



CLIMATE
ACTION
RESERVE

Mexico Ozone Depleting Substances Project Protocol

Destruction of Mexican Ozone Depleting
Substances in Mexico

Workgroup Draft

December 19, 2014

Expected Effective Date: April 2015

Notes on the Workgroup Comment Draft

This document represents a complete protocol draft which requires additional feedback to polish into a final protocol for adoption. Workgroup members have the opportunity to review and comment on this draft prior to its review by the public at large. Pink boxes indicate topics on which we have questions and/or are seeking additional comment.

The comment period for the Mexico ODS Workgroup members is December 19 – January 21. We have a Workgroup meeting scheduled on January 14th to give the Workgroup an opportunity to discuss their comments with the Reserve staff. **Written comments must be received by the close of business (6:00 pm Pacific) on Wednesday, January 21.** Comments should be organized by protocol section, and may be submitted to policy@climateactionreserve.org, preferably in the form of a MS Word document. Reserve staff will review Workgroup comments and implement any necessary protocol changes. Workgroup members will also have the option of submitting comments during the public comment period, expected to begin in early February. If you have any questions, please contact Heather Raven at heather@climateactionreserve.org or (213) 542-0282 or Teresa Lang at tlang@climateactionreserve.org or (213) 891-6932.

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Table of Contents

Abbreviations and Acronyms.....	1
1 Introduction.....	2
2 The GHG Reduction Project	3
2.1 Background.....	3
2.2 Project Definition.....	4
2.3 Eligible ODS	5
2.4 Eligible ODS Sources	5
2.5 The Project Developer	6
3 Eligibility Rules.....	7
3.1 Location	7
3.2 Project Start Date.....	7
3.3 Project Crediting Period	8
3.4 Additionality	8
3.4.1 The Legal Requirement Test.....	8
3.4.2 The Performance Standard Test.....	8
3.5 Regulatory Compliance.....	9
4 The GHG Assessment Boundary	10
5 Quantifying GHG Emission Reductions.....	15
5.1 Quantifying Baseline Emissions	15
5.2 Quantifying Project Emissions	19
5.2.1 Calculating Project Emissions from the Use of CFC Substitutes	19
5.2.2 Calculating Default Project Emissions from ODS Destruction and Transportation	20
5.2.3 Calculating Site-Specific Project Emissions from ODS Destruction.....	21
5.2.4 Calculating Site-Specific Project Emissions from ODS Transportation.....	23
5.3 Deduction for Vapor Composition Risk.....	24
6 Project Monitoring and Operations.....	26
6.1 Reserve ODS Tracking System	26
6.2 Point of Origin Documentation Requirements	27
6.3 Custody and Ownership Documentation Requirements	29
6.4 ODS Composition and Quantity Analysis Requirements	29
6.4.1 ODS Quantity Analysis	30
6.4.2 ODS Composition and Concentration Analysis	30
6.4.3 Analysis of Mixed ODS	32
6.5 Destruction Facility Requirements.....	33
6.6 Monitoring Parameters.....	36
7 Reporting Parameters.....	40
7.1 Project Documentation.....	40
7.2 Record Keeping	40
7.3 Reporting Period and Verification Cycle.....	41
8 Verification Guidance.....	42
8.1 Standard of Verification.....	42

8.2	Monitoring and Operations Plan.....	42
8.3	Verifying Project Eligibility	42
8.4	Core Verification Activities	43
8.5	Verification Site Visits	44
8.6	ODS Verification Items.....	45
8.6.1	Project Eligibility and CRT Issuance	45
8.6.2	Conformance with Operational Requirements and ODS Eligibility.....	46
8.6.3	Quantification of GHG Emission Reductions	47
8.6.4	Risk Assessment	48
8.6.5	Completing Verification	48
9	Glossary of Terms	49
10	References.....	53
Appendix A	Summary of Legal Requirement Test Development	Error! Bookmark not defined.
A.1	Montreal Protocol.....	Error! Bookmark not defined.
A.2	Mexico	Error! Bookmark not defined.
Appendix B	Summary of Performance Standard Development.....	57
B.1	Methodology	Error! Bookmark not defined.
B.2	Conclusion.....	Error! Bookmark not defined.
Appendix C	EPA Rules Governing ODS Destruction	58
Appendix D	Default Emissions Factors for Calculating ODS Transportation and Destruction Emissions	59
D.1	Summary	59
D.2	Methodology and Analysis	60
D.3	Conclusion.....	61
Appendix E	Emission Factor Tables.....	62
Appendix F	ODS Project Diagram Sample	63

List of Tables

Table 2.1. Production Phase-Out Schedule of the Montreal Protocol for Article 5 Countries	3
Table 4.1. Description of all Sources, Sinks, and Reservoirs.....	11
Table 5.1. Refrigerant Baseline Scenarios	16
Table 5.2. Global Warming Potential of Eligible ODS Refrigerants.....	17
Table 5.3. Eligible Low Pressure and High Pressure ODS	25
Table 5.4. Determining the Deduction for Vapor Composition Risk	25
Table 6.1. Identification of Point of Origin.....	27
Table 6.2. Project Monitoring Parameters	37
Table 8.1. Summary of Eligibility Criteria for a Mexico ODS Destruction Project	43
Table 8.2. Verification Site Visit Requirements.....	44
Table 8.3. Eligibility Verification Items	45
Table 8.4. Operational Requirement and ODS Eligibility Verification Items	46
Table 8.5. Quantification Verification Items	47
Table 8.6. Risk Assessment Verification Items.....	48

List of Figures

Figure 4.1. Illustration of the GHG Assessment Boundary	10
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List of Equations

Equation 5.1. Calculating GHG Emission Reductions	15
Equation 5.2. Calculating Site-Specific Emission Rate	16
Equation 5.3. Baseline Emissions	17
Equation 5.4. Total Project Emissions.....	19
Equation 5.5. Calculating Project Emissions from the Use of Non-ODS Refrigerants.....	20
Equation 5.6. Project Emissions from Transportation and Destruction Using the Default Emission Factors	21
Equation 5.7. Project Emissions from the Destruction of ODS	21
Equation 5.8. Fossil Fuel Emissions from the Destruction of ODS	21
Equation 5.9. Electricity Emissions from the Destruction of ODS	22
Equation 5.10. Calculating Project Emissions from ODS Not Destroyed	23
Equation 5.11. Calculating Project Emissions of CO ₂ from the Oxidation of ODS.....	23
Equation 5.12. Calculating Project Emissions from the Transportation of ODS	24
Equation 5.13. Determining Liquid Fill Level in Project Container	25

Abbreviations and Acronyms

NOTE: This section has not yet been fully updated.

CO ₂	Carbon dioxide
CFC	Chlorofluorocarbon
CH ₄	Methane
CRT	Climate Reserve Tonne
FIDE	Fideicomiso para el Ahorro de Energía Eléctrica
GHG	Greenhouse gas
MT	Metric ton (or tonne)
N ₂ O	Nitrous oxide
ODS	Ozone depleting substances
Reserve	Climate Action Reserve
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales
SSR	Source, sink, and reservoir

1 Introduction

The Climate Action Reserve (Reserve) Mexico Ozone Depleting Substances Project Protocol provides guidance to account for, report, and verify greenhouse gas (GHG) emission reductions associated with the destruction of Mexican-sourced ODS at facilities in Mexico.

The Climate Action Reserve is the most experienced, trusted and efficient offset registry to serve the California cap-and-trade program and the voluntary carbon market. With deep roots in California and a reach across North America, the Reserve encourages actions to reduce greenhouse gas emissions and works to ensure environmental benefit, integrity and transparency in market-based solutions to address global climate change. It operates the largest accredited registry for the California compliance market and has played an integral role in the development and administration of the state's cap-and-trade program. For the voluntary market, the Reserve establishes high quality standards for carbon offset projects, oversees independent third-party verification bodies and issues and tracks the transaction of carbon credits (Climate Reserve Tonnes) generated from such projects in a transparent, publicly-accessible system. The Reserve program promotes immediate environmental and health benefits to local communities and brings credibility and value to the carbon market. The Climate Action Reserve is a private 501(c)(3) nonprofit organization based in Los Angeles, California.

Project developers that initiate ODS destruction projects use this document to quantify and register GHG reductions with the Reserve. The protocol provides eligibility rules, methods to calculate reductions, performance-monitoring instructions, and procedures for reporting project information to the Reserve. Additionally, all project reports receive independent verification by ISO-accredited and Reserve-approved verification bodies. Guidance for verification bodies to verify reductions is provided in the Reserve Verification Program Manual and Section 8 of this protocol.

This protocol is designed to ensure the complete, consistent, transparent, accurate, and conservative quantification and verification of GHG emission reductions associated with an ODS destruction project.¹

¹ See the WRI/WBCSD GHG Protocol for Project Accounting (Part I, Chapter 4) for a description of GHG reduction project accounting principles.

2 The GHG Reduction Project

2.1 Background

The term “ozone depleting substances” refers to a large group of chemicals known to destroy the stratospheric ozone layer when released into the atmosphere. ODS were historically used in a wide variety of applications including refrigerants, foam blowing agents, solvents, and fire suppressants. In addition to their potency as ozone depleting substances, the ODS addressed by this protocol also exhibit high global warming potential (GWP). The GWP of these ODS range from several hundred to several thousand times that of carbon dioxide (see Table 5.2).

The adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer² in 1987 laid out a global framework for the phase-out of the production of certain known ODS. The Montreal Protocol differentiated two separate phase-out schedules: one for the developing Article 5 countries, such as Mexico,³ and a more rapid phase-out for the developed Non-Article 5 countries.⁴ The current ODS phase-out schedule for Article 5 countries as dictated by the Montreal Protocol is presented in Table 2.1 below.

Table 2.1. Production Phase-Out Schedule of the Montreal Protocol for Article 5 Countries

Ozone Depleting Substance	Article 5 Countries
CFC (chlorofluorocarbons)	January 1, 2010
Halons	January 1, 2010
Carbon tetrachloride	January 1, 2010
Methyl chloroform	January 1, 2015
Methyl bromide	January 1, 2015
HBFC (Hydrobromofluorocarbons)	January 1, 1996
HCFC (hydrochlorofluorocarbons)	January 1, 2013: freeze at baseline (average 2009/2010)
	January 1, 2015: 10% below baseline
	January 1, 2020: 35% below baseline
	January 1, 2025: 67.5% below baseline
	January 1, 2030-December 31, 2039: total of 2.5 % of baseline during the entire period
	January 1, 2040: full phase-out

This protocol is explicitly limited to the destruction of phased-out ODS refrigerants sourced in Mexico and destroyed at a destruction facility in Mexico. ODS sourced from other Article 5 countries or from within the U.S. are covered in the Article 5 and U.S. Ozone Depleting Substances Project Protocols, respectively.

² United Nations Environment Programme, Ozone Secretariat. (1987 and subsequent amendments). The Montreal Protocol on Substances that Deplete the Ozone Layer.

³ United Nations Environment Programme, Ozone Secretariat. List of Parties categorized as operating under Article 5 paragraph 1 of the Montreal Protocol. Retrieved September 24, 2009, from http://ozone.unep.org/Ratification_status/list_of_article_5_parties.shtml.

⁴ See http://ozone.unep.org/Ratification_status/ for a list of all countries that have ratified the Montreal Protocol.

As of January 1, 2010, Mexico and other Article 5 countries under the Montreal Protocol have agreed to stop all production of CFC ODS, with the exception of certain critical use exemptions. However, the Montreal Protocol does not require the destruction of extant stocks of ODS. Rather, virgin stockpiles may be sold for use, and installed banks may be recovered, recycled, reclaimed, and reused indefinitely, often in equipment with very high leak rates. Because the Montreal Protocol does not forbid the use of existing or recycled controlled substances beyond the phase-out dates, even properly managed ODS banks will eventually be released to the atmosphere during equipment servicing, use, and end-of-life.

Prior to the production phase-out in Article 5 countries, such as Mexico, equipment utilizing CFC refrigerants was preferred in a wide variety of applications. These applications included industrial and commercial refrigeration, cold storage, comfort cooling equipment (i.e. air conditioning), and various consumer applications. While the production of CFC refrigerants has been phased out, use of these ODS is still widespread, and can be found everywhere from vehicle air conditioners to industrial chillers. These substances continue to be released from equipment through operation, servicing, and end-of-life.

NOTE: The Reserve plans to add additional Mexico-specific background here.

2.2 Project Definition

For the purposes of this protocol, a project is defined as any set of activities undertaken by a single project developer resulting in the destruction of eligible ODS at a single qualifying destruction facility within a 12-month period. Destruction may take place under one or more Certificates of Destruction. Each Certificate of Destruction must document the ODS destroyed. The ODS destroyed may come from a single origin (e.g. one supermarket) or from numerous sources. However, the entire quantity of eligible ODS destroyed must be documented on one or more Certificates of Destruction issued by a qualifying destruction facility.

Although project developers may engage in ongoing recovery, aggregation and destruction activities, destruction events that fall outside of the 12-month window designated for a project may only be counted as part of a separately registered project. Project developers may choose a shorter time horizon for a single project (e.g. three months or six months), but no project may run longer than 12 months.

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

- The project developer and owner of emission reductions are the same for all ODS destroyed
- The qualifying destruction facility is the same for all Certificates of Destruction
- Project activities span a timeframe of no more than 12 months from the project's start date to completion of the last ODS destruction event
- No Certificate of Destruction is included as part of another project

For all projects, the end fate of the ODS must be destruction at a destruction facility in Mexico that is permitted under NOM-098-SEMARNAT-2002⁵ to destroy hazardous waste, and whose permit explicitly includes the destruction of ODS. The destruction facility must meet or exceed the Montreal Protocol's Technology and Economic Assessment Panel (TEAP) guidelines provided in the Report of the Task Force on Destruction Technologies.⁶ Facilities must demonstrate compliance with NOM-098-SEMARNAT-2002 for destruction of ODS, as well as demonstrate destruction and removal efficiency (DRE) of 99.99 percent and emission levels consistent with the guidelines set forth in the aforementioned TEAP report (see Appendix C).

2.3 Eligible ODS

Eligible ODS under this protocol are limited to those listed under Annex A, Group I of the Montreal Protocol and used in refrigerant applications. With the exception of certain critical uses, these CFC have been fully phased out of production as of January 1, 2010. The Annex A, Group I CFC used in refrigeration applications and eligible for crediting under this protocol are:

- CFC-11
- CFC-12
- CFC-113
- CFC-114
- CFC-115

Eligibility of Foams – Context & Seeking Comment:

A number of workgroup members have asked why foams are not eligible under this protocol. The Reserve wants to provide additional background as to why this continues to be the plan, while also giving the workgroup an opportunity to comment.

During development of the Reserve's Article 5 Project Protocol, in which ODS from all Article 5 countries is eligible, the Reserve was unable to develop standardized baseline assumptions for all Article 5 countries, due to a lack of comprehensive data about the end of life (EOL) fate of foams in these countries. The Reserve is not aware of any comprehensive data on the business-as-usual end of life fate of foams in Mexico, specifically, but welcomes workgroup members to share such data if they are aware of it. The Reserve also welcomes workgroup members to share any additional insight, comments, or concerns about why foams should or should not be excluded from the protocol.

2.4 Eligible ODS Sources

Eligible ODS sources consist of ODS material produced prior to the Mexican production phase-out that could legally be sold into the Mexican refrigerant market.⁷ The ODS must originate from domestic Mexican supplies; imported refrigerant is not eligible under this protocol. Project developers seeking to register projects involving the destruction of refrigerant from other Article 5 countries must use the Reserve's Article 5 Ozone Depleting Substances Project Protocol.

In the absence of a GHG reduction project, this material may be illegally vented or recovered for re-sale into the refrigerant recharge market. As described in Section **Error! Reference source not found.**, for GHG reduction calculation purposes, this protocol conservatively assumes that the refrigerant would be reclaimed.

⁵ Diario Oficial del la Federación (DOF). (2004). NOM-098-SEMARNAT-2002. Secretaría de Gobernación (SEGOB). Retrieved from http://www.dof.gob.mx/nota_detalle.php?codigo=664977&fecha=01/10/2004

⁶ United Nations Environment Programme, Technology and Economic Assessment Panel. (2002). Report of the Task Force on Destruction Technologies.

⁷ Any ODS produced in association with a critical use or as by-product is ineligible.

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

1. Privately held stockpiles of used ODS refrigerant that can legally be sold to the market
2. Mexican government stockpiles of seized ODS refrigerant that can legally be sold to the market
3. Mexican government stockpiles of seized ODS that cannot be legally sold to the market
4. Used ODS refrigerant recovered from industrial, commercial, or residential equipment at servicing or end-of-life

ODS sources not in one of the above categories, such as ODS that were used as or produced for use as solvents, medical aerosols, or other applications are not eligible under this protocol.

Privately held and saleable virgin ODS refrigerants are not eligible under this protocol.

2.5 The Project Developer

The “project developer” is an entity that has an active account on the Reserve, submits a project for listing and registration with the Reserve, and is ultimately responsible for all project reporting and verification. Project developers may be ODS aggregators, facility owners, facility operators or GHG project financiers. The project developer must have clear ownership of the project’s GHG reductions. Ownership of the GHG reductions must be established by clear and explicit title and the project developer must attest to such ownership prior to commencement of verification activities each time a project is verified by signing the Reserve’s Attestation of Title form.⁸

⁸ Attestation of Title form available at <http://www.climateactionreserve.org/how/projects/register/project-submittal-forms/>. Verification activities not related to confirming the Attestation of Title (such as site visits or project material eligibility confirmation) may commence prior to this form being uploaded to the Reserve.

3 Eligibility Rules

Projects must fully satisfy the following eligibility rules in order to register with the Reserve. The criteria only apply to projects that meet the definition of a GHG reduction project (Section 2.2).

Eligibility Rule I:	Location	→	<i>Mexico</i>
Eligibility Rule II:	Project Start Date	→	<i>No more than six months prior to project submission</i>
Eligibility Rule III:	Additionality	→	<i>Meet performance standard</i>
		→	<i>Exceed legal requirements</i>
Eligibility Rule IV:	Regulatory Compliance	→	<i>Compliance with all applicable laws</i>

3.1 Location

For ODS destruction to be eligible as a project under this protocol, all ODS must be sourced from stocks in Mexico and destroyed within Mexico.

Project developers seeking to register projects involving the destruction of ODS from the U.S. or other Article 5 countries must use the Reserve's U.S. and Article 5 Ozone Depleting Substances Project Protocols, respectively.

3.2 Project Start Date

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

- For non-mixed ODS projects⁹ that are not aggregated at the destruction facility, the project start date is the day that the project ODS departs the final storage or aggregation facility for transportation to the destruction facility.
- For non-mixed ODS projects where eligible material is aggregated at the destruction facility, the project start date is the day when destruction commences, as documented by a Certificate of Destruction.
- For mixed ODS projects, the project start date is the day that mixing procedures begin.

To be eligible, the project must be submitted to the Reserve no more than six months after the project start date, unless the project is submitted during the first 12 months following the date of adoption of this protocol by the Reserve Board (the Effective Date).¹⁰ For a period of 12 months from the Effective Date of this protocol (Version 1.0), projects with start dates no more than 24 months prior to the Effective Date of this protocol are eligible. Specifically, projects with start dates on or after April XX, 2013 are eligible to register with the Reserve if submitted by April XX, 2016. Projects with start dates prior to April XX, 2013 are not eligible under this protocol. Projects may always be submitted for listing by the Reserve prior to their start date.

⁹ As defined in Section 6.4.

¹⁰ Projects are considered submitted when the project developer has fully completed and filed the appropriate Project Submittal Form, available at <http://www.climateactionreserve.org/how/program/documents/>.

3.3 Project Crediting Period

An ODS project includes a discrete series of destruction events over a 12-month period, beginning on the project start date. No destruction events may occur more than 12 months after the project start date. For the purposes of this protocol, it is assumed that, absent the project, the avoided ODS emissions would have occurred over a longer time-horizon.

Under this protocol, the project crediting period is the period of time over which avoided emissions are quantified for the purpose of determining creditable GHG reductions. Specifically, ODS projects are issued CRTs for the quantity of ODS that would have been released over a ten-year period following a destruction event. At the time the project is verified, CRTs are issued for all ODS emissions avoided by the project over the 10-year crediting period.

3.4 Additionality

The Reserve strives to register only projects that yield surplus GHG reductions that are additional to what would have occurred in the absence of a carbon offset market.

Projects must satisfy the following tests to be considered additional:

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

3.4.1 The Legal Requirement Test

All projects are subject to a Legal Requirement Test to ensure that the GHG reductions achieved by a project would not otherwise have occurred due to federal, state, or local regulations, or other legally binding mandates. A project passes the Legal Requirement Test when there are no laws, statutes, regulations, court orders, environmental mitigation agreements, permitting conditions or other legally binding mandates requiring the destruction of ODS.

To satisfy the Legal Requirement Test, project developers must submit a signed Attestation of Voluntary Implementation form¹¹ prior to the commencement of verification activities each time the project is verified (see Section 8).¹² In addition, the project's Monitoring and Operations Plan (Section 6) must include procedures that the project developer will follow to ascertain and demonstrate that the project at all times passes the Legal Requirement Test.

3.4.2 The Performance Standard Test

Projects pass the Performance Standard Test by meeting a performance threshold, i.e. a standard of performance applicable to all ODS destruction projects, established on an *ex ante* basis by this protocol.¹³

For this protocol, the Reserve uses a Performance Standard Test based on an evaluation of Mexican "common practice" for managing ODS. As detailed in Appendix B, destruction of ODS is not common practice in Mexico. Because the Reserve has determined that destruction of CFC refrigerant from Mexico is not common practice, projects that meet the project definition and other eligibility requirements of this protocol pass the Performance Standard Test.

¹¹ Attestation forms are available at <http://www.climateactionreserve.org/how/program/documents/>.

¹² Verification activities not related to confirming the Attestation of Voluntary Implementation (such as site visits or project material eligibility confirmation) may commence prior to this form being uploaded to the Reserve.

¹³ A summary of the study to establish the Performance Standard Test is provided in Appendix B.

The Reserve will periodically re-evaluate the appropriateness of the Performance Standard Test, and if necessary, amend this protocol accordingly. Projects that meet the Performance Standard Test and other requirements of the version of this protocol in effect at the time of their submission are eligible to generate CRTs.

3.5 Regulatory Compliance

Projects must be in material compliance with all applicable laws (e.g. air, water quality, and safety) at all times during each reporting period, as defined in Section **Error! Reference source not found.** The regulatory compliance requirement extends to the operations of destruction facilities where the ODS is destroyed, as well as the facilities where mixed ODS projects are mixed and sampled, and the transportation of the ODS to the destruction facility. These facilities and transportation events must meet applicable regulatory requirements during implementation of project activities. For example, any upsets or exceedances of permitted emission limits at a destruction facility must be recorded in their daily log and managed in keeping with their startup, shutdown, and malfunction plan.

Project developers must attest that project activities do not cause material violations of applicable laws (e.g. air, water quality, safety, etc.). To satisfy this requirement, project developers must submit a signed Attestation of Regulatory Compliance form¹⁴ prior to the commencement of verification activities each time the project is verified. Project developers are also required to disclose in writing to the verifier any and all instances of legal violations – material or otherwise – caused by the project activities.

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

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

¹⁴ Attestation forms are available at <http://www.climateactionreserve.org/how/program/documents/>.

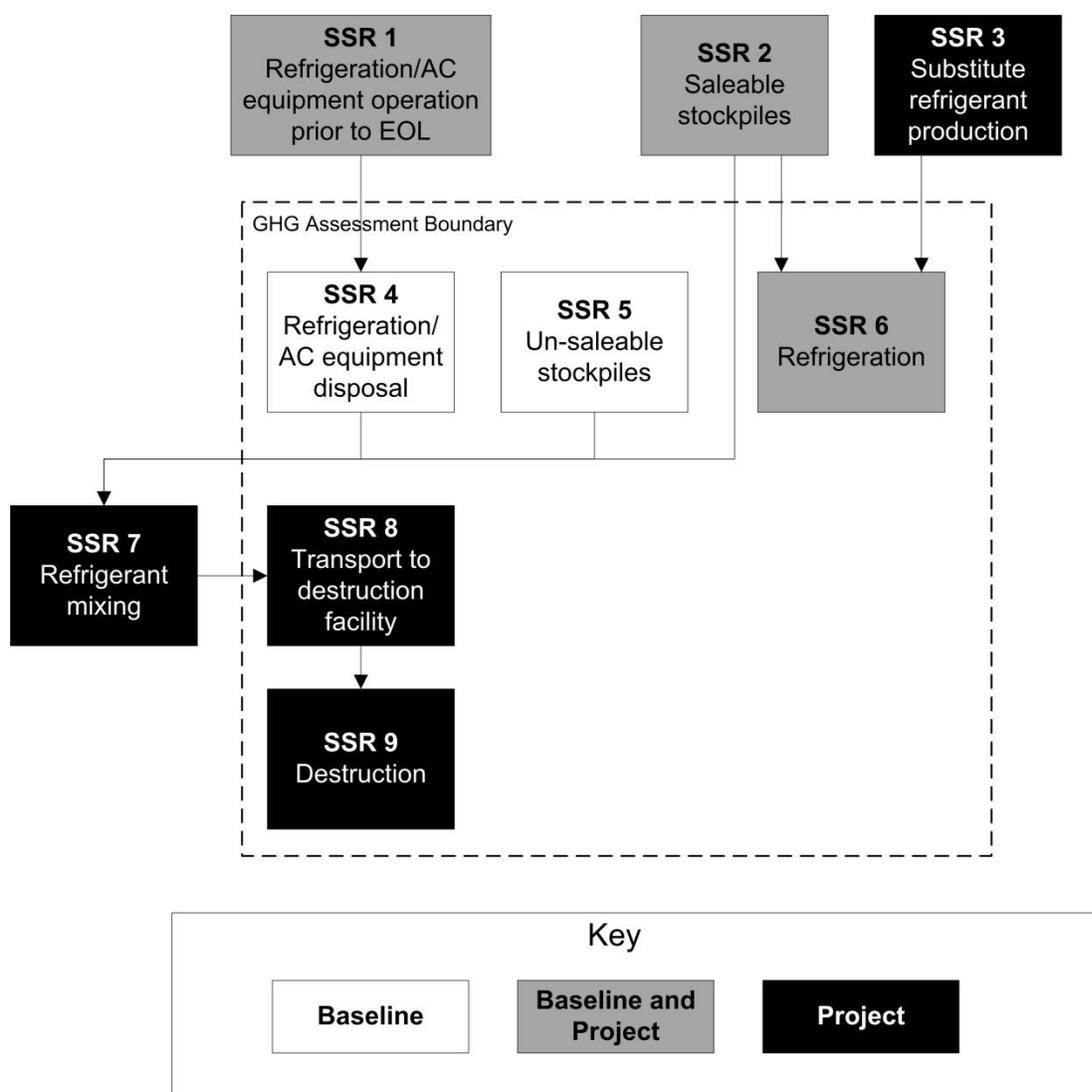
4 The GHG Assessment Boundary

The GHG Assessment Boundary delineates the GHG sources, sinks, and reservoirs (SSRs) that must be assessed by project developers in order to determine the net change in emissions caused by an ODS project.¹⁵

Figure 4.1 **Error! Reference source not found.** illustrates all relevant GHG SSRs associated with ODS project activities and delineates the GHG Assessment Boundary.

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

Figure 4.1. Illustration of the GHG Assessment Boundary



¹⁵ The definition and assessment of SSRs is consistent with ISO 14064-2 guidance.

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

SSR		Source Description	Gas	Included (I) or Excluded (E)	Quantification Method	Justification/Explanation
1	Refrigeration and A/C equipment operation prior to end-of-life (EOL)	ODS emissions from leaks and servicing of ODS origin equipment prior to end-of-life	ODS	E	N/A	Excluded, as project activity is unlikely to affect emissions relative to baseline activity
2	Saleable stockpiles	ODS emissions occurring from long-term storage of ODS which can legally be sold to market	ODS	E	N/A	Excluded, as project activity is unlikely to affect emissions relative to baseline activity
3	Substitute refrigerant production	Emissions of substitute refrigerant occurring during production	CO ₂ e	E	N/A	Excluded, as this emission source is assumed to be very small
		Fossil fuel emissions from the production of substitute refrigerants	CO ₂	E	N/A	Excluded, as this emission source is assumed to be very small
			CH ₄	E	N/A	Excluded, as this emission source is assumed to be very small
			N ₂ O	E	N/A	Excluded, as this emission source is assumed to be very small
4	Refrigeration/ AC equipment disposal	Emissions of ODS from the release of refrigerant at end-of-life	ODS	I	Baseline: Estimated as 100% immediate release Project: N/A	Baseline emissions will be significant
		Fossil fuel emissions from the recovery and aggregation of refrigerant at end-of-life	CO ₂	E	N/A	Excluded, as this emission source is assumed to be very small
			CH ₄	E	N/A	Excluded, as this emission source is assumed to be very small
			N ₂ O	E	N/A	Excluded, as this emission source is assumed to be very small

SSR		Source Description	Gas	Included (I) or Excluded (E)	Quantification Method	Justification/Explanation
5	Un-saleable stockpiles	ODS emissions occurring from long-term storage of ODS which cannot legally be sold to market	ODS	I	Baseline: Estimated based on site-specific emission rates Project: N/A	Baseline emissions will be significant
6	Refrigeration	Emissions of ODS from leaks and servicing through continued operation of equipment	ODS	I	Baseline: Estimated according to appropriate baseline scenario Project: N/A	Baseline equipment emissions will be significant
		Emissions of substitute from leaks and servicing through continued operation of equipment	CO ₂ e	I	Baseline: N/A Project: Estimated based on default emission rate	Project equipment emissions will be significant
		Indirect emissions from grid-delivered electricity	CO ₂	E	N/A	Excluded, as project activity is unlikely to affect emissions relative to baseline activity
			CH ₄	E	N/A	Excluded, as project activity is unlikely to affect emissions relative to baseline activity
			N ₂ O	E	N/A	Excluded, as project activity is unlikely to affect emissions relative to baseline activity
7	Refrigerant mixing	Fossil fuel emissions from ODS mixing activities at mixing facility	CO ₂	E	N/A	Excluded, as these emission sources are assumed to be very small
CH ₄						
N ₂ O						

SSR		Source Description	Gas	Included (I) or Excluded (E)	Quantification Method	Justification/Explanation
8	Transport to destruction facility	Fossil fuel emissions from the vehicular and ocean transport of ODS from aggregation point to final destruction facility	CO ₂	I	Baseline: N/A Project: Estimated based on distance and weight transported	Project emissions will be small, and can be calculated using the default factor provided
			CH ₄	E	N/A	Excluded, as this emission source is assumed to be very small
			N ₂ O	E	N/A	Excluded, as this emission source is assumed to be very small
9	Destruction	Emissions of ODS from incomplete destruction at destruction facility	ODS	I	Baseline: N/A Project: Estimated based on ODS destroyed, or included in default deduction	Project emissions will be small, and can be calculated using the default factor provided
		Emissions from the oxidation of carbon contained in destroyed ODS	CO ₂	I	Baseline: N/A Project: Estimated based on ODS destroyed, or included in default deduction	Project emissions will be small, and can be calculated using the default factor provided
		Fossil fuel emissions from the destruction of ODS at destruction facility	CO ₂	I	Baseline: N/A Project: Estimated based on ODS destroyed, or included in default deduction	Project emissions will be small, and can be calculated using the default factor provided
			CH ₄	E	N/A	Excluded, as this emission source is assumed to be very small
			N ₂ O	E	N/A	Excluded, as this emission source is assumed to be very small

SSR		Source Description	Gas	Included (I) or Excluded (E)	Quantification Method	Justification/Explanation
		Indirect emissions from the use of grid-delivered electricity	CO ₂	I	Baseline: N/A Project: Estimated based on ODS destroyed, or included in default deduction	Project emissions will be small, and can be calculated using the default factor provided
			CH ₄	E	N/A	Excluded, as this emission source is assumed to be very small
			N ₂ O	E	N/A	Excluded, as this emission source is assumed to be very small

5 Quantifying GHG Emission Reductions

Converting Pounds (lbs) to Kilograms (kg) and Fahrenheit to Celsius – Seeking Comment

The protocol currently refers to quantity of ODS in pounds and temperature in Fahrenheit. The Reserve plans to convert these figures to kilograms and Celsius. However, at various times over the course of protocol development, we have heard workgroup members refer to both types of measurements, particularly referring to ODS in pounds. Please confirm that the equations in these sections, as well as monitoring requirements, would be most appropriate in metric units of kilograms and Celsius.

GHG emission reductions from an ODS project are quantified by comparing actual project emissions to the calculated baseline emissions. Baseline emissions are an estimate of the GHG emissions from sources within the GHG Assessment Boundary (see Section 4) that would have occurred in the absence of the ODS destruction project. Project emissions are actual GHG emissions that occur at sources within the GHG Assessment Boundary. Project emissions must be subtracted from the baseline emissions to quantify the project's total net GHG emission reductions (Equation 5.1).

A project may not span more than 12 months, and GHG emission reductions must be quantified and verified at least once for the entire project time length. The length of time over which GHG emission reductions are quantified and verified is called a "reporting period." Project developers may choose to have multiple reporting periods within a project or a project time length shorter than 12 months, if desired. The quantification methods presented below are specified for a single reporting period, which may be less than or equal to the entire project time length.

Equation 5.1. Calculating GHG Emission Reductions

$ER_t = BE_t - PE_t$		
Where,		<u>Units</u>
ER_t	= Total emission reductions during the reporting period	MTCO ₂ e
BE_t	= Total baseline emissions during the reporting period, from all SSRs in the GHG Assessment Boundary (as calculated in Section 5.1)	MTCO ₂ e
PE_t	= Total project emissions during the reporting period, from all SSRs in the GHG Assessment Boundary (as calculated in Section 5.2)	MTCO ₂ e

5.1 Quantifying Baseline Emissions

Total baseline emissions for the reporting period must be estimated by calculating and summing the emissions from all relevant baseline SSRs that are included in the GHG Assessment Boundary (as indicated in Table 4.1) using Equation 5.3. This includes emissions from stockpiled refrigerants and end-of-life refrigerants that would have occurred over the ten-year crediting period. Note that emissions shall be quantified in pounds throughout this section and converted into metric tons in Equation 5.3 below.

The Reserve has defined four different baselines for refrigerants in Mexico. Table 5.1 identifies the refrigerant categories, and the associated applicable baseline scenario. The standardized baseline scenarios in Table 5.1 have been selected to provide a conservative estimation of baseline emissions from ODS refrigerants in Mexico.

Table 5.1. Refrigerant Baseline Scenarios

Refrigerant Origin	Baseline Scenario	Applicable Annual Emission Rate	10-year Cumulative Emissions (%) ¹⁶ (ER_{refr})
1. Privately held stockpiles of used ODS refrigerant that can legally be sold to the market	Use for recharge of existing refrigeration equipment	25% ¹⁷	94%
2. Government stockpiles of ODS refrigerant that can legally be sold into the refrigerant market	Use for recharge of existing refrigeration equipment	25% ¹⁷	94%
3. Government stockpiles of ODS refrigerants that cannot legally be sold into the refrigerant market	Continued storage	Site specific emission rate as documented (see Equation 5.2)	$1-(1-ER_{stock})^{10}$
4. Used ODS refrigerant recovered from end-of-life equipment	End-of-life release to the atmosphere	100%	100%

The site specific emission rate for government stockpiles that cannot legally be sold into the refrigerant market shall be calculated according to Equation 5.2.

Equation 5.2. Calculating Site-Specific Emission Rate

$ER_{stock,i} = \left(1 - \frac{Q_{end}}{Q_{start}}\right)^{\frac{1}{y}}$		
<i>Where,</i>		
		<u>Units</u>
$ER_{stock,i}$	= Average annual emission rate of refrigerant ODS <i>i</i>	%
Q_{end}	= Total quantity of ODS refrigerant <i>i</i> in government stockpile at time of destruction	lb ODS
Q_{start}	= Total quantity of ODS refrigerant <i>i</i> in government stockpile at time of seizure	lb ODS
y	= Time from seizure to destruction of ODS stockpile	years

Equation 5.3 shall be used to calculate the baseline emissions that would have occurred over a ten-year horizon in the absence of the project activity, per the project crediting period limit (see Section 3.3). This equation requires the use of the applicable emission rate provided in Table 5.1 or calculated using Equation 5.2, and the ODS-specific GWP provided in Table 5.2.

¹⁶ 10-year cumulative emissions = $1-(1-\text{emission rate})^{10}$, or the percent of a given substance which will be released over ten years at a constant emission rate.

¹⁷ United Nations Environment Programme, Technology and Economic Assessment Panel. (2005). Report of the Task Force on Foam End-of-Life Issues.

Equation 5.3. Baseline Emissions

$$BE = \left[\frac{\sum_i (Q_{refr,i} \times ER_{refr,i} \times GWP_{refr,i})}{2204.623} \right] \times (1 - VR)$$

Where, Units

BE	=	Total quantity of refrigerant baseline emissions during the reporting period	tCO ₂ e
Q _{refr,i}	=	Total quantity of pure refrigerant ODS <i>i</i> sent for destruction by the project	lb ODS
ER _{refr,i}	=	10-year cumulative emission rate of refrigerant ODS <i>i</i> (see Table 5.1)	%
GWP _{refr,i}	=	Global warming potential of refrigerant ODS <i>i</i> (see Table 5.2)	lb CO ₂ e/ lb ODS
2204.623	=	Conversion from pounds to metric tons	lb/t
VR	=	Deduction for vapor composition risk (see Section 0)	%

Table 5.2. Global Warming Potential of Eligible ODS Refrigerants

ODS Species	Global Warming Potential ¹⁸ (CO ₂ e)
CFC-11	4,750
CFC-12	10,900
CFC-113	6,130
CFC-114	10,000
CFC-115	7,370

To calculate Q_{refr,i} (total quantity of pure refrigerant ODS sent for destruction), the total weight of material destroyed by the project shall be adjusted to exclude the weight of ineligible material, including high boiling residue, as determined by the laboratory analysis required in Section 6.4.2. In the case of multiple laboratory analyses, the highest reported value for HBR shall be used. In any case where the composition of the single ODS species is less than 100%, the value of this term must be adjusted to reflect the weight of pure ODS for each eligible chemical. For example, if a project destroys 1,000 lbs. of material that contains 5% high boiling residue and 95% eligible ODS *i*, the value of Q_{refr,i} would be 902.5 lbs.

While water is also considered ineligible material, the moisture content requirement in Section 6.4.2 of the protocol (i.e. that the moisture content must be less than 75% of the saturation point for the ODS) already ensures that the weight of any moisture present will not have a material impact on the quantification of emission reductions. Thus the weight does not need to be adjusted to reflect the weight of moisture present in the sample.

If, during verification, the verification body cannot confirm that a portion of the ODS that was sent for destruction was eligible, this portion of the material shall be considered ineligible. This ineligible ODS shall be excluded from baseline emission calculations. The quantity of ineligible ODS sent for destruction shall be subtracted from Q_{refr,i} prior to the calculation of Equation 5.3 in

¹⁸ IPCC, Errata: Climate Change 2007, The Physical Science Basis, The Working Group I contribution to the IPCC Fourth Assessment Report, available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-errata.pdf>.

order to calculate baseline emissions only for ODS that was confirmed to be eligible by the verification body. This quantity shall be determined by one of the following methods:

Option A: Confirmed weight and composition

If the project developer can produce data that, based on the verifier's professional judgment, confirm the weight and composition for the specific ODS that is deemed to be ineligible (or whose eligibility cannot be confirmed), these data shall be used to adjust the value of $Q_{\text{ref},i}$ accordingly.

Option B: Default values

If sufficient data are not available to satisfy the Option A requirements, then the most conservative estimate of the weight and composition of the ineligible container of ODS shall be used. Specifically, the composition of the ineligible container of ODS shall be assumed to be 100 percent of the ODS species with the highest GWP based on the composition analysis, and the relevant container that was deemed ineligible shall be assumed to have been full. If the project developer has only some of the data required for Option A (i.e. weight or composition, but not both), this may be used in place of the conservative assumptions above, as long as the data can be confirmed by the verification body. The resulting estimate of the weight of ineligible ODS shall be subtracted from the total weight of that ODS species destroyed in the project, not to exceed the actual amount of that ODS species destroyed. See Box 5.1 for an example of Option B.

Box 5.1. Applying Option B to Adjust for Ineligible ODS After Destruction

This option shall be applied when multiple containers of ODS are combined into a single container for destruction, but the eligibility of the ODS in one or more of the original containers cannot be verified.

Example:

A refrigerant aggregator receives shipments of three different containers (A, B, and C), which are combined into one project container (Z) for destruction. During verification, the project developer is unable to produce documentation to verify the eligibility of container C.

Original Containers from Point of Origin	Maximum Container Volume	Composition
A	1000 L	unknown
B	500 L	unknown
C	500 L	unknown
Project container	Weight	Composition
Z	5000 lbs	50% CFC-11 50% CFC-12

Based on Option B above, the project developer must assume that the composition of container C was 100 percent CFC-12 and that the container was completely full. Using the temperature recorded on the composition analysis (62°F for this example), the maximum amount of ODS would be equal to the volume of the container (500 L) multiplied by the density of CFC-12 at 62°F (2.9553 lb/L), or 1,478 lbs. This amount is subtracted from the total amount of eligible ODS prior to quantification of emission reductions.

Resulting eligible ODS:

CFC-11: 2500 lbs

CFC-12: 2500 – 1478 = 1022 lbs

5.2 Quantifying Project Emissions

Project emissions are actual GHG emissions that occur within the GHG Assessment Boundary as a result of project activities. Project emissions must be quantified every reporting period on an *ex post* basis.

As shown in Equation 5.4, project emissions equal:

- Emissions from substitute refrigerants, plus
- Emissions from the transportation of ODS, plus
- Emissions from the destruction of ODS

Note that emissions shall be quantified in pounds throughout this section and converted into metric tons in Equation 5.4 below.

Equation 5.4. Total Project Emissions

$PE_t = \frac{Sub_{ref} + Tr + Dest}{2204.623}$		
Where,		<u>Units</u>
PE _t	= Total quantity of project emissions during the reporting period	MTCO ₂ e
Sub _{ref}	= Total emissions from substitute refrigerant	lb CO ₂ e
Tr	= Total emissions from transportation of ODS (calculated using either the default value in Equation 5.6, or Equation 5.12)	lb CO ₂ e
Dest	= Total emissions from the destruction process associated with destruction of ODS (calculated using either the default value in Equation 5.6, or Equation 5.7 through Equation 5.11)	lb CO ₂ e
2204.623	= Conversion from pounds to metric tons	lb/t

5.2.1 Calculating Project Emissions from the Use of CFC Substitutes

When refrigerant ODS are destroyed, continued demand for refrigeration will lead to the production and consumption of other refrigerant chemicals whose production is still legally allowed. Projects that destroy refrigerant from stockpiles that can legally be sold to market must therefore estimate the emissions associated with the non-CFC substitute chemicals that are assumed to be used in their place. Projects that destroy used refrigerant recovered from end-of-life equipment do not need to account for substitutes, as the destruction of this ODS does not increase the demand for substitute refrigerants. Similarly, projects that destroy government stockpiles that cannot legally be sold to the refrigerant market do not need to account for substitutes, as the destruction is not expected to increase use of substitute refrigerants. The point of origin of the ODS must be documented to support the selected baseline per Section 6.2. If the verifier can confirm that the point of origin is either end of life equipment tracked to location of ODS recovery or government stockpiles that cannot be legally sold, then Sub_{ref} = 0.

Equation 5.5 accounts for the emissions associated with the substitute refrigerants that will be used in place of destroyed ODS refrigerants. Like the destroyed ODS calculations in the

baseline, substitute emissions shall also be estimated based on the projected emissions over the ten-year crediting period.

Destroyed ODS refrigerants are assumed to be replaced by HFC-134a. A review of the literature indicates that HFC-134a and HC-600a are the dominant new refrigerants being used in place of ODS in Article 5 countries.¹⁹ However, no reliable, quantitative data could be identified on the relative market share of these refrigerants. As HFC-134a has a higher GWP, this assumption is therefore conservative.

Seeking Additional Data on Substitute Refrigerants in Mexico:

It is our understanding that HFC-134a is actually much more dominant in Mexico than HC-400a, and that propane (R290) is also used as a substitute. The Reserve does not plan to change this section or its assumptions, unless additional data or resources are available from the workgroup to substantiate the market share of each substitute, demonstrating that the current assumptions are overly conservative in Mexico.

Project emissions from the use of non-CFC substitute refrigerants shall be calculated, as applicable, according to Equation 5.5.

Equation 5.5. Calculating Project Emissions from the Use of Non-ODS Refrigerants

$$Sub_{refr} = \sum_i (Q_{refr,i} \times 0.77 \times 1430)$$

Where,		Units
Sub _{,refr}	= Total quantity of project refrigerant substitute emissions	lb CO ₂ e
Q _{refr,i}	= Total quantity of eligible, pure refrigerant ODS <i>i</i> destroyed	lb
0.77	= Leak rate of HFC-134a (13.7% per year) ²⁰	% (0-1)
1430	= Global warming potential of HFC-134a	lb CO ₂ e/ lb sub

5.2.2 Calculating Default Project Emissions from ODS Destruction and Transportation

Projects must account for emissions that result from the transportation and destruction of ODS. Because these emission sources are both individually and in aggregate very small, the Reserve has developed a default emission factor for ODS projects based on conservative assumptions and the SSRs outlined in Table 4.1.²¹ The emission factor shall be equal to 7.5 pounds CO₂e per pound of ODS refrigerant destroyed. This emission factor aggregates both transportation and destruction emissions.

Project developers have the option of using the default emission factor, or using the Equations in Sections 5.2.3 and 5.2.4 to calculate project-specific emissions. Equation 5.6 shall be used to calculate ODS transportation and destruction emissions if default emission factors are used.

¹⁹ United Nations Environment Programme, Technology and Economic Assessment Panel. (2006). Progress Report.

²⁰ United Nations Environment Programme, Technology and Economic Assessment Panel. (2006). Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee.

²¹ See Appendix D for a summary of how the default emission factor was derived.

NOTE on the default emission factor of transportation and destruction of ODS:

The default emission factor above (7.5 pounds CO₂e) is very conservative, and will not be changed unless the Reserve is able to revise this emission factor to make it more specific to Mexico. The Reserve is working with Quimobasicos to review some site specific ODS destruction emissions data. Additional comment and/or recommendations for resources that may be applicable here are welcome.

Equation 5.6. Project Emissions from Transportation and Destruction Using the Default Emission Factors

$Tr + Dest = Q_i \times 7.5$		
Where,		<u>Units</u>
Tr + Dest	=	Total emissions from ODS transportation and destruction, as calculated using default emission factors
Q _i	=	Total quantity of refrigerant <i>i</i> ODS sent for destruction, including eligible and ineligible material
7.5	=	Default emission factor for transportation and destruction of ODS
		lb CO ₂ e lb ODS lb CO ₂ e/ lb ODS

5.2.3 Calculating Site-Specific Project Emissions from ODS Destruction

Under this protocol, ODS must be destroyed at destruction facilities which demonstrate compliance with the TEAP recommendations.²² These facilities demonstrate their ability to achieve destruction efficiencies upwards of 99.99 percent for substances with thermal stability ratings higher than the ODS included herein.²³ Associated with the operation of these facilities are emissions of CO₂ from the fuel and electricity used to power the destruction, emissions of un-combusted ODS, and emissions of CO₂ from the oxidation of ODS. Equation 5.7 through Equation 5.9 provide guidance on calculating emissions from ODS destruction in cases where project developers opt not to use the default factors outlined in Section 5.2.3.

Equation 5.7. Project Emissions from the Destruction of ODS

$Dest = FF_{dest} + EL_{dest} + ODS_{emissions} + ODS_{CO_2}$		
Where,		<u>Units</u>
Dest	=	Total emissions from the destruction of ODS
FF _{dest}	=	Total emissions from fossil fuel used in the destruction facility (Equation 5.8)
EL _{dest}	=	Total indirect emissions from grid electricity used at the destruction facility (Equation 5.9)
ODS _{emissions}	=	Total emissions of un-destroyed ODS (Equation 5.10)
ODS _{CO₂}	=	Total emissions of CO ₂ from ODS oxidation (Equation 5.11)
		lb CO ₂ e lb CO ₂ lb CO ₂ lb CO ₂ e lb CO ₂

²² TEAP, <http://uneptie.org/ozonation/topics/disposal.htm>.

²³ ICF International. (2009). ODS Destruction in the United States of America and Abroad. U.S. EPA Stratospheric Protection Division.

Equation 5.8. Fossil Fuel Emissions from the Destruction of ODS

$$FF_{dest} = \frac{\sum_k (FF_{PR,k} \times EF_{FF,k})}{0.454}$$

Where,

		Units
FF_{dest}	= Total carbon dioxide emissions from the destruction of fossil fuel used to destroy ODS	lb CO ₂
$FF_{PR,k}$	= Total fossil fuel k used to destroy ODS	volume fossil fuel
$EF_{FF,k}$	= Fuel specific emission factor (see Appendix D)	kg CO ₂ / volume fossil fuel
0.454	= Conversion from kg to lb of CO ₂	kg CO ₂ / lb CO ₂

Equation 5.9. Electricity Emissions from the Destruction of ODS

$$EL_{dest} = EL_{PR} \times EF_{EL}$$

Where,

		Units
EL_{dest}	= Total carbon dioxide emissions from the consumption of electricity from the grid used to destroy ODS	lb CO ₂
EL_{PR}	= Total electricity consumed to destroy ODS	MWh
EF_{EL}	= Carbon emission factor for electricity used ²⁴	lb CO ₂ / MWh

NOTE on EF_{EL} (the emission factor for electricity used):

EF_{EL} (the emission factor for electricity used) is based on US regional grid emission factors (see footnote 24 below). The Reserve would like to update these numbers for Mexico, and we believe CFE has created a similar grid emission factor for Mexico, but to date, the Reserve has not been able to locate these emission factors. Please let us know if you can help us to locate this type of data.

²⁴ Refer to the version of the EPA eGRID that most closely corresponds to the time period during which the electricity was used. Project shall use the annual total output emission rates for the subregion where the destruction facility is located, not the non-baseload output emission rates. The eGRID tables are available at <http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>.

Equation 5.10. Calculating Project Emissions from ODS Not Destroyed

$$ODS_{emissions} = \sum_i Q_{refr,i} \times 0.0001 \times GWP_i$$

Where,

		<u>Units</u>
ODS _{emissions}	= Total emissions of un-destroyed ODS	lb CO ₂ e
Q _{refr,i}	= Total quantity of refrigerant ODS <i>i</i> sent for destruction	lb ODS
0.0001	= Maximum allowable portion of ODS fed to destruction that is not destroyed (0.01%)	
GWP _i	= Global warming potential of ODS <i>i</i> (see Table 5.2)	lb CO ₂ e/ lb ODS

Equation 5.11. Calculating Project Emissions of CO₂ from the Oxidation of ODS

$$ODS_{CO_2} = \sum_i Q_{refr,i} \times 0.9999 \times CR_i \times \frac{44}{12}$$

Where,

		<u>Units</u>
ODS _{CO₂}	= Total emissions of CO ₂ from ODS oxidation	lb CO ₂
Q _{refr,i}	= Total quantity of refrigerant ODS <i>i</i> sent for destruction	lb ODS
0.9999	= Minimum destruction efficiency of destruction facility (99.99%)	
CR _i	= Carbon ratio of ODS <i>i</i> CFC-11: 12/137 CFC-12: 12/121 CFC-113: 24/187 CFC-114: 24/171 CFC-115: 24/154	MW C/ MW ODS
44/12	= Ratio of molecular weight of CO ₂ to C	MW CO ₂ / MW C

5.2.4 Calculating Site-Specific Project Emissions from ODS Transportation

As part of any ODS destruction project, ODS must be transported from aggregators to destruction facilities, and emissions from this transportation must be accounted for under this protocol using Equation 5.6 or Equation 5.12. Equation 5.12 provides guidance on calculating site-specific CO₂ emissions associated with the transport of ODS. Emissions shall be calculated for each leg of the transportation process separately, and then summed according to Equation 5.12 below.

Emissions shall be calculated for each leg of the transportation process separately, and then summed according to Equation 5.12 below.

Equation 5.12. Calculating Project Emissions from the Transportation of ODS²⁵

$Tr = \sum_i (TMT_i \times EF_{TMT})$		
Where,		
		<u>Units</u>
Tr	=	Total emissions from transportation of ODS lb CO ₂ e
PMT _i	=	Pound-miles traveled ²⁶ for ODS <i>i</i> destroyed (to be calculated including the eligible ODS, any accompanying material, and containers from point of aggregation to destruction) pound-miles
EF _{TMT}	=	CO ₂ emissions per pound-mile traveled On-road truck transport = 0.000297 Rail transport = 0.0000252 Waterborne craft = 0.000048 Aircraft = 0.0015279 lb CO ₂ /pound-mile

NOTE on EF_{TMT}:

These emission factors are based on fuel use per vehicle mile traveled in the US. Though they are likely to be similar, Reserve would like to adapt these figures to Mexico and is seeking recommendations for a data resource where this may have been calculated for transportation within Mexico. Otherwise, the Reserve will likely update these numbers based on IPCC default emission factors for transport.

5.3 Deduction for Vapor Composition Risk

For any given container of ODS, a portion of the container will be filled with liquid, and the remaining space will be filled with vapor. This protocol only requires that a liquid sample be taken for composition analysis. For containers that hold a mixture of ODS, the composition of ODS in the vapor may be different from the composition of ODS in the liquid due to differences in the thermodynamic properties of the chemicals. If the container holds chemicals that are not eligible for crediting, the quantification of emission reductions based on the analysis of liquid sample could overstate the actual reductions from the destruction of the material.

To address this risk, projects that destroy containers which contain more than one chemical must use Table 5.4 to determine their risk category and applicable value of *VR* to be applied to the calculation of baseline emissions for that container (Equation 5.3). Table 5.3 classifies the eligible ODS species as low or high pressure. For the purposes of this protocol, any ineligible chemical with a boiling point less than 32°F at 1 atm is considered high pressure.

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

²⁵Derived from: U.S. Environmental Protection Agency, Climate Leaders. (2008). Greenhouse Gas Inventory Protocol Core Module Guidance: Optional emissions from business travel, commuting, and product transport.

²⁶A pound-mile is defined as the product of the distance travelled in miles and the mass transported in pounds. Therefore, 500 lbs transported four miles is equal to 2,000 pound-miles.

container. Once the weight of the contents of the project container is known, the liquid fill level of the container shall be determined using Equation 5.13.

Table 5.3. Eligible Low Pressure and High Pressure ODS

Low Pressure ODS	High Pressure ODS
CFC-11	CFC-12
CFC-113	CFC-13
CFC-114	CFC-115

Table 5.4. Determining the Deduction for Vapor Composition Risk

If the value of $Fill_{liquid}$ (Equation 5.13) is:	AND the concentration of eligible low pressure ODS is:	AND the concentration of ineligible high pressure chemical is:	Then the vapor risk deduction factor (VR) for that container shall be:
> 0.70	N/A	N/A	0
0.50 – 0.70	> 1%	> 10%	0.02
< 0.50	> 1%	> 5%	0.05

The presence of eligible, high-pressure ODS may mitigate the risk of over-crediting, so there are two scenarios where a container is exempt from a deduction otherwise required in Table 5.4:

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

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

This deduction applies to both mixed and non-mixed ODS projects as defined in Section 6.6.

Equation 5.13. Determining Liquid Fill Level in Project Container

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

Where,		Units
$Fill_{liquid}$	= Fill level of the liquid in the project container	fraction
$V_{container}$	= Total volume of the project container	gal
$M_{destroyed}$	= Total mass of the contents of the project container	lbs
ρ_{liquid}	= Modeled density of the liquid material in the project container at the measured temperature	lbs/gal
ρ_{vapor}	= Modeled density of the vapor material in the project container at the measured temperature	lbs/gal

6 Project Monitoring and Operations

The Reserve requires a Monitoring and Operations Plan to be established and implemented for all monitoring, operations, and reporting activities associated with the ODS destruction project. The Monitoring and Operations Plan will serve as the basis for verifiers to confirm that the monitoring, operations, and reporting requirements in this section and Section 7 have been and will continue to be met, and that consistent, rigorous monitoring and record keeping is ongoing for the project. The Monitoring and Operations Plan must cover all aspects of monitoring and reporting contained in this protocol and must specify how data for all relevant parameters in **Error! Reference source not found.** will be collected and recorded.

At a minimum, the Monitoring and Operations Plan shall stipulate the frequency of data acquisition; a record keeping plan (see Section 7.2 for minimum record keeping requirements); and the role of individuals performing each specific monitoring activity; and a detailed project diagram. The Monitoring and Operations Plan shall contain a project diagram that illustrates the project ODS point(s) of origin, any reclamation facilities used, information on ODS transportation mode and transportation companies, mixing/sampling facilities, testing laboratories, and the destruction facility (see Appendix F for a sample project diagram). The Monitoring and Operations Plan should also include QA/QC provisions to ensure that operations, data acquisition and ODS analyses are carried out consistently and with precision. In addition, the Monitoring and Operations Plan must stipulate data management systems and coordination of data between ODS aggregators, project developers, and destruction facilities.

Project developers are responsible for monitoring the performance of the project and ensuring that there is no double-counting of GHG reductions associated with ODS destruction. To achieve this, the Monitoring and Operations Plan must also include a description of how data will be provided to the Reserve ODS tracking system (see Section 6.1).

Finally, the Monitoring and Operations Plan must include procedures that the project developer will follow to ascertain and demonstrate that the project at all times passes the Legal Requirement Test and is in material compliance with all applicable laws (Section 3.4.1 and 3.5, respectively).

6.1 Reserve ODS Tracking System

For the purposes of ensuring the integrity of ODS destruction projects, the Reserve maintains an online database of all destruction activities for which CRTs are registered and issued. Entries into this system within the Reserve software must be made by the project developer prior to the beginning of verification activities relating to confirming that reductions have not been claimed by other parties for the destruction activity in question.²⁷

All projects are required to have one or more Certificate(s) of Destruction accounting for all eligible ODS destroyed as part of the project. The following information shall be entered by the project developer into the Reserve software from the Certificate(s) of Destruction issued by the destruction facility, and a copy of the certificate(s) must be provided to the project verifier:

- Project developer (project account holder)
- Destruction Facility

²⁷ Other verification activities (such as site visits) may commence prior to submission of information into the ODS tracking system.

- Generator name
- Certificate of Destruction ID number
- Start destruction date
- End destruction date
- Total weight of material destroyed (including eligible and ineligible material)

6.2 Point of Origin Documentation Requirements

NOTE:

This section currently has only minor changes from the Article 5 Project Protocol (specific to SISSAO). The Reserve's technical contractor will be making recommendations on improvements to this section, and the Reserve is seeking additional comment on whether there are any additional or different documentation requirements that might help reduce the risk of fraud.

Project developers are responsible for collecting data on the point of origin for each quantity of ODS, as defined in Table 6.1. The project developer must maintain detailed acquisition records of all quantities of ODS destroyed by the project.

Table 6.1. Identification of Point of Origin

ODS	Point of Origin	10-year Cumulative Emissions (%) ¹
1. Government stockpiles of virgin ODS	Location of stockpile	94% or site-specific emission rate (see Section 5.1 Error! Reference source not found.)
2. Used ODS stockpiled prior to February 3, 2010 ²	Location of stockpile	94% or site specific emission rate (see Section 5.1 Error! Reference source not found.)
3. Used ODS in quantities less than 500 lbs	Location where ODS is first aggregated to greater than 500 lbs	94%
4. Used ODS in quantities greater than 500 lbs	Site of installation from which ODS is removed	94%
5. Used ODS of any quantity recovered from end-of-life equipment	Location where ODS is recovered from end-of-life equipment	100%
<p>¹ This information is provided to illustrate the connection between point of origin and the cumulative emission rate used to calculate baseline emissions. See Table 5.1 for more details on these emission rates and related baseline scenarios.</p> <p>² The Reserve's Article 5 ODS Project Protocol was adopted February 3, 2010 and is maintained here due to eligibility of Mexican-sourced ODS in both protocols.</p>		

Project developers must be able to document the point of origin for all ODS that will be included in the project as defined in the table above. For destroyed ODS where the point of origin is a reservoir-style stockpile (i.e. it was not sealed), the date on which the ODS was stockpiled is established using "first-in/first-out" accounting. Specifically, the date on which a quantity of ODS was "stockpiled" is defined as the furthest date in the past on which the quantity of ODS contained in the reservoir was greater than or equal to the total quantity of all ODS removed from the reservoir since that date (including any ODS removed and destroyed as part of the project). The date must be established using management systems and logs that verify the

quantities of ODS placed into and removed from the reservoir throughout the relevant period. Provided these elements are met, and the stockpile follows the “first-in/first-out” accounting, the date on which a quantity of ODS was stockpiled may be established.

For government-held virgin stockpiles, documentation of the point of origin must be generated at the time material is placed at the stockpile location and every time material is added to the stockpile. For used stockpiles, documentation must confirm that the stockpile has been stored at the point of origin prior to February 3, 2010.²⁸

For ODS recovered by service technicians in individual quantities less than 500 pounds, the point of origin is defined as the facility where two or more containers were combined and exceeded 500 pounds in a single container. Those handling quantities less than 500 pounds in a single container need not provide the documentation required below. However, once smaller quantities are aggregated and exceed 500 pounds in a single container, tracking is required at that location and point in time forward.

For containers of ODS greater than 500 pounds (determined as the weight of eligible ODS within a single container), the project developer must provide documentation as to the origin of the ODS within that container and when it was recovered. If it is shown that, prior to aggregation in the project container, the ODS was contained as a quantity greater than 500 pounds, then the documentation must extend back to this previous container and its point of origin. The project developer must provide documentation tracking the ODS back to a point in time and location where it was either a) contained or recovered as a quantity of less than 500 pounds, or b) recovered by a service technician as a quantity of greater than 500 pounds.

For ODS recovered from end-of-life equipment, the project developer must provide documentation to confirm that the ODS was recovered at the point of origin and that the equipment was disposed of/decommissioned after the ODS was recovered. It may not be possible to document the exact time the ODS was recovered from all equipment (e.g. at a reclamation facility processing large numbers of appliances), but the verifier must confirm that the inventory and activity logs support the quantity of ODS being destroyed for that reporting period.

All data must be generated at the point of origin. Documentation of the point of origin of ODS shall include the following:

- Facility name and physical address
- For quantities greater than 500 pounds, identification of the system by serial number, if available, or description, location, and function, if serial number is unavailable
- Serial or ID number of containers used for storage and transport

In addition to the documentation noted above, project developers must list and/or update information about the project ODS on Mexico’s voluntary ODS Information Monitoring System, SISSAO, to reflect the appropriate point of origin.²⁹

Seeking Comment:

²⁸ The Reserve’s Article 5 ODS Project Protocol was adopted February 3, 2010 and is maintained here due to eligibility of Mexican-sourced ODS in both protocols.

²⁹ SISSAO stands for the “Sistema de Información y Seguimiento de Sustancias Agotadoras de la Capa de Ozono” and is accessible at <http://sissao.semarnat.gob.mx/>.

Will project developers be able to comply with the above requirement to list/update information on SISSAO or does it create undue burden? Is there anything else that could/should be added to this requirement?

6.3 Custody and Ownership Documentation Requirements

NOTE:

This section currently has only minor changes from the Article 5 Project Protocol (specific is SISSAO). The Reserve's technical contractor will be making recommendations on improvements to this section, and the Reserve is seeking additional comment on whether there are any additional or different documentation requirements that might help reduce the risk of fraud.

In conjunction with establishing the point of origin for each quantity of ODS, project developers must also document the custody and ownership of ODS. These records shall include names, addresses, and contact information of persons buying/selling the material for destruction and the quantity of the material (the combined mass of refrigerant and contaminants) bought/sold. Such records may include Purchase Orders, Purchase Agreements, packing lists, bills of lading, lab test results, transfer container information, receiving inspections, freight bills, transactional payment information, and any other type of information that will support previous ownership of the material and the transfer of that ownership to the project developer. The verification body will review these records and will perform other tests necessary to authenticate the previous owners of the material and the physical transfer of the product and the title transfer of ownership rights of all emissions and emission reductions associated with destroyed ODS to the project developer, as documented through contracts, agreements, or other legal documents.

No GHG credits may be issued under this protocol for ODS where ownership cannot be established.

The transfer of custody may be established using the following documentation, as appropriate:

- Tax ID, or other applicable identifier, of transferor and transferee
- Bill of lading (where appropriate)
- Date of transfer of custody
- Serial or ID numbers of all containers containing ODS (received and delivered)
- Weight of all containers containing ODS (received and delivered)
- Distance and mode of transportation used to move ODS (truck, rail or air)

In addition to the documentation noted above, project developers must list and/or update information about the project ODS on Mexico's voluntary ODS Information Monitoring System, SISSAO. As verification bodies will not have access to the SISSAO system, project developers are required to demonstrate updated SISSAO listing information to verification bodies during the site visit, allowing them to review the SISSAO listing at that time.

Seeking Comment:

Will project developers be able to comply with the above requirement to list/update information on SISSAO or does it create undue burden? Is there anything else that could/should be added to this requirement?

6.4 ODS Composition and Quantity Analysis Requirements

The requirements of this section must be followed to determine the quantities of ODS refrigerants. Prior to destruction, the precise mass and composition of ODS to be destroyed must be determined. For projects where the destruction facility is also the project developer, these analyses must be performed by an independent third party as specified further below.

6.4.1 ODS Quantity Analysis

Mass shall be determined by individually measuring the weight of each container of ODS: (1) when it is full prior to destruction; and (2) after it has been emptied and the contents have been fully purged and destroyed. The mass of ODS and any contaminants destroyed shall be considered equal to the difference between the full and empty weights of the containers, as measured by the scale at the destruction facility and recorded by the destruction facility on the weight tickets and the Certificate of Destruction. No adjustments shall be made by the project developer to the weights as measured and recorded by the destruction facility in calculating the mass of ODS and contaminants.

The following requirements must be met for the measurement of each container:

1. A single scale must be used for generating both the full and empty weight tickets at the destruction facility
2. The scale used must have its calibration verified quarterly by PROFECO or a verification company approved by PROFECO. Verification must be performed according to NOM-010-SCFI-1994 using test weights certified to NOM-038-SCFI-2000. A scale is considered calibrated if it is within the maintenance tolerance of the relevant NOM-010-SCFI-1994 accuracy class. If a scale is found to be outside of this tolerance, it must be recalibrated
3. The full weight must be measured no more than two days prior to commencement of destruction per the Certificate of Destruction, and the empty weight must be measured no more than two days after the conclusion of destruction per the Certificate of Destruction.
4. For projects where the destruction facility is also the project developer, an independent third party must be onsite at the time of measurement to attest to the accuracy of the full and empty weight tickets.

Verifiers shall confirm that the weights recorded on the weight tickets and the Certificate of Destruction by the destruction facility are used without adjustment to calculate emission reductions. The mass of eligible ODS shall then be determined using these weights and the results of the laboratory analyses discussed further below.

NOTE:

Please comment on the above requirements, and whether they seem reasonable. In particular, please note that the regulation requires calibration of scales annually, while the Reserve believes a quarterly calibration requirement (in line with US destruction facility requirements) is more appropriate. In addition, please review the new requirement for an independent third party to be present if the destruction facility is acting as the project developer; this is not required in the other ODS protocols but has been added here for additional rigor due to the fact that Quimobasicos is currently the only eligible destruction facility in Mexico, who plans to act as a project developer as well.

6.4.2 ODS Composition and Concentration Analysis

Composition and concentration of ODS and contaminants shall 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 Air-Conditioning, Heating and Refrigeration Institute (AHRI) certified laboratory using the AHRI 700-2006 standard or its successor. The laboratory must not be affiliated with the project developer or the project beyond performing composition analysis services.

If the laboratory is located in the US, the laboratory must be certified by AHRI. The transport and delivery of project samples must comply with Mexican and US import/export laws and maintain additional documentation of that process for verification purposes.

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 project developer³⁰
3. Samples must be taken by a technician who has completed SEMARNAT's course "Services Refrigeration and Air Conditioning Good Practices" and who is listed on the ODS Information Monitoring System (SISSAO).
4. Samples must be taken utilizing procedures contained in the SEMARNAT's UPO's Good Practices Handbook.³¹
5. Samples must be taken with a clean, fully evacuated sample bottle with a minimum capacity of one pound that meets applicable Mexican Ministry of Communications and Transportation requirements
6. The technician must ensure that the sample is representative of the contents of the container. All valves between the interior of the container and the sample port must be opened for a minimum of 15 minutes before the sample is taken
7. Each sample must be taken in liquid state
8. A minimum sample size of one pound must be drawn for each sample
9. Each sample must be individually labeled and tracked according to the container from which it was taken, and the following information recorded:
 - a) Time and date of sample
 - b) Name of project developer
 - 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 sampling³²
10. Chain of custody from point of sampling to AHRI laboratory for each sample must be documented by paper bills of lading or electronic, third-party tracking that includes proof of delivery (e.g. FedEx, UPS)

All project samples shall be analyzed using AHRI 700-2006 or its successor to confirm the mass percentage and identity of each component of the sample. The analysis shall provide:

³⁰ For instances where the project developer is the destruction facility itself, an outside technician must be employed for sample taking.

³¹ SEMARNAT. (2006). Buenas Practicas en Refrigeración y Aire Acondicionado. Retrieved from <http://app1.semarnat.gob.mx:8080/sissao/archivos/ManualBuenasPracticas2.pdf>

³² Projects that destroy ODS prior to the adoption date of this protocol may use proxy data from NOAA recording stations in the area.

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 percent of the saturation point for the ODS taking into account the temperature recorded at the time the sample was taken. For containers that hold mixed ODS, the sample's saturation point shall be assumed to be that of the ODS species in the mixture with the lowest saturation point that is at least 10 percent of the mixture by mass
4. Analysis of high boiling residue, which must be less than 10 percent by mass
5. Analysis of other ODS in the case of mixtures of ODS and their percentage by mass

If any of the requirements above are not met, no GHG reductions may be verified for the ODS from that container. If a sample is tested and does not meet one of the requirements as defined above, the project developer may elect to have the material re-sampled and re-analyzed. While there is no limit to the number of samples that may be taken, the analysis results of all samples must be disclosed to the verification body, and the most conservative composition analysis from these samples shall be used for the quantification. If a project developer elects to have the material dried prior to resampling, the previous samples (prior to drying) may be disregarded.

Note that the threshold for moisture saturation will be difficult to achieve at very low temperatures, and it is recommended that sampling not occur if the ambient air temperature is below 32°F. Project developers may sample for moisture content and perform any necessary de-watering prior to the required sampling and laboratory analysis.

If the container holds non-mixed ODS (defined as greater than 90 percent composition of a single ODS species), no further information or sampling is required to determine the mass and composition of the ODS.

If the container holds mixed ODS, which is defined as less than 90 percent composition of a single ODS species, the project developer must meet additional requirements as provided in Section 6.4.3.

6.4.3 Analysis of Mixed ODS

If a container holds mixed ODS, its contents must be processed and measured for composition and concentration according to the requirements of this section (in addition to the requirements of Section 6.4). The sampling required under this section may be conducted at the final destruction facility or prior to delivery to the destruction facility. However, the circulation and sampling activities must be conducted by a third-party organization (i.e. not the project developer), and by individuals who have been properly trained for the functions they perform. Circulation and sampling may be conducted at the project developer's facility, but all activities must be directed by a properly trained and contracted third-party. The project's Monitoring and Operations Plan must specify the procedures by which mixed ODS are analyzed. If the mixing and sampling are conducted at the destruction facility, then the most conservative result of the two samples shall be used to satisfy the requirements of Section 6.4. If the mixing and sampling do not occur at the destruction facility, then the most conservative composition analysis from the mixing facility samples shall be used for the quantification of emission reductions.

The composition and concentration of ODS on a mass basis of each container shall be determined using the results of the analysis of this section. The results of the composition

analysis in Section 6.4 shall be used by verifiers to confirm that the destroyed ODS was in fact the same ODS that is sampled under these requirements.

The ODS mixture must be circulated in a container that meets all of the following criteria:

1. The container has no solid interior obstructions³³
2. The container was fully evacuated prior to filling
3. The container must have mixing ports to circulate liquid and gas phase ODS
4. The liquid port intake shall be at the bottom of the container, and the vapor port intake shall be at the top of the container. For horizontally-oriented mixing containers, the intakes shall be located in the middle third of the container
5. The container and associated equipment can circulate the mixture via a closed loop system from the liquid port to the vapor port

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 recommended in the SEMARNAT's UPO's Good Practices Handbook³⁴

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:

1. Liquid mixture shall be circulated from the liquid port to the vapor port
2. A volume of the mixture equal to two times the volume in the container shall be circulated
3. Circulation must occur at a rate of at least 30 gallons/minute. Alternatively, circulation may occur at a rate that is less than 30 gallons/minute, as long as criterion #2 is achieved within the first six hours of mixing
4. Start and end times shall be recorded

Within 30 minutes of the completion of circulation, a minimum of two samples shall be taken from the bottom liquid port according to the procedures in Section 6.4. Both samples shall be analyzed at an appropriate laboratory per the requirements of Section 6.4. The mass composition and concentration of the mixed ODS shall be equal to the lesser of the two GWP-weighted concentrations.

If a temporary holding tank is used, after drawing the sample, the holding tank shall be emptied back into the original container for transport to the destruction location.

6.5 Destruction Facility Requirements

Destruction of ODS must occur at a facility in Mexico that is permitted under NOM-098-SEMARNAT-2002 to destroy hazardous waste; whose permit explicitly includes the destruction of ODS; and that meets all of the guidelines provided in Appendix C and in the TEAP Report of the Task Force on Destruction Technologies.³⁵

³³ Mesh baffles or other interior structures that do not impede the flow of ODS are acceptable.

³⁴ SEMARNAT. (2006). Buenas Practicas en Refrigeración y Aire Acondicionado. Retrieved from <http://app1.semarnat.gob.mx:8080/sissao/archivos/ManualBuenasPracticas2.pdf>

³⁵ Available at <http://www.uneptie.org/ozonaction/topics/disposal.htm>.

In addition to the facility's permit to destroy hazardous waste and ODS, destruction facilities must provide third-party certified results indicating that the facility meets all performance criteria set forth in Appendix C. Following the initial performance testing, project developers must demonstrate that the facility has conducted comprehensive performance testing annually to validate compliance with the TEAP DRE and emissions limits as reproduced in Appendix C. No ODS destruction credits shall be issued for destruction that occurs at a facility that has failed to undergo comprehensive performance testing according to the required schedule, or has failed to meet the requirements of such performance testing.

NOTE:

In the Reserve's other ODS protocols, the requirement is that following the initial performance testing, the facility must conduct comprehensive performance testing at least every three years, as opposed to every year, to validate compliance with the TEAP DRE and emissions limits. However, Quimobasicos supports and believes it could meet an annual requirement.

The Reserve wants to make sure everyone supports this more rigorous frequency. If new destruction facilities become eligible, would this annual (as opposed to every three years) requirement be too large a barrier to entry?

At the time of ODS destruction, all destruction facilities must have a valid permit to destroy hazardous waste under NOM-098-SEMARNAT-2002, which explicitly allows for the destruction of ODS, and any other air or water permits required by local, state, or federal law to destroy ODS. Facilities must document compliance with all monitoring and operational requirements associated with the destruction of ODS materials, as dictated by these permits, including emission limits, calibration schedules, and personnel training. Any upsets or exceedances of emission limits with corrective actions taken noted in a daily log and managed in keeping with the facility's startup, shutdown, and malfunction plan. Facilities must document operation consistent with the TEAP requirements, as defined in this section and Appendix C.

Operating parameters of the destruction unit while destroying ODS material shall be monitored and recorded as described in the Code of Good Housekeeping³⁶ approved by the Montreal Protocol. This data shall be used in the verification process to demonstrate that during the destruction process, the destruction unit was operating similarly to the period in which the DRE³⁷ was calculated. The DRE is determined by using the Comprehensive Performance Test (CPT)³⁸ as a proxy for DRE and is disclosed to the public in the destruction facility's NOM-098-SEMARNAT-2002 permit.

To monitor that the destruction facility operates in accordance with applicable regulations and within the parameters recorded during DRE testing, the following parameters must be tracked continuously during the entire ODS destruction process:

- The ODS feed rate
- The amount and type of consumables used in the process (not required if default project emission factor for transportation and destruction is used)
- 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)

³⁶ TEAP. (2006). Code of Good Housekeeping. *Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer - 7th Edition*.

³⁷ DRE disclosed in Title V operating permit.

³⁸ CPT must have been conducted with a less combustible chemical than the ODS in question.

- Operating temperature and pressure of the destruction unit during ODS destruction
- Effluent discharges measured in terms of water and pH levels
- Continuous emissions monitoring system (CEMS) data on the emissions of carbon monoxide during ODS destruction

The project developer must maintain records of all these parameters for review during the verification process.

Destruction facilities shall provide a valid Certificate of Destruction for all ODS destroyed. The Certificate of Destruction shall include:

- Project developer (project account holder)
- Destruction facility
- Generator name
- Certificate of Destruction ID number
- Serial, tracking or ID number of all containers for which ODS destruction occurred
- Weight of material destroyed from each container (including eligible and ineligible material)
- Type of material destroyed from each container (including all materials listed on laboratory analysis of ODS composition from sampling at the destruction facility)
- Start destruction date
- End destruction date

6.6 Monitoring Parameters

NOTE:

No need to review this section and the following Table 6.2. Section is currently unchanged from the Article 5 Project Protocol and will be updated once the remainder of the protocol is finalized.

Prescribed monitoring parameters necessary to calculate baseline and project emissions are provided in Table 6.2 below. In addition to the parameters below that are used in the calculations provided in Section 5 **Error! Reference source not found.**, project developers are responsible for maintaining all records required under Sections 0 through 7.

Table 6.2. Project Monitoring Parameters

Eq. #	Parameter	Description	Data Unit	Measurement Frequency	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Comment
		Legal Requirement Test		For each reporting period		Must be monitored and determined for each reporting period
		Mass of ODS (or ODS mixture) in each container		Per container	M	Must be determined for each container destroyed
		Concentration of ODS (or ODS mixture) in each container		Per container	M	Must be determined for each container destroyed
Equation 5.1	ER_t	Total quantity of emission reductions during the reporting period	tCO ₂ e	For each reporting period	C	
Equation 5.1, Equation 5.3	BE_t	Total quantity of baseline emissions during the reporting period	tCO ₂ e	For each reporting period	C	
Equation 5.1, Equation 5.4	PE_t	Total quantity of project emissions during the reporting period	tCO ₂ e	For each reporting period	C	
Equation 5.2	$ER_{stock,i}$	Average annual emission rate of refrigerant ODS <i>i</i>	%	For each reporting period	C	
Equation 5.2	Q_{end}	Total quantity of ODS refrigerant <i>i</i> in government stockpile at time of destruction	lb ODS	For each reporting period	M	
Equation 5.2	Q_{start}	Total quantity of ODS refrigerant <i>i</i> in government stockpile at time of seizure	lb ODS	For each reporting period	M	
Equation 5.3, Equation 5.5, Equation 5.10, Equation 5.11	$Q_{refr,i}$	Total quantity of eligible refrigerant ODS <i>i</i> destroyed	lb ODS	For each reporting period	M	
Equation 5.3	$ER_{refr,i}$	10-year cumulative emission rate of refrigerant ODS <i>i</i>	%	N/A	R	See Table 5.1
Equation 5.3, Equation 5.10	$GWP_{refr,i}$	Global warming potential of refrigerant ODS <i>i</i>	lb CO ₂ e/ lb ODS	N/A	R	See Table 5.2

Eq. #	Parameter	Description	Data Unit	Measurement Frequency	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Comment
Equation 5.3	VR	Vapor risk deduction factor	% (0-1)	For each reporting period	R	See Table 5.4
Equation 5.4, Equation 5.5	Sub _{,ref}	Total emissions from substitute refrigerant	lb CO ₂ e	For each reporting period	C	
Equation 5.4, Equation 5.6, Equation 5.12	Tr	Total emissions from transportation of ODS	lb CO ₂ e	For each reporting period	C	May be calculated using default or using project specific inputs
Equation 5.4, Equation 5.6, Equation 5.7	Dest	Total emissions from the destruction process associated with destruction of ODS	lb CO ₂ e	For each reporting period	C	May be calculated using default or using project specific inputs
Equation 5.6	Q _i	Total quantity of refrigerant <i>i</i> sent for destruction, including eligible and ineligible material	lb ODS	For each reporting period	M	
Equation 5.7, Equation 5.8	FF _{dest}	Total emissions from fossil fuel used in the destruction facility	lb CO ₂ e	For each reporting period	C	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.7, Equation 5.9	EL _{dest}	Total emissions from grid electricity at the destruction facility	lb CO ₂ e	For each reporting period	C	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.7, Equation 5.10	ODS _{emissions}	Total emissions of un-destroyed ODS	lb CO ₂ e	For each reporting period	C	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.7, Equation 5.11	ODS _{CO2}	Total emissions of CO ₂ from ODS oxidation	lb CO ₂	For each reporting period	C	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.8	FF _{PR,k}	Total fossil fuel <i>k</i> used to destroy ODS	lb CO ₂ e	For each reporting period	M	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.8	EF _{FF,k}	Fuel specific emission factor	kg CO ₂ /volume fuel	N/A	R	Use only if calculating site-specific project emissions from ODS destruction

Eq. #	Parameter	Description	Data Unit	Measurement Frequency	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Comment
Equation 5.9	EL_{PR}	Total electricity consumed to destroy ODS	MWh	For each reporting period	M	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.9	EF_{EL}	Carbon emission factor for electricity used	lb CO ₂ /MWh	N/A	R	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.11	CR_i	Carbon ratio of ODS <i>i</i>	MW C/ MW ODS	N/A	R	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.12	PMT_i	Pound-miles-traveled for ODS <i>i</i> destroyed	tonne-miles	For each reporting period	M	Including weight of all storage containers Use only if calculating site-specific project emissions from ODS destruction
Equation 5.12	$EFPMT$	Mode-specific emission factor	kg CO ₂ /pound-mile	N/A	R	Use only if calculating site-specific project emissions from ODS destruction
Equation 5.13	$Fill_{liquid}$	Liquid fill level in project container	% (0-1)	For each reporting period	C	
Equation 5.13	$V_{container}$	Volumetric capacity of project container	gallons	For each reporting period	O	
Equation 5.13	$M_{destroyed}$	Total mass of material destroyed in the project container	lbs	For each reporting period	M	
Equation 5.13	ρ_{liquid}	Density of the liquid phase material in the project container	lb/gal	For each reporting period	C	
Equation 5.13	ρ_{vapor}	Density of the vapor phase material in the project container	lb/gal	For each reporting period	C	

7 Reporting Parameters

This section provides requirements and guidance on reporting rules and procedures. A priority of the Reserve is to facilitate consistent and transparent information disclosure by project developers. Project developers must submit verified emission reduction reports to the Reserve at the conclusion of every project reporting period.

7.1 Project Documentation

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

- Project Submittal form
- Certificate(s) of Destruction (not public)
- Laboratory analysis of ODS composition from sampling at destruction facility (not public)
- Laboratory analysis of ODS composition from sampling at mixing facility, if applicable (not public)
- Project diagram from Monitoring and Operations Plan – See Appendix F (not public)
- Signed Attestation of Title form
- Signed Attestation of Regulatory Compliance form
- Signed Attestation of Voluntary Implementation form
- Verification Report
- Verification Statement

Project developers must provide the following documentation each reporting period in order for the Reserve to issue CRTs for quantified GHG reductions.

- Verification Report
- Verification Statement
- Certificate(s) of Destruction (not public)
- Laboratory analysis of ODS composition from sampling at destruction facility (not public)
- Laboratory analysis of ODS composition from sampling at mixing facility, if applicable (not public)
- Project diagram from Monitoring and Operations Plan – see Appendix F (not public)
- Signed Attestation of Title form
- Signed Attestation of Regulatory Compliance form
- Signed Attestation of Voluntary Implementation form

Unless otherwise specified, the above project documentation will be available to the public via the Reserve's online registry with the Certificate of Destruction tracking information from Section 6.1. Further disclosure and other documentation may be made available by the project developer on a voluntary basis. Project submittal forms can be found at <http://www.climateactionreserve.org/how/projects/register/project-submittal-forms/>.

7.2 Record Keeping

For purposes of independent verification and historical documentation, project developers are required to keep all information outlined in this protocol for a period of 10 years after verification.

System information the project developer should retain includes:

- All data inputs for the calculation of the project emission reductions, including all required sampled data
- Copies of all permits, Notices of Violations (NOVs), and any relevant administrative or legal consent orders dating back at least three years prior to the project start date
- Executed Attestation of Title forms, Attestation of Regulatory Compliance forms, and Attestation of Voluntary Implementation forms
- Destruction facility monitoring information (CEMS data, DRE documentation, scale readings, calibration procedures, and permits)
- Verification records and results
- Chain of custody and point of origin documentation
- ODS composition and quantity lab reports

NOTE:

This section currently contains a number of terms used in the US legal system. Could any of the above terms be updated to refer to terms more appropriate for the English translation of Mexican terms? We also would appreciate comments on the proper terminology in Spanish for the Spanish translation of the protocol we will eventually put together.

7.3 Reporting Period and Verification Cycle

ODS destruction projects may be no greater than 12 months in duration, measured from the project start date to completion of ODS destruction. As stated in Section 5**Error! Reference source not found.**, project developers may choose a shorter time horizon for their project (e.g. three months or six months), but no project may run longer than a 12 months. At the project developer's discretion, a project may have one or more reporting periods as defined in Section 5**Error! Reference source not found.**

8 Verification Guidance

This section provides verification bodies with guidance on verifying GHG emission reductions from ODS destruction projects developed to the standards of this protocol. This verification guidance supplements the Reserve's Verification Program Manual and describes verification activities specifically related to ODS destruction projects.

Verification bodies trained to verify Mexico ODS destruction projects must be familiar with the following documents:

- Climate Action Reserve Program Manual
- Climate Action Reserve Verification Program Manual
- Climate Action Reserve Mexico Ozone Depleting Substances Project Protocol

The Reserve's Program Manual, Verification Program Manual, and project protocols are designed to be compatible with each other and are available on the Reserve's website at <http://www.climateactionreserve.org>.

Only ISO-accredited verification bodies trained by the Reserve for this project type are eligible to verify ODS destruction project reports. Verification bodies approved under other project protocol types are not permitted to verify Mexico ODS destruction projects. Information about verification body accreditation and Reserve project verification training can be found on the Reserve website at <http://www.climateactionreserve.org/how/verification/>.

8.1 Standard of Verification

The Reserve's standard of verification for ODS destruction projects is the Mexico Ozone Depleting Substances Project Protocol (this document), the Reserve Program Manual, and the Verification Program Manual. To verify an ODS destruction project developer's project report, verification bodies apply the guidance in the Verification Program Manual and this section of the protocol to the standards described in Sections 2 through 7 of this protocol. Sections 2 through 7 provide eligibility rules, methods to calculate emission reductions, performance monitoring instructions and requirements, and procedures for reporting project information to the Reserve.

8.2 Monitoring and Operations Plan

The Monitoring and Operations Plan serves as the basis for verification bodies to confirm that the monitoring and reporting requirements in Section 6 and Section 7 have been met, and that consistent, rigorous monitoring and record keeping has been conducted. Verification bodies shall confirm that the Monitoring and Operations Plan covers all aspects of monitoring and reporting contained in this protocol and specifies how data for all relevant parameters in **Error! Reference source not found.** are collected and recorded.

8.3 Verifying Project Eligibility

Verification bodies must affirm an ODS destruction project's eligibility according to the rules described in this protocol. The table below outlines the eligibility criteria for an ODS destruction project. This table does not present all criteria for determining eligibility comprehensively; verification bodies must also look to Section 3 and the verification items list in Table 8.3.

Table 8.1. Summary of Eligibility Criteria for a Mexico ODS Destruction Project

Eligibility Rule	Eligibility Criteria	Frequency of Rule Application
Start Date	For 12 months following the Effective Date (April 2015) of this protocol, a pre-existing project with a start date on or after April 2013 may be submitted for listing; after this 12 month period, projects must be submitted for listing within 6 months of the project start date	Once per project
Location of Destruction	Mexico	Once per project
Point of Origin of ODS	Mexico	Each verification
Project Definition	<ul style="list-style-type: none"> ▪ Project developer and GHG ownership is the same for all ODS destroyed ▪ A single destruction facility has been used for all ODS destruction ▪ All project activities span no more than 12 months from the project start date to the conclusion of destruction activities ▪ Eligible ODS include CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115 	Each verification
Performance Standard	Project destroys ODS refrigerant that meets project definitions	Each verification
Legal Requirement Test	Signed Attestation of Voluntary Implementation form and monitoring procedures for ascertaining and demonstrating that the project passes the Legal Requirement Test	Each verification
Regulatory Compliance	Signed Attestation of Regulatory Compliance form and disclosure of all non-compliance events to verification body; project must be in material compliance with all applicable laws	Each verification
Exclusions	<ul style="list-style-type: none"> ▪ ODS sourced from any country other than Mexico ▪ ODS destroyed outside of Mexico ▪ ODS produced for or used in any application other than refrigeration ▪ Privately held virgin ODS refrigerants 	Each verification

8.4 Core Verification Activities

The Mexico Ozone Depleting Substances Project Protocol provides explicit requirements and guidance for quantifying the GHG reductions associated with the destruction of ODS sourced from Mexico at destruction facilities in Mexico. The Verification Program Manual describes the core verification activities that shall be performed by verification bodies for all project verifications. They are summarized below in the context of an ODS destruction project, but verification bodies must also follow the general guidance in the Verification Program Manual.

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

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

Identifying emission sources, sinks, and reservoirs

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

Reviewing operations, GHG management systems and estimation methodologies

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

Verifying emission reduction estimates

The verification body further investigates areas that have the greatest potential for material misstatements and then confirms whether or not material misstatements have occurred. This involves site visits to the project facility (or facilities if the project includes multiple facilities) to ensure the ODS management, sampling and destruction systems on the ground correspond to and are consistent with data provided to the verification body. In addition, the verification body recalculates a representative sample of the performance or emissions data for comparison with data reported by the project developer in order to double-check the calculations of GHG emission reductions.

8.5 Verification Site Visits

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

Table 8.2. Verification Site Visit Requirements

ODS Source	Site Visit(s) Required
ODS obtained from private stockpiles or government stockpiles that can legally be sold to the refrigerant market	<ul style="list-style-type: none"> ▪ Site of stockpile ▪ Destruction facility ▪ ODS mixing & sampling facility (if applicable) ▪ One additional project facility^a
ODS refrigerants obtained from government stockpiles that cannot legally be sold into the refrigerant market	<ul style="list-style-type: none"> ▪ Site of stockpile ▪ Destruction facility ▪ ODS mixing & sampling facility (if applicable) ▪ One additional project facility^a
Used ODS refrigerant recovered from end-of-life equipment	<ul style="list-style-type: none"> ▪ Destruction facility ▪ ODS mixing & sampling facility (if applicable) ▪ One additional project facility^a

^a The verification body shall visit one additional facility within the project diagram, including but not limited to: a point of reclamation or aggregation, the project developer's offices, a point of origin, etc. The verification body shall choose this additional facility based upon the project-specific risk assessment.

8.6 ODS Verification Items

The following tables provide lists of items that a verification body needs to address while verifying an ODS destruction project. The tables include references to the section in the protocol where requirements are further specified. The table also identifies items for which a verification body is expected to apply professional judgment during the verification process. Verification bodies are expected to use their professional judgment to confirm that protocol requirements have been met in instances where the protocol does not provide (sufficiently) prescriptive guidance. For more information on the Reserve's verification process and professional judgment, please see the Verification Program Manual.

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

8.6.1 Project Eligibility and CRT Issuance

Table 8.3 lists the criteria for reasonable assurance with respect to eligibility and CRT issuance for ODS destruction projects. These requirements determine if a project is eligible to register with the Reserve and/or have CRTs issued for the reporting period. If any requirement is not met, either the project may be determined ineligible or the GHG reductions from the reporting period (or subset of the reporting period) may be ineligible for issuance of CRTs, as specified in Sections 2, 3, and 6.

Table 8.3. Eligibility Verification Items

Protocol Section	Eligibility Qualification Item	Apply Professional Judgment?
2.2	Verify that the project meets the definition of a Mexico ODS destruction project	No
Error! Reference source not found.	Verify that the project activities involve a single project developer and a single qualifying destruction facility	No
Error! Reference source not found.	Verify that the destroyed ODS is sourced from Mexico	No
Error! Reference source not found.	Verify that the destroyed ODS has been phased out in Mexico	No
2.2	Verify that the ODS was not used as nor produced for use as solvents, medical aerosols, or other non-refrigeration applications	Yes
Error! Reference source not found.	Verify that project activities span no more than 12 months	No
Error! Reference source not found.	Verify ownership of the reductions by reviewing Attestation of Title and chain of custody documentation	No

Protocol Section	Eligibility Qualification Item	Apply Professional Judgment?
Error! Reference source not found.	Verify that credits for destroyed ODS have not been claimed on the Reserve or any other registry, using Attestation of Title and Reserve tracking software	No
3.2	Verify eligibility of project start date	No
3.2	Verify accuracy of project start date based on operational records	No
3.2	Verify that the project has documented and implemented a Monitoring and Operations Plan	No
3.4.1	Confirm execution of the Attestation of Voluntary Implementation form to demonstrate eligibility under the Legal Requirement Test	No
3.4.2	Verify that the project meets the Performance Standard Test	No
3.5	Verify that the project activities comply with applicable laws by reviewing any instances of non-compliance provided by the project developer and performing a risk-based assessment to confirm the statements made by the project developer in the Attestation of Regulatory Compliance form	Yes
6	Verify that the project Monitoring and Operations Plan contains a mechanism for ascertaining and demonstrating that the project passes the Legal Requirement Test at all times	Yes
6	Verify that monitoring meets the requirements of the protocol. If it does not, verify that a variance has been approved for monitoring variations	Yes
6	Verify the Monitoring and Operations Plan includes a project diagram and that the project diagram is complete, accurate, and up-to-date	No
Appendix C	Verify that the destruction facility meets the requirements of this protocol; verify that the facility is permitted under NOM-098-SEMARNAT-2002 to destroy hazardous waste including ODS and that the facility has been third-party certified as meeting the requirements of the TEAP <i>Report on the Task Force on HCFC Issues</i> in Appendix C and has successfully completed the comprehensive performance testing within the three years prior to the end date of destruction activities	No
	If any variances were granted, verify that variance requirements were met and properly applied	No

8.6.2 Conformance with Operational Requirements and ODS Eligibility

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

NOTE:

Table 8.4 below will likely be updated further, based on contractor recommendations, which have not yet been incorporated.

Table 8.4. Operational Requirement and ODS Eligibility Verification Items

Protocol Section	Operational Requirement and ODS Eligibility Items	Apply Professional Judgment?
6	Verify that the destruction facility monitored the parameters identified in Section 6	No

Protocol Section	Operational Requirement and ODS Eligibility Items	Apply Professional Judgment?
6.1	For all ODS, verify that information has been correctly entered in Reserve tracking system and that the Certificate of Destruction entry is unique to this project	No
6.2	For all ODS, verify that the point of origin is correctly identified and documented	Yes
6.2, 6.4	For all ODS, verify that the point of origin documentation agrees with the data reported at the destruction facility (weight and composition) with no significant discrepancies	Yes
6.3	For all ODS, verify that the ODS can be tracked through retained chain of custody documentation from the Certificate of Destruction back to the point of origin	Yes
6.4	Verify that the scales used for measuring mass of ODS destroyed are properly maintained and tested for calibration quarterly	No
6.4	Verify that the weight of full and empty ODS containers was measured two days prior to destruction commencing and two days following completion, respectively	No
6.4	Verify that all ODS samples were taken by a third-party technician while in the possession of the destruction company	No
6.4	Verify the chain of custody by which ODS sample was transferred from the destruction facility to the lab	No
6.4	Verify that all ODS was analyzed for composition and concentration at a lab approved under the AHRI 700-2006 standard, or its successor	No
6.4	Verify that the calculation of ODS composition and mass concentration correctly accounted for moisture, mixing, and high boiling residue	No
6.4.3	For mixed refrigerants, verify that credits are only claimed for refrigerants eligible under this protocol	No
6.4.3	For mixed refrigerants, verify that credits are only claimed for refrigerants eligible under this protocol	No
6.4.3	For mixed refrigerants, verify that proper re-circulation occurred	No
6.4.3	For mixed refrigerants, verify that recirculation and sampling were performed by properly trained technicians	Yes
6.5	Verify that the Certificate of Destruction contains all required information	No
2.2	Verify that the facility has a valid NOM-098-SEMARNAT-2002 permit which explicitly allows for ODS destruction	No
Appendix C	Verify that the facility has been third-party certified as meeting the requirements of the TEAP <i>Report on the Task Force on HCFC Issues</i> and of this protocol	No
Appendix C	Verify that the destruction facility where the ODS was destroyed has a documented destruction and removal efficiency greater than 99.99 percent, and that CPT was conducted with a material less combustible than the ODS destroyed	No
Appendix C	Verify that the destruction facility operated within the parameters under which it was tested to achieve a 99.99 percent or greater destruction and removal efficiency	No

8.6.3 Quantification of GHG Emission Reductions

Table 8.5 lists the items that verification bodies shall include in their risk assessment and recalculation of the project's GHG emission reductions. These quantification items inform any determination as to whether there are material and/or immaterial misstatements in the project's

GHG emission reduction calculations. If there are material misstatements, the calculations must be revised before CRTs are issued.

Table 8.5. Quantification Verification Items

Protocol Section	Quantification Item	Apply Professional Judgment?
Error! Reference source not found.	Verify that all destroyed ODS for which CRTs are claimed appear on a valid Certificate of Destruction	No
Error! Reference source not found.	Verify that SSRs included in the GHG Assessment Boundary correspond to those required by the protocol and those represented in the project documentation	No
Error! Reference source not found.	Verify that the project was correctly characterized as end-of-life, saleable stockpile, or un-saleable stockpile	Yes
Error! Reference source not found.	Verify that the appropriate baseline scenario was applied for each quantity of ODS destroyed	Yes
5.2.1	Verify that the substitute emissions have been properly characterized, calculated, and aggregated correctly	No
5.2.2, 5.2.3	Verify that the project developer correctly quantified and aggregated electricity use, or that the default factor was applied	Yes
5.2.2, 5.2.3	Verify that the project developer correctly quantified and aggregated fossil fuel use, or that the default factor was applied	Yes
5.2.2, 5.2.3	Verify that the project developer applied the correct emission factors for fossil fuel combustion and grid-delivered electricity, or that the default factor was applied	Yes
5.2.2, 5.2.3	Verify that emissions from incomplete ODS destruction and oxidation of ODS carbon have been correctly quantified and aggregated, or that the default factor was applied	Yes
5.2.2, 5.2.4	Verify that the project developer correctly quantified and aggregated transportation emissions, or that the default factor was applied	Yes

8.6.4 Risk Assessment

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

Table 8.6. Risk Assessment Verification Items

Protocol Section	Item that Informs Risk Assessment	Apply Professional Judgment?
Error! Reference source not found.	Verify that the project Monitoring and Operations Plan is sufficiently rigorous to support the requirements of the protocol and proper operation of the project	Yes
Error!	Verify that appropriate monitoring equipment is in place at destruction	Yes

Protocol Section	Item that Informs Risk Assessment	Apply Professional Judgment?
Reference source not found.	facility to meet the requirements of the protocol	
Error! Reference source not found.	Verify that the individual or team responsible for managing and reporting project activities are qualified to perform these functions	Yes
Error! Reference source not found.	Verify that appropriate training was provided to personnel assigned to operations, record-keeping, sample-taking, and other project activities	Yes
Error! Reference source not found.	Verify that all contractors are qualified for managing and reporting greenhouse gas emissions if relied upon by the project developer. Verify that there is internal oversight to assure the quality of the contractor's work	Yes
Error! Reference source not found.	Verify that all required records have been retained by the project developer	No

8.6.5 Completing Verification

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

9 Glossary of Terms

Note:

This section is has not been updated from the Article 5 Project Protocol and is included for your reference. New terms will be added specific to Mexico and this protocol.

Accredited verifier	A verification firm approved by the Climate Action Reserve to provide verification services for project developers.
Additionality	Project activities that are above and beyond “business as usual” operation, exceed the baseline characterization, and are not mandated by regulation.
Anthropogenic emissions	GHG emissions resultant from human activity that are considered to be an unnatural component of the Carbon Cycle (i.e. fossil fuel destruction, de-forestation, etc.).
Biogenic CO ₂ emissions	CO ₂ emissions resulting from the destruction and/or aerobic decomposition of organic matter. Biogenic emissions are considered to be a natural part of the Carbon Cycle, as opposed to anthropogenic emissions.
Carbon dioxide (CO ₂)	The most common of the six primary greenhouse gases, consisting of a single carbon atom and two oxygen atoms.
Certificate of Destruction	An official document provided by the destruction facility certifying the date, quantity, and type of ODS destroyed.
CO ₂ equivalent (CO ₂ e)	The quantity of a given GHG multiplied by its total global warming potential. This is the standard unit for comparing the degree of warming which can be caused by different GHGs.
Commencement of destruction process	When the ODS waste-stream is hooked up to the destruction chamber.
Commercial refrigeration equipment	The refrigeration appliances used in the retail food, cold storage warehouse, or any other sector that require cold storage. Retail food includes the refrigeration equipment found in supermarkets, grocery and convenience stores, restaurants, and other food service establishments. Cold storage includes the refrigeration equipment used to house perishable goods or any manufactured product requiring refrigerated storage.
Container	An air- and water-tight unit for storing and/or transporting ODS material without leakage or escape of ODS.
Destruction	Destruction of ozone depleting substances by qualified destruction, transformation, or conversion plants achieving greater than 99.99 percent destruction and removal efficiency. Destruction may be performed using any technology, including transformation, that results in the complete breakdown of the ODS into either a waste or usable by-product.

Destruction facility	A facility that destroys, transforms, or converts ozone depleting substances using a technology that meets the standards defined by the UN Environment Programme Technology and Economic Assessment Panel Task Force on Destruction Technologies.
Direct emissions	GHG emissions from sources that are owned or controlled by the reporting entity.
Effective Date	The date of adoption of this protocol by the Reserve board April XX 2015 .
Emission factor (EF)	A unique value for determining an amount of a GHG emitted for a given quantity of activity data (e.g. metric tons of carbon dioxide emitted per barrel of fossil fuel burned).
Emissions rate	The annual rate at which ODS is lost to the atmosphere, including emissions from leaks during operation and servicing events.
Fossil fuel	A fuel, such as coal, oil, and natural gas, produced by the decomposition of ancient (fossilized) plants and animals.
Generator	The facility from which the ODS material on a single Certificate of Destruction departed prior to receipt by the destruction facility. If the material on a single Certificate of Destruction was aggregated as multiple shipments to the destruction facility, then the destruction facility shall be the Generator.
GHG reservoir	A physical unit or component of the biosphere, geosphere, or hydrosphere with the capability to store or accumulate a GHG that has been removed from the atmosphere by a GHG sink or a GHG captured from a GHG source.
GHG sink	A physical unit or process that removes GHG from the atmosphere.
GHG source	A physical unit or process that releases GHG into the atmosphere.
Global Warming Potential (GWP)	The ratio of radiative forcing (degree of warming to the atmosphere) that would result from the emission of one unit of a given GHG compared to one unit of CO ₂ .
Greenhouse gas (GHG)	Carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), sulfur hexafluoride (SF ₆), hydrofluorocarbons (HFCs), or perfluorocarbons (PFCs).
Indirect emissions	Reductions in GHG emissions that occur at a location other than where the reduction activity is implemented, and/or at sources not owned or controlled by project participants.
Methane (CH ₄)	A potent GHG with a GWP of 21, consisting of a single carbon atom and four hydrogen atoms.

Metric ton (MT, tonne)	A common international measurement for the quantity of GHG emissions, equivalent to about 2204.6 pounds or 1.1 short tons.
MMBtu	One million British thermal units.
Mobile combustion	Emissions from the transportation of employees, materials, products, and waste resulting from the combustion of fuels in company owned or controlled mobile combustion sources (e.g. cars, trucks, tractors, dozers, etc.).
Ozone depleting substances (ODS)	Ozone depleting substances are substances known to deplete the stratospheric ozone layer. The ODS controlled under the Montreal Protocol and its Amendments are chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC), halons, methyl bromide (CH ₃ Br), carbon tetrachloride (CCl ₄), methyl chloroform (CH ₃ CCl ₃), hydrobromofluorocarbons (HBFC) and bromochloromethane (CHBrCl).
Project baseline	A "business as usual" GHG emission assessment against which GHG emission reductions from a specific GHG reduction activity are measured.
Project developer	An entity that undertakes a GHG project, as identified in Section 2.2 of this protocol.
Recharge	Replenishment of refrigerant agent (using reclaimed or virgin material) into equipment that is below its full capacity because of leakage or because it has been evacuated for servicing or other maintenance.
Reclaim	Reprocessing and upgrading of a recovered ozone depleting substance through mechanisms such as filtering, drying, distillation and chemical treatment in order to restore the ODS to a specified standard of performance. Chemical analysis is required to determine that appropriate product specifications are met. It often involves processing off-site at a central facility.
Recovery	The removal of ozone depleting substances from machinery, equipment, containment vessels, etc., into an external container during servicing or prior to disposal without necessarily testing or processing it in any way.
Reuse/recycle	Reuse of a recovered ozone depleting substance following a basic cleaning process such as filtering and drying. For refrigerants, recycling normally involves recharge back into equipment and it often occurs on-site.
Startup, shutdown, and malfunction plan	A management plan that includes a description of potential causes of malfunctions, including releases from emergency safety vents, that may result in significant releases of hazardous air pollutants, and actions the source is taking to minimize the frequency and severity of those malfunctions.
Stockpile	ODS stored for future use or disposal in bulk quantities at a single location. These quantities may be composed of many small containers or a single large container.
Substitute emissions	A term used in this protocol to describe the greenhouse gases emitted from the use of substitute chemicals used to replace the ODS destroyed by a project.

Substitute refrigerant	Those refrigerants that will be used to fulfill the function that would have been filled by the destroyed ODS refrigerants. These refrigerants may be drop-in replacements used in equipment that previously used the type of ODS destroyed, or may be used in new equipment that fulfills the same market function.
Transportation system	A term used to encompass the entirety of the system that moves the ODS from the country of origin to the destruction facility.
Verification	The process used to ensure that a given participant's GHG emissions or emission reductions have met the minimum quality standard and complied with the Reserve's procedures and protocols for calculating and reporting GHG emissions and emission reductions.
Verification body	A Reserve-approved firm that is able to render a verification opinion and provide verification services for operators subject to reporting under this protocol.

10 References

Note:

This section has not been updated from the Article 5 Project Protocol and is included for your reference. New terms will be added specific to Mexico and this protocol.

Air-Conditioning, Heating, and Refrigeration Institute. (2006). Standard 700: 2006 Standard for Specifications for Fluorocarbon Refrigerants.

ARGE Energy Changes Projektentwicklung GmbH, Tanzer Consulting GmbH, & USG Umweltservice GmbH. (2008). Emission reductions due to controlled recovering of Chlorofluorocarbons (CFC) from end-of-life refrigerator and freezer appliances.

California Climate Action Registry. (2009). General Reporting Protocol, Version 3.1.

Climate Action Reserve. Article 5 Ozone Depleting Substances Project Protocol. Version 2.0 (June 27, 2012).

Climate Action Reserve. Ozone Depleting Substances Project Protocol. Version 2.0 (June 27, 2012).

Climate Action Reserve. (October 26, 2011). Program Manual.

Climate Action Reserve. (December 20, 2010). Verification Program Manual.

Diario Oficial de la Federación (DOF). (2004). NOM-098-SEMARNAT-2002. Retrieved from http://www.dof.gob.mx/nota_detalle.php?codigo=664977&fecha=01/10/2004.

EOS Climate. (2008). Methodology for Ozone Depleting Substances Destruction Projects.

HR 2454, American Clean Energy and Security Act of 2009.

ICF International. (2009). ODS Destruction in the United States of America and Abroad. *U.S. Environmental Protection Agency, Stratospheric Protection Division*.

International Organization for Standardization (ISO) 14064-2. (2006). Greenhouse Gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.

Lim, Sung Yong, Senior Manager, Fund Administration Department, Korea Specialty Chemical Industry Association. (2010). Personal correspondence.

National Institute of Standards and Technology. (2012). Specifications, Tolerance, and Other Technical Requirements for Weighing and Measuring Devices. *NIST Handbook 44*.

Ozone Secretariat. (2010). CFC Destruction in A5 Parties. personal communication.

Scheutz et al. (2007). Attenuation of fluorocarbons released from foam insulation in landfills. *Environmental Science & Technology*, 41: 7714-7722.

Scheutz et al. (2007). Release of fluorocarbons from insulation foam in home appliances during shredding. *Journal of the Air & Waste Management Association, Technical Paper*.

SEMARNAT. (2005). El Sistema de Información y Seguimiento de Sustancias Agotadoras de la Capa de Ozono. Retrieved from <http://sissao.semarnat.gob.mx/>

SEMARNAT. (2006). Buenas Practicas en Refrigeración y Aire Acondicionado. Retrieved from <http://app1.semarnat.gob.mx:8080/sissao/archivos/ManualBuenasPracticas2.pdf>

U.S. Clean Air Act. Title VI: Protection of Stratospheric Ozone. Section 604(a).

U.S. Code of Federal Regulations. Title 40—Protection of Environment, Chapter I—Environmental Protection Agency, Subchapter C—Air Programs, Part 82—Protection of the Stratospheric Ozone.

U.S. Environmental Protection Agency, Climate Leaders. (2007). Greenhouse Gas Inventory Protocol Core Module Guidance: Direct Emissions from Stationary Combustion Sources.

U.S. Environmental Protection Agency, Climate Leaders. (2008). Greenhouse Gas Inventory Protocol Core Module Guidance: Optional emissions from business travel, commuting, and product transport.

U.S. Environmental Protection Agency. (2008). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007.

U.S. Environmental Protection Agency. (December 2008). eGRID2007 Version 1.1, Year 2005 Greenhouse Gas Annual Output Emission Rates. Available at <http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>.

United Nations Environment Programme, Ozone Secretariat. (2009). Addendum to: Information provided by Parties in accordance with Article 7 of the Montreal Protocol on Substances that Deplete the Ozone Layer.

United Nations Environment Programme, Ozone Secretariat. (1987 and subsequent amendments). The Montreal Protocol on Substances that Deplete the Ozone Layer.

United Nations Environment Programme, Ozone Secretariat. Data Access Center. Retrieved on September 22, 2009, from http://ozone.unep.org/Data_Reporting/Data_Access/.

United Nations Environment Programme, Ozone Secretariat. Status of Ratification. Retrieved on September 24, 2009, from http://ozone.unep.org/Ratification_status/montreal_protocol.shtml

United Nations Environment Programme, Ozone Secretariat. List of Parties categorized as operating under Article 5 paragraph 1 of the Montreal Protocol. Retrieved on September 24, 2009, from http://ozone.unep.org/Ratification_status/list_of_article_5_parties.shtml

United Nations Environment Programme, Technology and Economic Assessment Panel. (2005). Report of the Task Force on Foam End-of-Life Issues.

United Nations Environment Programme, Technology and Economic Assessment Panel. (2005). Special report: Safeguarding the ozone layer and the global climate system: issues related to hydrofluorocarbons and perfluorocarbons.

United Nations Environment Programme, Technology and Economic Assessment Panel. (2006). Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee.

United Nations Environment Programme, Technology and Economic Assessment Panel. (2006). Progress Report.

United Nations Environment Programme, Technology and Economic Assessment Panel. (2007). Report of the Task Force on HCFC Issues.

United Nations Environment Programme, Technology and Economic Assessment Panel. (2002). Report of the Task Force on Destruction Technologies.

World Meteorological Organization and United Nations Environment Programme, Intergovernmental Panel on Climate Change (IPCC). 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

World Resources Institute and World Business Council for Sustainable Development. (2005). The Greenhouse Gas Protocol for Project Accounting.

Appendix A Summary of Legal Requirement Test Development

This section has not yet been updated for Mexico.

Appendix B Summary of Performance Standard Development

This section has not yet been updated for Mexico.

Appendix C EPA Rules Governing ODS Destruction

This section has not yet been updated for Mexico.

Appendix D Default Emissions Factors for Calculating ODS Transportation and Destruction Emissions

NOTE: This section has not yet been updated for Mexico and has been included for your reference.

This Appendix describes the derivation of the default emission factor used in Section 5 (representing Equation 5.7 through Equation 5.12). The default emission factor of 7.5 pounds CO₂e per pound of ODS refrigerant destroyed is very conservative, and as noted in Section 5, will not be changed unless the Reserve is able to revise this emission factor to make it more specific to Mexico. As such, this appendix has not been changed from Appendix D of the Article 5 Project Protocol and is included for reference only at this time.

That said, the Reserve is working with Quimobasicos to review some site specific ODS destruction emissions data, and welcomes additional recommendations from the workgroup for resources that may be applicable here.

D.1 Summary

The GHG Assessment Boundary for ODS destruction projects under the Reserve includes emissions in both the baseline and project scenario. These emission sources include the following:

Baseline	Project
<ul style="list-style-type: none"> ▪ Emissions of ODS from refrigerant applications 	<ul style="list-style-type: none"> ▪ Emissions of substitute refrigerant applications ▪ CO₂ emissions from fossil fuel and electricity used in destruction facility ▪ CO₂ emissions from fossil fuel used in transport to destruction facility ▪ ODS emissions from incomplete destruction of ODS ▪ CO₂ emissions from ODS oxidation during destruction

All of these emission sources must be accounted for to ensure complete, accurate, and conservative calculations of project emission reductions. However, some of these emission sources are of a significantly greater magnitude than others, and some of the smaller sources are costly to track and verify, and difficult to assess. In order to lessen the burden on project developers and verifiers, the Reserve has calculated a standard deduction that can be applied to all projects to account for the following project scenario emissions:

1. CO₂ emissions from fossil fuel and electricity used by the destruction facility
2. CO₂ emissions from fossil fuel used for transporting the ODS to the destruction facility
3. ODS emissions from incomplete destruction of ODS
4. CO₂ emissions from ODS oxidation during destruction

The aggregate of these emission sources amounts to less than 0.5 percent of total emission reductions under even the most conservative assumptions. As a result, a conservative emission factor can be applied. This appendix provides background on the development of these default emission factors.

D.2 Methodology and Analysis

The Reserve created a model that incorporated all of the relevant equations from Section **Error! Reference source not found.** to conservatively calculate emissions resulting from the four project sources mentioned above. The equations that have been rolled up into this emission factor are Equation 5.7 through Equation 5.12.

In many cases, the equations used for estimating emissions required additional input and emission factors. Where calculations required such inputs (e.g. electricity grid emission factors), the most conservative factors available were used. Fossil fuel emissions from the destruction process were calculated based on confidential industry records made available to the Reserve that describe the energy requirements associated with ODS destruction projects. The assumptions used in this analysis are as follows:

Parameter	Assumption
$ODS_i =$	1 tonne ODS
$FF_{PR,k} =$	0.0009 MMBtu natural gas/lb ODS destroyed
$EF_{FF,k} =$	54.01 kg CO ₂ /MMBtu ³⁹
$EL_{PR} =$	0.0018 MWh/lb ODS destroyed
$EF_{EL} =$	0.889 tCO ₂ /MWh ⁴⁰
$TMT_i =$	2,000 miles by truck, 3,000 miles by ocean freighter
$EF_{TMT} =$	0.297 kgCO ₂ /TMT ⁴¹
$CR^1 =$	Actual per ODS

Under these assumptions, and use of Equation 5.7 through Equation 5.12, the calculations provided the following results for the different project categories:

Table D.1. Project Emissions (Excluding Substitutes)

All quantities in tonnes CO₂/tonne ODS destroyed.

	Fossil Fuel Emissions from the Destruction	Electricity Emissions from the Destruction	Emissions from ODS Not Destroyed	Emissions from CO ₂	Emissions from the Transportation of ODS	Total
CFC-11 refrigerant	0.11	3.53	0.47	0.32	0.59	5.02
CFC-12 refrigerant	0.11	3.53	1.07	0.36	0.59	5.66
CFC-114 refrigerant	0.11	3.53	1.00	0.47	0.59	5.70
CFC-115 refrigerant	0.11	3.53	0.74	0.47	0.59	5.43

Because the ODS covered in this protocol have such high GWPs (750 to 10,900) even emissions of five to six tonnes CO₂e per tonne ODS destroyed are relatively small. These emissions amount to less than 0.15 percent baseline emissions.

³⁹ U.S. EPA, Climate Leaders. (2007). Stationary Combustion Guidance. Note that the highest emission factor was selected to be conservative.

⁴⁰ U.S. EPA. (December 2008). eGRID2007, Version 1.1 Year 2005 GHG Annual Output Emission Rates. Note that the highest emission factor in the nation was selected to be conservative.

⁴¹ U.S. EPA, Climate Leaders. (2008). Optional emissions from business travel, commuting, and product transport. Note that the highest emitting mode of transportation was selected to be conservative.

D.3 Conclusion

To account for the emission sources above, project developers may apply a 7.5 tonne CO₂e/tonne ODS emission factor for all ODS Article 5 projects. This default emission factor represents a very conservative estimate of these emission sources derived using worst-case emission factors and empirical data.

Appendix E Emission Factor Tables

Table E.1. CO₂ Emission Factors for Fossil Fuel Use

Fuel Type	Heat Content	Carbon Content (Per Unit Energy)	Fraction Oxidized	CO ₂ Emission Factor (Per Unit Energy)	CO ₂ Emission Factor (Per Unit Mass or Volume)
Coal and Coke	MMBtu / Short ton	kg C / MMBtu		kg CO₂ / MMBtu	kg CO₂ / Short ton
Anthracite Coal	25.09	28.26	1.00	103.62	2,599.83
Bituminous Coal	24.93	25.49	1.00	93.46	2,330.04
Sub-bituminous Coal	17.25	26.48	1.00	97.09	1,674.86
Lignite	14.21	26.30	1.00	96.43	1,370.32
Unspecified (Residential/ Commercial)	22.05	26.00	1.00	95.33	2,102.29
Unspecified (Industrial Coking)	26.27	25.56	1.00	93.72	2,462.12
Unspecified (Other Industrial)	22.05	25.63	1.00	93.98	2,072.19
Unspecified (Electric Utility)	19.95	25.76	1.00	94.45	1,884.53
Coke	24.80	31.00	1.00	113.67	2,818.93
Natural Gas (By Heat Content)	Btu / Standard cubic foot	kg C / MMBtu		kg CO₂ / MMBtu	kg CO₂ / Standard cub. ft.
975 to 1,000 Btu / Std cubic foot	975 – 1,000	14.73	1.00	54.01	Varies
1,000 to 1,025 Btu / Std cubic foot	1,000 – 1,025	14.43	1.00	52.91	Varies
1,025 to 1,050 Btu / Std cubic foot	1,025 – 1,050	14.47	1.00	53.06	Varies
1,050 to 1,075 Btu / Std cubic foot	1,050 – 1,075	14.58	1.00	53.46	Varies
1,075 to 1,100 Btu / Std cubic foot	1,075 – 1,100	14.65	1.00	53.72	Varies
Greater than 1,100 Btu / Std cubic foot	> 1,100	14.92	1.00	54.71	Varies
Weighted U.S. Average	1,029	14.47	1.00	53.06	0.0546
Petroleum Products	MMBtu / Barrel	kg C / MMBtu		kg CO₂ / MMBtu	kg CO₂ / gallon
Asphalt & Road Oil	6.636	20.62	1.00	75.61	11.95
Aviation Gasoline	5.048	18.87	1.00	69.19	8.32
Distillate Fuel Oil (#1, 2 & 4)	5.825	19.95	1.00	73.15	10.15
Jet Fuel	5.670	19.33	1.00	70.88	9.57
Kerosene	5.670	19.72	1.00	72.31	9.76
LPG (average for fuel use)	3.849	17.23	1.00	63.16	5.79
Propane	3.824	17.20	1.00	63.07	5.74
Ethane	2.916	16.25	1.00	59.58	4.14
Isobutene	4.162	17.75	1.00	65.08	6.45
n-Butane	4.328	17.72	1.00	64.97	6.70
Lubricants	6.065	20.24	1.00	74.21	10.72
Motor Gasoline	5.218	19.33	1.00	70.88	8.81
Residual Fuel Oil (#5 & 6)	6.287	21.49	1.00	78.80	11.80
Crude Oil	5.800	20.33	1.00	74.54	10.29
Naphtha (<401 deg. F)	5.248	18.14	1.00	66.51	8.31
Natural Gasoline	4.620	18.24	1.00	66.88	7.36
Other Oil (>401 deg. F)	5.825	19.95	1.00	73.15	10.15
Pentanes Plus	4.620	18.24	1.00	66.88	7.36
Petrochemical Feedstocks	5.428	19.37	1.00	71.02	9.18
Petroleum Coke	6.024	27.85	1.00	102.12	14.65
Still Gas	6.000	17.51	1.00	64.20	9.17
Special Naphtha	5.248	19.86	1.00	72.82	9.10
Unfinished Oils	5.825	20.33	1.00	74.54	10.34
Waxes	5.537	19.81	1.00	72.64	9.58

Source: U.S. EPA, Climate Leaders. (2007). Stationary Combustion Guidance, Table B-2 except:

Default CO₂ emission factors (per unit energy) are calculated as: Carbon Content × Fraction Oxidized × 44/12.

Default CO₂ emission factors (per unit mass or volume) are calculated as: Heat Content × Carbon Content × Fraction Oxidized × 44/12 × Conversion Factor (if applicable).

Heat content factors are based on higher heating values (HHV).

Appendix F ODS Project Diagram Sample

Generalized ODS Project System Diagram

