODS blowing agent i from building foam sent for destruction	mtODS
$ER_{i,app}$	= 10-year emission rate of appliance ODS blowing agent i at end-of-life from table B.2	%
$ER_{i,build}$	= 10-year emission rate of building ODS blowing agent i at end-of-life from table B.2	%
GWP_i	= The GWP value for ODS i from table B.2	mtCO ₂ e/ mtODS

$$BA_{app,i} = Q_{recover} + Q_{recover} \left(\frac{1-RE}{RE} \right)$$

Where,

	<u>Units</u>
$BA_{app,i}$ = Total mass of ODS foam blowing agent in foam prior to treatment or processing, including ODS foam blowing agent lost during processing	mtODS
$Q_{recover}$ = Total mass of ODS foam blowing agent recovered during processing and sent for destruction, as determined according to appendix D	mtODS
RE = Recovery efficiency of the ODS foam blowing agent recovery process ² from equation A.2 (in appendix A)	%

$$BA_{build} = Q_{foam} \times BA\%$$

Where,

BA_{build} = Total mass of ODS blowing agent <i>i</i> from building foam sent for destruction	mtODS
Q_{foam} = Total mass of foam with entrained ODS blowing agent sent for destruction	mt
BA% = Mass fraction of ODS blowing agent entrained in building foam, as determined according to appendix C	fraction (0-1)

5.2. Quantifying Project Emissions

- (a) Project emissions (PE) must be quantified by summing the emissions for all SSRs identified as included in the project in table 4.1 using equation 5.5.

Equation 5.5. Total Project Emissions

$$PE = Sub_{ref} + BA_{pr} + Tr + Dest$$

Where,

	<u>Units</u>
PE = Total mass of project emissions	mtCO ₂ e
Sub _{ref} = Total GHG emissions from substitute refrigerant	mtCO ₂ e
BA _{pr} = Total mass of ODS blowing agent from appliance foam released during ODS extraction	mtCO ₂ e
Tr = Total GHG emissions from transportation of ODS (calculated using either the default value in equation 5.8 or equation 5.10)	mtCO ₂ e
Dest = Total GHG emissions from the process associated with destruction of ODS	mtCO ₂ e

² RE does not extend to the ODS destruction efficiency, which is handled separately under this protocol.

- (b) Project emissions from substitute refrigerants (Sub_{ref}) must be quantified using equation 5.6.
- (c) Sub_{ref} must include the estimated CO₂e emissions over a ten-year period from non-ODS substitute refrigerants that are used in their place. The emission factors for substitute refrigerants in table B.1 must be used.
- (d) The total mass of refrigerant ODS sent for destruction (Q_{ref_i}) excludes the mass of HBR, moisture, and ineligible ODS.
- (e) If the project did not destroy any refrigerant, then $Sub_{ref} = 0$.

Equation 5.6. Project Emissions from the Use of Non-ODS Refrigerants

$Sub_{refr} = \sum_i (Q_{ref_i} \times SE_i)$		
<i>Where,</i>		
Sub_{refr}	= Total mass of project emissions from substitute refrigerants	<u>Units</u> mtCO ₂ e
Q_{ref_i}	= Total mass of refrigerant <i>i</i> sent for destruction	mt
SE_i	= Emission factor for substitute(s) for refrigerant <i>i</i> , from table B.1	mtCO ₂ e/ mtODS destroyed

- (f) Project emissions from the release of ODS foam blowing agent during recovery from appliance foam (BA_{pr}) must be quantified using equation 5.7.
- (g) The recovery efficiency (RE) of appliance foam ODS blowing agent must be calculated according to equation A.2.
- (h) The mass of the recovered and concentrated ODS blowing agent ($Q_{recover}$) from appliance foam must be calculated according to the procedures in appendix D.
- (i) If the project did not destroy any foam ODS, then $BA_{pr} = 0$.

Equation 5.7. Calculating Project Emissions from the Release of ODS Blowing Agent during Processing

$BA_{pr} = \sum_i (BA_{app,i} \times (1 - RE) \times GWP_i)$		
<i>Where,</i>		
BA_{pr}	= Total mass of ODS blowing agent from appliance foam released during ODS extraction	<u>Units</u> mtCO ₂ e
$BA_{app,i}$	= Total mass of appliance ODS foam blowing agent in foam prior to treatment or processing, including ODS foam blowing agent lost	mtODS

	during processing equation 5.4	
RE	= Recovery efficiency of the ODS foam blowing agent recovery process from equation A.2	%
GWP _i	= GWP of ODS <i>i</i> from table B.2	mtCO ₂ e/ mtODS
$BA_{app,i} = Q_{recover} + Q_{recover} \left(\frac{1-RE}{RE} \right)$		
<i>Where,</i>		<u>Units</u>
BA _{app,i}	= Total mass of ODS foam blowing agent in foam prior to treatment or processing, including ODS foam blowing agent lost during processing	mtODS
Q _{recover}	= Total mass of ODS foam blowing agent recovered during processing and sent for destruction, as determined according to appendix D	mtODS
RE	= Recovery efficiency of the ODS foam blowing agent recovery process ³ from equation A.2	%

- (j) Project emission from the transportation and destruction of ODS may be quantified using default emission factors in equation 5.8.
- (1) The default emission factor for ODS transportation and destruction (EF_{T&D}) is 7.5 metric tons CO₂e per metric ton ODS for refrigerant or extracted ODS blowing agent projects.
 - (2) The default emission factor for ODS transportation and destruction (EF_{T&D}) is 75 metric tons CO₂e per metric ton ODS for intact building foam projects.
 - (3) Q_{TotalODS} includes the mass of all eligible and ineligible ODS, moisture, HBR, and other accompanying material.

Equation 5.8. Project Emissions from Transportation and Destruction Using the Default Emission Factors

$Tr + Dest = \sum_i (Q_{TotalODS} \times EF_{T \& D})$		
<i>Where,</i>		<u>Units</u>
Tr+Dest	= Total GHG emissions from ODS transportation and destruction, as calculated using default emission factors	mtCO ₂ e

³ RE does not extend to the ODS destruction efficiency, which is handled separately under this protocol.

$Q_{\text{TotalODS},i}$	= Total mass of ODS i sent for destruction in the project	mtODS
$EF_{\text{T\&D}}$	= Default emission factor for transportation and destruction of ODS (7.5 for refrigerant or extracted ODS blowing agent projects, 75 for intact building foam projects)	mtCO ₂ e/ mtODS

- (k) If the transportation and destruction are not quantified using the default factors in equation 5.8, then equation 5.9 must be used to quantify site-specific ODS destruction emission ($Dest$), and equation 5.10 must be used to quantify ODS transportation emissions (Tr).
- (l) In both equation 5.9 and equation 5.10, Q_{destroy} is the total mass sent for destruction including HBR, moisture, ineligible ODS, and other ineligible material.

Equation 5.9. Project Emissions from the Destruction of ODS

$Dest = FF_{dest} + EL_{dest} + ODS_{emissions} + ODS_{CO2}$		
Where,		<u>Units</u>
$Dest$	= Total GHG emissions from the destruction of ODS	mtCO ₂ e
FF_{dest}	= Total GHG emissions from fossil fuel used in the destruction facility	mtCO ₂
EL_{dest}	= Total indirect GHG emissions from grid electricity used at the destruction facility	mtCO ₂
$ODS_{emissions}$	= Total GHG emissions of undestroyed ODS	mtCO ₂ e
ODS_{CO2}	= Total GHG emissions of CO ₂ from ODS oxidation	mtCO ₂
With:		
$FF_{dest} = \frac{\sum_k (FF_{PR,k} \times EF_{FF,k})}{1000}$		
Where,		<u>Units</u>
FF_{dest}	= Total carbon dioxide emissions from the destruction of fossil fuel used to destroy ODS	mtCO ₂
$FF_{PR,k}$	= Total fossil fuel k used to destroy ODS	unit of fossil fuel
$EF_{FF,k}$	= Fuel specific emission factor from table B.5	kg CO ₂ /unit fossil fuel
1000	= Conversion of kg to metric tons	kgCO ₂ /mtCO ₂
And:		
$EL_{dest} = \frac{(EL_{PR} \times EF_{EL})}{2204.62}$		

<i>Where,</i>		<u>Units</u>
EL_{dest}	= Total carbon dioxide emissions from the consumption of electricity from the grid used to destroy ODS	mtCO ₂
EL_{PR}	= Total electricity consumed to destroy ODS	MWh
EF_{EL}	= Carbon emission factor for electricity used from table B.6	lb CO ₂ /MWh
And:		
$ODS_{emissions} = \sum_i (Q_{destroy,i} \times GWP_i) \times 0.0001$		
<i>Where,</i>		<u>Units</u>
$ODS_{emissions}$	= Total GHG emissions of undestroyed ODS	mtCO ₂ e
$Q_{destroy,i}$	= Total mass of ODS <i>i</i> sent for destruction in the project	mtODS
0.0001	= Maximum allowable percent of ODS fed to destruction that is not destroyed	
GWP_i	= The GWP value for ODS _{<i>i</i>} from table B.1	mtCO ₂ e/ mtODS
And:		
$ODS_{CO_2} = \sum_i (Q_{destroy,i} \times CR_i) \times 0.9999 \times 3.667$		
ODS_{CO_2}	= Total GHG emissions of CO ₂ from ODS oxidation	mtCO ₂
$Q_{destroy,i}$	= Total mass of ODS <i>i</i> sent for destruction in the project	mtODS
0.9999	= Minimum destruction efficiency of destruction facility	
CR_i	= Carbon ratio of ODS <i>i</i> from table B.3	mole C/ mole ODS
3.667	= Ratio of CO ₂ to C	

- (m) A ton-mile is (TMT_{*i*}) is the product of the distance travelled in miles and the mass of ODS, any accompanying materials, and containers transported in metric tons.
- (n) Emissions shall be calculated for each leg of the transportation process separately and then summed according to equation 5.10.

Equation 5.10. Calculating Project Emissions from the Transportation of ODS

$Tr = \sum_i \left(\frac{TMT_i \times EF_{TMT}}{1000} \right)$		
<i>Where,</i>		<u>Units</u>
Tr	= Total GHG emissions from transportation of ODS	mtCO ₂ e
TMT _{<i>i</i>}	= Ton-miles-traveled for ODS <i>i</i> destroyed	mt-miles
EF _{TMT}	= CO ₂ emissions per mt-mile-traveled from table B.4	kgCO ₂ / mt-mile

5.3. Accounting for Disqualified ODS Material After Destruction

ARB or registry offset credits may only be generated for the destruction of eligible ODS that meet the point of origin and chain of custody requirements specified in chapter 6 of this protocol. Any disqualified ODS must be removed from baseline emission calculations using the following method to determine the weight and ODS species of the disqualified ODS:

- (a) The total weight of each container of disqualified ODS shall be considered as the container's full capacity when the ODS is acquired. Documentation of the acquired ODS must identify the capacity of the disqualified ODS container or the entire destruction event is not eligible for crediting. If a container's capacity is labelled in volume rather than in weight, the ODS densities in table B.3 must be used to convert the volume to weight. If converting between mass and volume, the ODS must be in a liquid state.
- (b) The species of each disqualified ODS shall be the species with the highest GWP of the destruction event.
- (c) The determined weight of disqualified ODS shall be subtracted from the total mass of that ODS species destroyed in the project.
 - (1) The total mass of refrigerant ODS sent for destruction ($Q_{\text{refr},i}$) shall be adjusted in equation 5.3.
 - (2) The total mass of ODS foam blowing agent in foam prior to treatment or processing, including ODS foam blowing agent lost during processing ($BA_{\text{app},i}$) shall be adjusted in equation 5.4.
 - (3) The total mass of ODS blowing agent from building foam sent for destruction ($BA_{\text{build},i}$) shall be adjusted in equation 5.4.

5.4. Conversion Factors and Rounding Practices

- (a) For the purpose of this protocol, 1 pound (lb) equals 0.45359 kilogram (Kg).
- (b) The following rounding practices shall be applied for the purpose of this protocol:
 - (1) At least five significant figures shall be maintained.
 - (2) There shall be no rounding to the left side of the decimal.

Chapter 6. Monitoring

6.1. General Monitoring Requirements.

- (a) The Offset Project Operator or, if applicable, the Authorized Project Designee is responsible for monitoring all project activities to ensure compliance with the requirements of the Regulation and this protocol.
- (b) The point of origin of all ODS must be documented. To be eligible to receive ARB offset credits or registry offset credits, the Offset Project Operator or, if applicable, the Authorized Project Designee must collect and maintain documentation showing regulatory compliance back to all points of origin.
- (c) Documentation of the point of origin must be generated at the time of collection from the point of origin and must include all of the following:
 - (1) Facility name and physical address;
 - (2) Point of origin zip code;
 - (3) Identification of any refrigeration or air conditioning equipment by serial number, if available, or description, location, and function, if serial number is unavailable (for quantities greater than 500 pounds); and
 - (4) Serial or ID number of containers used for storage and transport.
- (d) The Offset Project Operator or, if applicable, Authorized Project Designee must collect and maintain documentation on the chain of custody and ownership of the ODS beginning at the point of origin until destruction, including all of the following:
 - (1) Names, addresses, and contact information of all entities buying and selling ODS for destruction; and
 - (2) The mass of ODS, including ineligible ODS and contaminants, at each transaction.
- (e) The Offset Project Operator or, if applicable, the Authorized Project Designee must collect and maintain all of the following information:
 - (1) For building foams:
 - (A) Building address;
 - (B) Date of construction;
 - (C) Blowing agent used; and

- (D) Approximate building dimensions.
- (2) For ODS blowing agent recovered from appliance foam:
 - (A) Number of appliances processed;
 - (B) Facility at which ODS foam blowing agent is extracted to concentrated form; and
 - (C) Facility at which appliance de-manufacture occurs, if applicable.
- (f) For ODS refrigerant and concentrated ODS foam blowing agent, the Offset Project Operator or, if applicable, the Authorized Project Designee must collect and maintain all of the following information from the composition and mass analysis:
 - (1) Time and date of sample;
 - (2) Name of Offset Project Operator or Authorized Project Designee;
 - (3) Name of technician taking sample;
 - (4) Employer of technician taking sample;
 - (5) Volume of container from which sample was extracted;
 - (6) Ambient air temperature at time of sampling; and
 - (7) Chain of custody for each sample from the point of sampling to the AHRI lab.
- (g) The destruction facility must track continuously during the ODS destruction process the following parameters and provide the data about these parameters to the Offset Project Operator or, if applicable, Authorized Project Designee. The Offset Project Operator or, if applicable, the Authorized Project Designee must collect and maintain all of the following information from the destruction facility:
 - (1) The ODS feed rate;
 - (2) The amount and type of consumables used in the process (not required if default project emission factor for transportation and destruction is used);
 - (3) The amount of electricity and amount and type of fuel consumed by the destruction unit (not required if default project emission factor for transportation and destruction is used);
 - (4) Operating temperature and pressure of the destruction unit during ODS destruction;

- (5) Effluent discharges measured in terms of water and pH levels; and
- (6) CEMS data on the emissions of carbon monoxide during ODS destruction.

6.2. Point of Origin Determination

- (a) The Offset Project Operator or, if applicable, Authorized Project Designee must collect and maintain data on the point of origin of each quantity of ODS as part of tracking chain of custody. Data must be generated at the time of collection from the point of origin.
- (b) Point of origin is defined as follows:
 - (1) For refrigerant ODS which is stored within a stockpile more than 24 months prior to acquisition by the Offset Project Operator:
 - (A) The point of origin for refrigerant ODS which became part of the stockpile before January 1, 2015 is the location of the stockpile.
 - (B) The point of origin for refrigerant ODS which became part of the stockpile after December 31, 2014, is the site at which greater than or equal to 500 pounds of ODS is first aggregated into a single or multiple containers after December 31, 2014. The point of origin may be the location of the stockpile or a site prior to the ODS becoming part of the stockpile.
 - (2) For refrigerant ODS which is not part of a stockpile for at least 24 months prior to acquisition by the Offset Project Operator:
 - (A) The point of origin for refrigerant ODS with mass less than 500 pounds is the site at which greater than or equal to 500 pounds of ODS is aggregated.
 - (B) The point of origin for refrigerant ODS with mass greater than or equal to 500 pounds is the site where the ODS is removed from service.
 - (3) For ODS blowing agent extracted from appliance foam, the point of origin is the facility where the ODS is extracted.
 - (4) For ODS blowing agent in building foam, the point of origin is the location from which the building foam was taken.

- (c) For refrigerant ODS, the following provisions also apply to point of origin determination:
- (1) Any location at which 500 pounds is reached in a single transaction or shipment is a point of origin; the 500 pounds does not need to be in a single container.
 - (2) For each container included within the project, the mass of HBR, moisture, ineligible ODS, and other ineligible material shall be included to determine if the 500 pound threshold is reached.
 - (3) If refrigeration or air conditioning equipment containing at least 500 pounds of ODS is transported prior to the ODS being removed from the equipment, then the point of origin is the site at which the refrigeration or air conditioning equipment was last in service.
 - (4) When ODS is added to a single container which is part of a stockpile and a portion of the ODS is subsequently removed from the container, the ODS removed must be considered the ODS stored the longest (i.e., first-in, first-out method).

6.3. Instrument QA/QC

- (a) Scales used to determine the mass of ODS used in calculating emission reductions must be inspected at least quarterly.
- (b) The scales must be properly calibrated per the destruction facility's RCRA permit, or for non-RCRA facilities calibrated at least quarterly to an accuracy of within 5% of reading. RCRA facilities that do not have calibration requirements defined in their RCRA permits must calibrate scales quarterly to an accuracy of within 5% of reading.

6.4. Document Retention

- (a) The Offset Project Operator or, if applicable, Authorized Project Designee is required to keep all documentation and information outlined in the Regulation and this protocol. Record retention requirements are set forth in section 95976 of the Regulation.

- (b) Information that must be retained by the Offset Project Operator or Authorized Project Designee includes:
- (1) All data inputs for the calculation of the offset project emission reductions, including all required sampled data;
 - (2) Copies of all permits, Notices of Violations (NOVs), and any relevant administrative or legal consent orders dating back at least 3 years prior to the project commencement date;
 - (3) Destruction facility monitoring information (CEMS data, DRE documentation, scale readings, calibration procedures, and permits);
 - (4) Chain of custody and point of origin documentation; and
 - (5) ODS composition and mass lab reports.

6.5. Monitoring Parameters – Quantification Methodology

The Offset Project Operator or, if applicable, Authorized Project Designee must monitor the parameters described in table 6.1.

Table 6.1. ODS Project Monitoring Parameters – Quantification Methodology

Eq. #	Parameter	Description	Data Unit	Measurement Frequency	Calculated (c) Measured (m) Reference (r) Operating records (o)	Comment
		Legal Requirement Test	N/A	For each offset project		Must be monitored and determined for each project
		Mass of ODS (or ODS mixture) in each container	mass of mixture	Per container	m	Must be determined for each container
		Mixture of ODS species in each container	mass ODS/ mass of mixture	Per container	m	Must be determined for each container
5.1	ER _t	Total mass of GHG emission reductions during the reporting period	tCO ₂ e	For each offset project	c	
5.1, 5.2	BE _t	Total mass of project baseline emissions during the reporting period	tCO ₂ e	For each offset project	c	
5.1, 5.5	PE _t	Total mass of project emissions during the reporting period	tCO ₂ e	For each offset project	c	
5.2, 5.3	BE _{refr}	Total mass of project baseline emissions from refrigerant ODS	tCO ₂ e	For each offset project	c	
5.2, 5.4	BE _{foam}	Total mass of project baseline emissions from ODS blowing agent	tCO ₂ e	For each offset project	c	
5.3, 5.6	Q _{refr,i}	Total mass of refrigerant ODS <i>i</i> sent for destruction	tODS	For each offset project	m	
5.3	ER _{refr,i}	10-year cumulative emission rate of refrigerant ODS <i>i</i>	0 - 1.0	N/A	r	See table B.1
5.3, 5.4, 5.7, 5.10	GWP _i	GWP of ODS <i>i</i>	tCO ₂ e/ tODS	N/A	r	See table B.1
5.4, 5.7	BA _{app,i}	Total mass of ODS blowing agent <i>i</i> from appliance foam prior to treatment or processing, including blowing agent lost during processing	tODS	For each offset project	c	

Eq. #	Parameter	Description	Data Unit	Measurement Frequency	Calculated (c) Measured (m) Reference (r) Operating records (o)	Comment
5.4	$BA_{\text{build},i}$	Total mass of ODS blowing agent <i>i</i> from building foam sent for destruction.	tODS	For each offset project	c	
5.4	$ER_{i,j}$	Lifetime emission rate of ODS blowing agent <i>i</i> from application <i>j</i> at end-of-life (see table B.1)	% (0-1)	N/A	r	
5.4	Q_{recover}	Total mass of ODS foam blowing agent recovered during processing and sent for destruction	tODS	For each offset project	m	
5.4, 5.7	RE	Recovery efficiency of the ODS foam blowing agent recovery process	% (0-1)	Once for each offset project	c	See appendix A.
5.4	Q_{foam}	Total weight of foam with entrained ODS blowing agent sent for destruction	Metric tons	For each offset project	m	
5.4	BA%	Mass ratio of ODS blowing agent entrained in building foam, as determined according to appendix C	% (0-1)	For each offset project	m	
5.5, 5.6	Sub_{refr}	Total GHG emissions from substitute refrigerant	tCO ₂ e	For each offset project	c	
5.5, 5.7	$BA_{\text{pr},i}$	Total mass of ODS foam blowing agent <i>i</i> from appliance foam released during ODS extraction	tCO ₂ e	For each offset project	c	
5.5, 5.8, 5.10	Tr	Total GHG emissions from transportation of ODS	tCO ₂ e	For each offset project	c	
5.5, 5.8, 5.9	Dest	Total GHG emissions from the destruction process associated with destruction of ODS	tCO ₂ e	For each offset project	c	
5.6	SE_i	Emission factor for substitute emissions of refrigerant <i>i</i> , per table 5.5	tCO ₂ e/ tODS destroyed	Per container	r	See table B.1
5.8, 5.10	$Q_{\text{ODS},i}$	Total mass of ODS <i>i</i> sent for destruction	tODS	For each offset project	m	

Eq. #	Parameter	Description	Data Unit	Measurement Frequency	Calculated (c) Measured (m) Reference (r) Operating records (o)	Comment
5.8	EF _i	Default emission factor for transportation and destruction of ODS <i>i</i>	tCO ₂ e/ tODS	N/A	r	Equal to 7.5 for refrigerant projects, and 75 for foam projects
5.9, 5.10	FF _{dest}	Total GHG emissions from fossil fuel used in the destruction facility	tCO ₂ e	For each offset project	c	Use only if calculating site-specific project emissions from ODS destruction
5.9, 5.10	EL _{dest}	Total GHG emissions from grid electricity at the destruction facility	tCO ₂ e	For each offset project	c	Use only if calculating site-specific project emissions from ODS destruction
5.10	FF _{PR,k}	Total fossil fuel <i>k</i> used to destroy ODS	tCO ₂ e	For each offset project	m	Use only if calculating site-specific project emissions from ODS destruction
5.10	EF _{FF,k}	Fuel specific emission factor	kgCO ₂ / volume fuel	N/A	r	Use only if calculating site-specific project emissions from ODS destruction
5.10	EL _{PR}	Total electricity consumed to destroy ODS	MWh	For each offset project	m	Use only if calculating site-specific project emissions from ODS destruction
5.10	EF _{EL}	Carbon emission factor for electricity used	lbCO ₂ / MWh	N/A	m	Use only if calculating site-specific project emissions from ODS destruction
5.10	ODS _{emissions}	Total GHG emissions of un-destroyed ODS	tCO ₂ e	For each offset project	c	Use only if calculating site-specific project emissions from ODS destruction
5.10	ODS _{CO2}	Total emissions of CO ₂ from ODS oxidation	tCO ₂	For each offset project	c	Use only if calculating site-specific project emissions from ODS destruction
5.10	CR _i	Carbon ratio of ODS <i>i</i>	mole C/ mole ODS	N/A	r	Use only if calculating site-specific project emissions from ODS destruction
5.10	TMT _i	Metric ton-miles-traveled for ODS <i>i</i> destroyed	Metric ton-miles	For each offset project	m	Use only if calculating site-specific project emissions from ODS transportation
5.10	EF _{TMT}	Mode-specific emission factor	kgCO ₂ / metric ton-mile	N/A	r	Use only if calculating site-specific project emissions from ODS transportation

6.6. Other Monitoring Requirements – Quantification Methodology

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

- (a) When transporting foam recovered from buildings or appliances, all recovered foam pieces must be placed in air-tight and water-tight storage until arrival at the destruction facility.
- (b) Projects using this protocol to quantify emission reductions from recovering and destroying concentrated ODS foam blowing agent must meet all of the following requirements:
 - (1) The ODS blowing agent must be extracted from the foam to a concentrated form prior to destruction.
 - (2) The extraction must occur under negative pressure.
 - (3) The recovered ODS foam blowing agent must be collected, stored, and transported in containers meeting DOT standards for refrigerants.
 - (4) The processes, training, QA/QC, and management systems relevant to the collection, storage, and transport of the ODS foam blowing agent must be documented.
- (c) Projects destroying ODS blowing agent recovered from foam must follow the procedures in appendix C. The Offset Project Operator or, if applicable, the Authorized Project Designee must collect and maintain documentation showing conformance with the procedures in appendix C.
- (d) Projects destroying ODS refrigerant or concentrated ODS foam blowing agent must follow the procedures in appendix D. The Offset Project Operator or, if applicable, the Authorized Project Designee must collect and maintain information showing conformance with the procedures in appendix D.

Chapter 7. Reporting

General requirements for reporting and record retention are included in the Regulation. In addition to the offset project requirements in sections 95975 and 95976 of the Regulation, ODS offset projects must follow the project listing and reporting eligibility requirements below.

7.1. Project Listing Requirements

- (a) Listing information must be submitted by the Offset Project Operator or Authorized Project Designee no later than the date on which the Offset Project Operator or Authorized Project Designee submits the first Offset Project Data Report.
- (b) In order for an ODS Compliance Offset Project to be listed, the Offset Project Operator or Authorized Project Designee must submit the information listed in section 95975 of the Regulation and the following information:
 - (1) Offset project name and ID number(s);
 - (2) Name and CITSS ID number for the:
 - (A) Offset Project Operator; and,
 - (B) Authorized Project Designee (if applicable);
 - (3) Contact information for both the Offset Project Operator and, if applicable the Authorized Project Designee, including all of the following information:
 - (A) Entity's mailing address;
 - (B) Entity's physical address, if different from the mailing address;
 - (C) Contact person's name;
 - (D) Contact person's phone number; and
 - (E) Contact person's email address;
 - (4) Contact information including name, phone number, email address, and if applicable, the organizational affiliation for:
 - (A) The person submitting the listing information;
 - (B) Technical Consultants; and
 - (C) Other Parties with a Material Interest;
 - (5) Date of form completion;
 - (6) Offset project Description (1-2 paragraphs);
 - (7) List of all points of origin by US state for ODS sourced for this project;
 - (8) All ODS species that will be destroyed under this project:
 - (A) Refrigerant Destruction: CFC-11, CFC-12, CFC-13, CFC-113, CFC-114, and CFC-115;

- (B) Destruction of ODS blowing agent in intact building foam: CFC-11, CFC-12, HCFC-22, and HCFC-141b; and
- (C) Destruction of concentrated ODS blowing agent in appliance foam: CFC-11, CFC-12, HCFC-22, and HCFC-141b;
- (9) Name of destruction facility;
- (10) Address of destruction facility;
- (11) Indication whether the destruction facility is a RCRA-permitted HWC;
- (12) If the destruction facility is not a RCRA-permitted HWC, indication whether the facility has met the TEAP requirements for ODS destruction;
- (13) Offset project commencement date;
- (14) Reporting period start and end dates;
- (15) Indication whether any GHG reductions associated with the offset project have ever been registered with or claimed by another registry or program, or sold to a third party prior to our listing; if so, identification of the registry or program, as well as vintage and reporting period;
- (16) Indication whether the offset project is being implemented and conducted as the result of any law, statute, regulation, court order, or other legally binding mandate. If so, an explanation must also be provided;
- (17) Indication whether an Offset Project Data Report has been developed and, if not, the date it will be in place;
- (18) For appliance foam projects only, indication whether the offset project-specific recovery efficiency has been determined and, if yes, the factor or, if not, the date when will this factor be established;
- (19) Indication whether any of the destroyed ODS was or will be sources from the US government and, if so, how much; and
- (20) Indication whether any of the destroyed ODS was or will be considered hazardous waste under US, state or local law and, if so, an explanation and how much.

7.2. Offset Project Data Report Requirements

- (a) The Offset Project Operator or Authorized Project Designee must submit an Offset Project Data Report (OPDR) at the conclusion of each Reporting Period according to the reporting schedule in section 95976 of the Regulation.
- (b) The Offset Project Operator or Authorized Project Designee must submit the information required by section 95976 of the Regulation and the following information:
 - (1) Offset project name and ID number(s);
 - (2) Name and CITSS ID number for the:
 - (A) Offset Project Operator; and,
 - (B) Authorized Project Designee (if applicable);
 - (3) Contact information for both the Offset Project Operator and, if applicable the Authorized Project Designee, including all of the following information:
 - (A) Entity's mailing address;
 - (B) Entity's physical address, if different from mailing address;
 - (C) Contact person's name;
 - (D) Contact person's phone number; and
 - (E) Contact person's email address;
 - (4) Contact information including name, phone number, email address, and, if applicable, the organizational affiliation for the person submitting the reporting information;
 - (5) Date OPDR completed;
 - (6) Reporting period start and end dates;
 - (7) Indication whether the offset project meets all local, state, or federal regulatory requirements;
 - (8) Date(s) of ODS destruction;
 - (9) Destruction facility name and location;
 - (10) ODS species destroyed;
 - (11) Mass and composition of ODS as determined by the processes outlined in appendix C and appendix D of this protocol;

- (12) Names of all parties and their contact information included in the chain of custody documentation;
- (13) Indication whether all the information in the offset project listing is still accurate. If not, provide updates;
- (14) Project baseline emissions;
- (15) Project emissions; and
- (16) Total GHG emission reductions.

Chapter 8. Regulatory Verification Requirements

- (a) All Offset Project Data Reports are subject to regulatory verification pursuant to section 95977 of the Regulation by an ARB accredited offset verification body.
- (b) The Offset Project Data Reports must receive a positive or qualified positive verification statement to be issued ARB or registry offset credits.
- (c) Although verifiers may combine multiple projects into one site visit if they all are at the same destruction facility, each offset project's data must be verified separately.
- (d) An ODS offset project requires only one site visit regardless of the number of destruction events within that reporting period.
- (e) For the purpose of this protocol, the site visit must include a visit to the destruction facility. The site visit may also include a visit to the OPO'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 point of origin.

Appendix A. Appliance Foam Recovery Efficiency and Calculations – Quantification Methodology

- (a) All appliance foam projects must calculate a recovery efficiency based on a run of a minimum ten appliances.
- (b) The concentration of ODS blowing agent in PU foam prior to any appliance treatment shall either be assumed to be 14.9% or calculated according to the steps below:
 - (1) Four PU foam samples must be cut using a reciprocating saw from each appliance, one sample each from the left side, right side, top, and bottom. Each sample must be at least four inches square and maintain the full thickness of the insulation.
 - (2) The cut edges of each foam sample shall be sealed using aluminum tape or similar product that prevents off-gassing.
 - (3) Each sample must be individually labeled to record appliance model and site of sample (left, right, top, or bottom).
 - (4) The samples must be analyzed according to the procedures dictated for building foam in appendix C.(b)(3). Each sample may be analyzed individually, or a single analysis for each appliance may be done using equal masses of foam from each sample.
 - (5) Based on the average of the samples for each appliance, the 90% upper confidence limit of the concentration must be calculated and used as the parameter BA_{conc} in equation A.1.
- (c) The ODS foam blowing agent from the sampled appliances must be collected and quantified according to the following steps:
 - (1) All samples must be processed (minimum of 40).
 - (2) Processing must begin with all equipment shut down and emptied of all materials.
 - (3) The blowing agent (BA) shall be extracted, collected, and concentrated.
 - (4) The mass of the recovered blowing agent shall be determined by comparison of the mass of the fully evacuated receiving containers to their mass when filled.
 - (5) This value shall be used as the parameter BA_{post} in equation A.2.

- (d) The quantity of foam in the processed appliances must be established either through use of a default value of 12.9 pounds per appliance, or according to the following steps:
- (1) All foam residual, which may be in a fluff, powder, or pelletized form, must be separated and collected. The separation and collection processes must be documented to demonstrate that no significant quantity of foam residual is lost in the air or other waste streams.
 - (2) Non-foam components in the residual (e.g., plastic) may be manually separated to determine a mass percent of foam in residual. Separation must be done on at least one kilogram of residual, and must result in at least 90% foam.
 - (3) The total recovered foam residual must be weighed and multiplied by the percent foam in residual, if applicable, to calculate the total mass of foam recovered. This value shall be used as the parameter $Foam_{res}$ in equation A.1.
- (e) If the value of 12.9 pounds per appliance is used, it shall be multiplied by the number of appliances processed to determine $Foam_{res}$ in the calculation of recovery efficiency.
- (f) The calculated values for BA_{conc} , BA_{post} , and $Foam_{res}$ shall be used in equation A.1 to calculate BA_{init} in equation A.1 and RE in equation A.2

Equation A.1. Initial Blowing Agent

$BA_{init} = \frac{Foam_{res}}{(1 - BA_{conc})} \times BA_{conc}$		
<i>Where,</i>		
$Foam_{res}$	= Mass of foam recovered	<u>Units</u> lbs foam
BA_{conc}	= Initial concentration of blowing agent in PU foam	lbs BA / lbs PU
BA_{init}	= Initial mass of blowing agent in appliances prior to treatment	lbs BA

Equation A.2. Recovery Efficiency

$$RE = \frac{BA_{post}}{BA_{init}}$$

Where,

		<u>Units</u>
RE	= Recovery efficiency	%
BA _{post}	= Mass of recovered blowing agent in concentrated form	lbs BA
BA _{init}	= Initial mass of blowing agent in appliances prior to treatment	lbs BA

Appendix B. Emission Factor Tables – Quantification Methodology

Table B.1. Parameters for ODS Refrigerants

ODS	100-yr Global Warming Potential (t CO ₂ e/t ODS) (GWP _i)	10-year Cumulative Emission Rate (%/10 years) (ER _{ref})	Substitute Emissions (t CO ₂ e/t 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

Table B.2. Parameters for ODS Foam

ODS Blowing Agent	100-yr Global Warming Potential (t CO ₂ e/t ODS) (GWP _i)	Appliance ODS blowing agent 10-year emission rate (ER _{i,app})	Building ODS blowing agent 10-year emission rate (ER _{i,build})
CFC-11	4,750	44%	20%
CFC-12	10,900	55%	36%
HCFC-22	1,810	75%	65%
HCFC-141b	725	50%	29%

Table B.3. 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
HCFC-22	12/87	3.66
HCFC-141b	24/117	1.25

Table B.4. CO₂ emissions per ton-mile-traveled

Transport Mode	kgCO ₂ / ton-mile
On-road truck transport	0.297
Rail transport	0.0252
Waterborne craft	0.048
Aircraft	1.5279

Table B.5. CO₂ Emission Factors for Fossil Fuel Use

Fuel Type	Default High Heat Value	Default CO ₂ Emission Factor	Default CO ₂ Emission Factor
Coal and Coke	MMBtu / short ton	kg CO ₂ / MMBtu	kg CO ₂ / short ton
Anthracite	25.09	103.54	2597.819
Bituminous	24.93	93.40	2328.462
Subbituminous	17.25	97.02	1673.595
Lignite	14.21	96.36	1369.276
Coke	24.80	102.04	2530.592

Mixed (Commercial sector)	21.39	95.26	2037.611
Mixed (Industrial coking)	26.28	93.65	2461.122
Mixed (Electric Power sector)	19.73	94.38	1862.117
Natural Gas	MMBtu / scf	kg CO₂ / MMBtu	kg CO₂ / scf
(Weighted U.S. Average)	1.028 x 10 ⁻³	53.02	0.055
Petroleum Products	MMBtu / gallon	kg CO₂ / MMBtu	kg CO₂ / gallon
Distillate Fuel Oil No. 1	0.139	73.25	10.182
Distillate Fuel Oil No. 2	0.138	73.96	10.206
Distillate Fuel Oil No. 4	0.146	75.04	10.956
Distillate Fuel Oil No. 5	0.140	72.93	10.210
Residual Fuel Oil No. 6	0.150	75.10	11.265
Used Oil	0.135	74.00	9.990
Kerosene	0.135	75.20	10.152
Liquefied petroleum gases (LPG)	0.092	62.98	5.794
Propane	0.091	61.46	5.593
Propylene	0.091	65.95	6.001
Ethane	0.069	62.64	4.322
Ethanol	0.084	68.44	5.749
Ethylene	0.100	67.43	6.743
Isobutane	0.097	64.91	6.296
Isobutylene	0.103	67.74	6.977
Butane	0.101	65.15	6.580
Butylene	0.103	67.73	6.976
Naphtha (<401 deg F)	0.125	68.02	8.503
Natural Gasoline	0.110	66.83	7.351
Other Oil (>401 deg F)	0.139	76.22	10.595
Pentanes Plus	0.110	70.02	7.702
Petrochemical Feedstocks	0.129	70.97	9.155
Petroleum Coke	0.143	102.41	14.645
Special Naphtha	0.125	72.34	9.043
Unfinished Oils	0.139	74.49	10.354
Heavy Gas Oils	0.148	74.92	11.088
Lubricants	0.144	74.27	10.695
Motor Gasoline	0.125	70.22	8.778
Aviation Gasoline	0.120	69.25	8.310
Kerosene-Type Jet Fuel	0.135	72.22	9.750
Asphalt and Road Oil	0.158	75.36	11.907
Crude Oil	0.138	74.49	10.280
Other fuels (solid)	MMBtu / short ton	kg CO₂ / MMBtu	kg CO₂ / short ton
Municipal Solid Waste	9.95	90.7	902.465
Tires	26.87	85.97	2310.014
Plastics	38.00	75.00	2850.000
Petroleum Coke	30.00	102.41	3072.300
Other fuels (gaseous)	MMBtu / scf	kg CO₂ / MMBtu	kg CO₂ / scf
Blast Furnace Gas	0.092 x 10 ⁻³	274.32	0.025
Coke Oven Gas	0.599 x 10 ⁻³	46.85	0.028
Propane Gas	2.516 x 10 ⁻³	61.46	0.155
Fuel Gas	1.388 x 10 ⁻³	59.00	0.082

Biomass Fuels – (solid)	MMBtu / short ton	kg CO₂ / MMBtu	kg CO₂ / short ton
Wood and Wood Residuals	15.38	93.80	1442.644
Agricultural Byproducts	8.25	118.17	974.903
Peat	8.00	111.84	894.720
Solid Byproducts	25.83	105.51	2725.323
Biomass Fuels – (gaseous)	MMBtu / scf	kg CO₂ / MMBtu	kg CO₂ / scf
Biogas (Captured methane)	0.841 x 10 ⁻³	52.07	0.044
Biomass Fuels – (liquid)	MMBtu / gallon	kg CO₂ / MMBtu	kg CO₂ / gallon
Ethanol	0.084	68.44	5.749
Biodiesel	0.128	73.84	9.452
Rendered Animal Fat	0.125	71.06	8.883
Vegetable Oil	0.120	81.55	9.786

Table B.6. CO₂ Electricity Emission Factors

eGRID subregion acronym	eGRID subregion name	Annual output emission rates	
		(lb CO ₂ /MWh)	(metric ton CO ₂ /MWh)*
AKGD	ASCC Alaska Grid	1,256.87	0.570
AKMS	ASCC Miscellaneous	448.57	0.203
AZNM	WECC Southwest	1,177.61	0.534
CAMX	WECC California	610.82	0.277
ERCT	ERCOT All	1,218.17	0.553
FRCC	FRCC All	1,196.71	0.543
HIMS	HICC Miscellaneous	1,330.16	0.603
HIOA	HICC Oahu	1,621.86	0.736
MROE	MRO East	1,610.80	0.731
MROW	MRO West	1,536.36	0.697
NEWE	NPCC New England	722.07	0.328
NWPP	WECC Northwest	842.58	0.382
NYCW	NPCC NYC/Westchester	622.42	0.282
NYLI	NPCC Long Island	1,336.11	0.606
NYUP	NPCC Upstate NY	545.79	0.248
RFCE	RFC East	1,001.72	0.454
RFCM	RFC Michigan	1,629.38	0.739
RFCW	RFC West	1,503.47	0.682
RMPA	WECC Rockies	1,896.74	0.860
SPNO	SPP North	1,799.45	0.816
SPSO	SPP South	1,580.60	0.717
SRMV	SERC Mississippi Valley	1,029.82	0.467
SRMW	SERC Midwest	1,810.83	0.821
SRSO	SERC South	1,354.09	0.614
SRTV	SERC Tennessee Valley	1,389.20	0.630
SRVC	SERC Virginia/Carolina	1,073.65	0.487

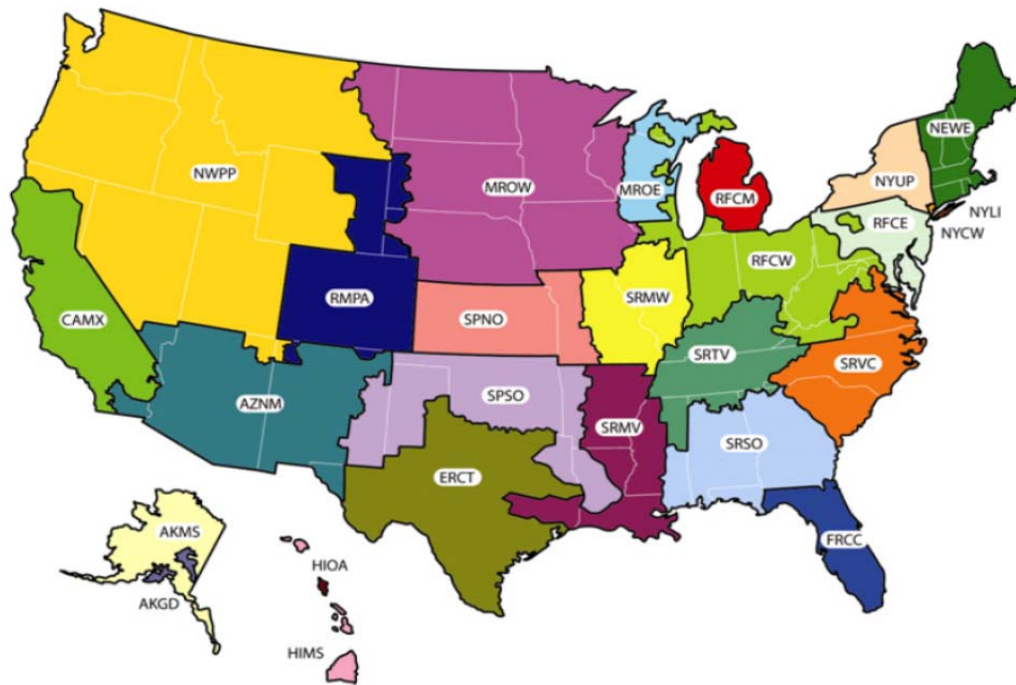


Figure B.1. Map of eGRID2010 Subregions

Appendix C. ODS Mass and Composition from Building Foam Projects – Quantification Methodology

ODS blowing agent from building insulation foam must be destroyed intact 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 accuracy of +/- 5%.
- (b) To determine the composition and mass ratio of the ODS foam blowing agent present in the foam at least two samples per building surface (e.g., wall, roof) must be taken. The samples must conform to all of the following requirements:
 - (1) Each must sample must be at least 2 inches in length, 2 inches in width, and 2 inches thick;
 - (2) 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;
 - (3) The analysis of ODS foam blowing agent content and mass ratio shall be performed at an independent laboratory unaffiliated with the Offset Project Operator or Authorized Project Designee. The analysis shall be done using one of the two following methods: (1) ASTM Method D 7132-05 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 Scheutz *et al.* (2007). The Scheutz method must include all of 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 scale, and sealed with Teflon-coated septa and aluminum caps;
 - (B) To release the ODS 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 chromatography;

- (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 ODS 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 chromatography;.
- (4) The mass of ODS foam blowing agent recovered shall then be divided by the total mass of the initial foam samples prior to analysis to determine the mass fraction of each ODS foam blowing agent present; and
 - (5) The results from all samples from a single building shall be averaged to determine the mass fraction of blowing agent in foam (BA%) used in equation 5.4.

Appendix D. ODS Mass and Composition from Refrigerant and Appliance Foam Projects – Quantification Methodology

Prior to destruction, the precise mass and composition of both ODS refrigerant and concentrated ODS foam blowing agent must be determined. The following analysis must be conducted:

- (a) Mass must be determined by individually measuring the weight of each container of ODS first when it is full prior to destruction and then after destruction is complete. The mass of ODS and any contaminants is equal to the difference between the full and empty weight, as measured. To be eligible to receive ARB offset credits or registry offset credits, all of the following requirements must be met when weighing the containers of ODS:
 - (1) A single scale conforming with the requirements in subchapter 6.3 of this protocol must be used for generating both the full and empty weight tickets at the destruction facility;
 - (2) The full weight must be measured no more than 48 hours prior to commencement of destruction per the CEMS data, if available, or the Certificate of Destruction;
 - (3) The empty weight must be measured no more than 48 hours after the conclusion of destruction per the CEMS data, if available, or the Certificate of Destruction; and
 - (4) Each single compartment, cylinder, drum, or any other eligible ODS container that has been identified and destined for destruction must be weighed separately, sampled separately, and treated as a separate destruction event.
 - (5) Recovery, collection, and aggregation activities may occur until the container has been identified and destined for destruction. After the ODS container has been identified and destined for destruction, ODS 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 weights required within 48 hours of both the commencement and conclusion of destruction, pursuant to subsections (a)(2) and (a)(3) in appendix D of this protocol:

- (1) For refrigerant 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 refrigerant which are included in the trailer's full weight prior to ODS destruction must be included in the trailer's empty weight after destruction; and
 - (C) A refrigerant container with a capacity over 1,000 pounds must be placed on the scale motionless for at least 3 minutes to allow the weight to stabilize before the weight measurement is recorded.
- (2) For refrigerant 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 (a)(1) in appendix D of this protocol; and;
 - (B) A refrigerant container with a capacity over 1,000 pounds must be placed on the scale motionless for at least 3 minutes to allow the weight to stabilize before the weight measurement is recorded.
- (3) For refrigerant containers weighed with the transportation vehicle included:
 - (A) The driver and any other passengers must exit the vehicle such that their weight 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 refrigerant which are included in the truck's full weight prior to ODS destruction must be included in the truck's empty weight after destruction;
 - (C) If more than 1,000 pounds of ODS refrigerant is being transported for destruction, then the truck must be situated motionless on the scale for at least 3 minutes to allow the weight to stabilize before the weight 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 destruction must be rounded down and the fuel level after ODS 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 weight must be subtracted, as applicable from $Q_{ref,i}$ in equation 5.3, $Q_{ref,i}$, in equation 5.6, $BA_{app,i}$ in equation both equation 5.4 and equation 5.7, and $Q_{TotalODS,i}$ in equation 5.8. The following fuel densities shall be used to adjust for weight:
 1. 7.0851 lb/gal for diesel; or
 2. 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 weight discrepancy must be subtracted, as applicable from $Q_{ref,i}$ in equation 5.3, $Q_{ref,i}$, in equation 5.6, $BA_{app,i}$ in both equation 5.4 and equation 5.7, and $Q_{TotalODS,i}$ in equation 5.8.
- (c) Composition and concentration of ODS must be established for each individual container by taking a sample from each container of ODS and having it analyzed for composition and concentration at an AHRI-certified laboratory using the AHRI 700-2006 standard. The laboratory performing the composition analysis must not be affiliated with the Offset Project Operator or Authorized Project Designee. All of the following requirements must be met for each sample:

- (1) The sample must be taken while ODS is in the possession of the company that will destroy the ODS;
 - (2) Samples must be taken by a technician unaffiliated with the Offset Project Operator or Authorized Project Designee; if the destruction facility is either the Offset Project Operator or Authorized Project Designee, an outside technician must perform this task;
 - (3) Samples must be taken with a clean, fully evacuated sample bottle that meets applicable DOT requirements with a minimum capacity of one pound;
 - (4) Each sample must be taken in liquid state;
 - (5) A minimum sample size of one pound must be drawn for each sample;
 - (6) Each sample must be individually labeled and tracked according to the container from which it was taken, and all of the following information recorded:
 - (A) Time and date of sample;
 - (B) Name of Offset Project Operator and Authorized Project Designee;
 - (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
 - (7) Chain of custody for each sample from the point of sampling to the AHRI 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 700-2006 to confirm the mass percentage and identity of each component of the sample. The analysis shall provide:
- (1) Identification of the refrigerant;
 - (2) Purity (%) of the ODS mixture by weight using gas chromatography;
 - (3) Moisture level in parts per million. The moisture content of each sample must be less than 75% of the saturation point for the ODS based on the temperature recorded at the time the sample was taken;

- (A) For non-mixed ODS, the saturation point is the saturation point of the major ODS species;
 - (B) For mixed ODS, the saturation point is the lowest saturation value of any species that makes up at least 10% of the composition;
- (4) Analysis of high boiling residue, which must be less than 10% by mass; and
- (5) Analysis of other ODS in the case of mixtures of ODS, and their percentage by mass.
- (e) If any of the requirements in sections (a) through (c) of this appendix are not met, no GHG reductions may be verified for ODS destruction associated with that container.
- (f) If a container holds non-mixed ODS, no further information or sampling is required to determine the mass and composition of the ODS. For non-mixed ODS, 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, the Offset Project Operator or Authorized Project Designee must meet all of the following additional requirements:
 - (1) The required sampling may be conducted at the final destruction facility or prior to delivery to the destruction facility;
 - (2) 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;
 - (3) The offset project documentation must specify the procedures by which mixed ODS are analyzed;
 - (4) Prior to sampling, the ODS mixture must be circulated in a container that meets all of the following criteria:
 - (A) The container has no solid interior obstructions;
 - (B) The container was fully evacuated prior to filling;
 - (C) The container must have sampling ports to sample liquid and gas phase ODS;

- (D) The sampling ports must be located in the middle third of the container (i.e., not at one end or the other); and
 - (E) The container and associated equipment can circulate the mixture via a closed loop system from the bottom to top;
- (5) If the original mixed ODS container does not meet these requirements, the mixed ODS must be transferred into a temporary holding tank or container that meets all of the above criteria. The weight of the contents placed into the temporary container shall be calculated and recorded. During transfer of ODS into and out of the temporary container, ODS shall be recovered to the vacuum levels required by the U.S. EPA for that ODS (see 40 CFR 82.156);
- (6) Once the mixed ODS is in a container or temporary storage unit that meets the criteria above, circulation of mixed ODS must be conducted as follows:
- (A) Liquid mixture shall be circulated from the liquid port to the vapor port;
 - (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 B.3; if converting between mass and volume, the mixed ODS 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;
- (7) Within 30 minutes of the completion of circulation, a minimum of two samples shall be taken from the bottom liquid port, and both samples must be analyzed at an AHRI approved laboratory; and
- (8) The Offset Project Operator or Authorized Project Designee must calculate the project GHG emission reductions using both sample results, and choose the sample resulting in the lower project emission reductions.