CLIMATE ACTION RESERVE

DRAFT SCOPING PAPER

Evaluating a Potential Update to the Mexico Ozone Depleting Substances Project Protocol

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1 Introduction

The Reserve is undergoing a public scoping process to evaluate the feasibility of expanding the list of eligible refrigerants for destruction under its Mexico Ozone Depleting Substances Project Protocol Version 1.0 (MX ODS V1.0). The refrigerants to be assessed are Hydrochlorofluorocarbon-22 (HCFC-22), Hydrofluorocarbon-134a (HFC-134a), Hydrofluorocarbon-125 (HFC-125), Hydrofluorocarbon-32 (HFC-32) and Hydrofluorocarbon-143a (HFC-143a). Use of CFCs has declined significantly, being replaced by HCFCs, which have significantly lower ozone-depleting potential (ODP) and global warming potential (GWP). HCFCs are now being replaced with HFCs, which, as they are not chlorinated, have zero ODP. However, many of them have a significant GWP. If the update of this protocol is approved, its name will be changed to Mexico Halocarbon Destruction Project Protocol to recognize that HFCs are not ozone depleting substances. The gases assessed for this protocol expansion are summarized below.

Gas for Consideration	100-Year GWP (tCO_2e/t-halocarbon)	Ozone Depletion Potential
HCFC-22	1,810	0.055
HFC-134a	1,430	0
HFC-125	3,500	0
HFC-32	675	0
HFC-143a	4,470	0

This scoping exercise is limited to used halocarbon refrigerant recovered from air conditioning, industrial, commercial, or residential refrigeration equipment at servicing or end-of-life. Un-saleable seized halocarbon stockpiles are also considered.

2 Key Questions to Address

Determining that it is feasible to add HCFC-22 and the selected HFCs to Mexico's ODS protocol depends on the possibility of generating emission reductions that adhere to two critical Reserve Program principles: 1) that the emission reductions from halocarbons destruction are real and, 2) that the emission reductions are additional.

2.1 What Makes an Emission Reduction Real?

Real emission reductions are a result of complete and accurate emissions accounting. Methods for quantifying emission reductions should, therefore, be conservative to avoid overstating a project's effect. The effects of a project on GHG emissions must be comprehensively accounted for, including unintended effects (often referred to as "leakage").[1]

Leakage is a critical concept in the context of a halocarbon destruction protocol as a real project should ensure that the gas destruction wasn't compensated with a subsequent increase in production that would offset the environmental benefit of the project. Mexico's HCFC and HFC phaseout schedules under the Montreal protocol are relevant for mitigating leakage as the

[1] Climate Action Reserve, 2015. Program Manual.

gradual reductions and eventual bans for consumption (consumption = production + imports - exports) limit the overall amount of these chemicals that can be consumed in Mexico.

In addition, to determine that GHG emission reductions are real, it is necessary to compare how a halocarbon destruction project would be different from the project's baseline scenario. The baseline scenario is the description of the typical halocarbon lifecycle in Mexico. Accurately defining the baseline conditions of a halocarbon destruction project is the basis for determining the actual environmental benefit a project would generate. The project scenario will generally also result in the use of a substitute gas to provide the same utility as the destroyed gas. This substitute almost always has a global warming potential (GWP), for which the project must account. Assessing new chemicals for inclusion in the protocol requires assurance that the substitute chemical will have a lower GWP.

2.2 What Makes an Emission Reduction Additional?

The second principle that this scoping paper assesses is additionality. Additional GHG emission reductions are above any that would have occurred in the absence of a carbon market for GHG reductions. "Business as usual" reductions, i.e., those that would occur in the absence of a GHG reduction project, should not be eligible for registration.[1] The Reserve uses two standardized approaches to determine the additionality of GHG emission reductions.

The first approach to assess additionality is the "legal requirement test". This test ensures that eligible projects (and the GHG emission reductions they achieve) would not have occurred anyway to comply with federal, state, local, or international regulations. 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 its implementation or requiring the implementation of similar measures that would achieve equivalent levels of GHG emission reductions.

The second approach to determine additionality is the "performance standard test". This test screens out projects that would have been implemented for reasons other than legal requirements. For example, because the projects are attractive investments irrespective of carbon offset revenues. This test ensures that the incentives created by the carbon market are likely to have played a critical role in decisions to implement projects that meet the performance standard. One type of performance standard test, which is applied in this scoping memo, is a common practice assessment. Under this approach, practices or technologies (in this case, halocarbon destruction) that are not common would be deemed additional.

Throughout the rest of this document, we present the results of a research exercise that seeks to answer whether emission reductions related to the destruction of HCFC-22, HFC-134a, HFC-125, HFC-32, and HFC-143a are real and additional (Section 3). To determine whether a halocarbon destruction project would be real, we summarize the HCFC-22 and HFC phaseout plan by Mexico, the consumption trends of the selected halocarbons in Mexico, their lifecycle, and the determined baseline scenario. To determine whether a halocarbon destruction project is additional, we present an update to the legal requirement test and an update to the performance standard test from V1.0 of the protocol.

Section 4 presents the conclusions of this assessment and proposals for a Mexico halocarbon Project Protocol Update.

3 Research Findings

3.1 Mexico's International Commitments to Phase out HCFCs and HFCs

3.1.1 HCFC Phase-out Under the Montreal Protocol

Mexico is a committed leader on addressing stratospheric ozone protection and the phasing out of halocarbons. The country signed the Montreal Protocol in 1987, and, in 1988, became the first Article 5 country to ratify it. Mexico went further than Article 5 requirements by adopting an accelerated CFC and HCFC Phase-Out Plan with more ambitious compliance commitments. For HCFC, the phaseout schedule is as follows:

- By January 1, 2018: 35% below baseline consumption [2]
- By January 1, 2020: 50% below baseline consumption
- By January 1, 2022: 67.5% below baseline consumption
- By January 1, 2030 – December 31, 2039: Total of 2.5% of baseline consumption during the entire period.
- By January 1, 2040: Full consumption phase-out.[3]

To implement the phaseout, Mexico set out three implementation stages divided by halocarbon subsector reflected in Table 3.1. To this date, Stage 1 has been completed, which means that there is no more consumption of HCFC for the manufacturing of domestic and commercial refrigeration.

Table 3.1. Implementation Stages of Mexico's HCFC Phase-Out Plan[4]

Stage 1, 2018 35% phase-out	**Stage 2, 2020** Up to 50% of phaseout in 2020	**Stage 3[5]**
▪ Phase-out of foam sector and domestic and commercial refrigeration ▪ Flushing services for refrigeration systems ▪ Aerosol sector	▪ Phase-out of remaining foam and aerosol sector ▪ Remaining flushing services ▪ Extruded Polystyrene (XPS) sector	▪ Servicing sector ▪ Remaining manufacturing sectors ▪ New HCFC production sector

[2] For Article 5 countries the baseline is defined by averaging the consumption from 2009 to 2010. Mexico's HCFC-22 consumption baseline is 8,505 tonnes according to the following source: United Nations Programme, 2018. Comments and recommendations of the Secretariat on Mexico's HCFC phase-out management plan (stage II, third tranche). UNEP/OzL.Pro/ ExCom/81/45.
[3] Phase-Out targets for 2030 and 2040 represent Article 5 targets, as opposed to accelerated Mexico commitments.
[4] Multilateral Fund for the Implementation of the Montreal Protocol, May 2019. HCFC Phase-Out Management Plans and HCFC-Production Phase-Out Management Plans. Available at: http://www.multilateralfund.org/Our%20Work/policy/Shared%20Documents/Policy83HPMP-HPPMP.pdf
[5] Based on the last HCFC- Phase-Out Management Plans and HCFC Production Phase-Out Management Plans, dated in May 2019. Mexico has not signed a Phase III halocarbon management plan.

3.1.2 The Kigali Amendment

Through the Kigali Amendment to the Montreal Protocol, all countries have committed to legally binding targets that require gradual reductions in HFC consumption and production. For Mexico, the agreement specifies that a licensing system for the import and export of HFCs should enter into force no later than January 1, 2021. Under this agreement, Mexico will have to freeze its consumption in 2024, taking as a baseline the average of HFC consumption in the period from 2020 to 2022. The goals that Mexico must meet to phase-down 80% of the baseline before 2045, by year are:

- 2020-2022: Average of consumption to set the baseline
- 2024: Consumption freeze
- By 2029: 10% consumption below baseline
- By 2035: 35% consumption below baseline
- By 2040: 50% consumption below baseline
- By 2045: 80% consumption below baseline

Mexico's government is analyzing the options to comply with these commitments and is holding public workshops to establish a work plan. As the consumption freeze will begin in 2024, HFC consumption continues to increase due to the successful phaseout of HCFCs.

3.2 The Status of HCFC-22 in Mexico

3.2.1 Consumption

Hydrochlorofluorocarbon-22 (HCFC-22, or R-22) is used in Mexico for commercial refrigeration, domestic air conditioning, refrigerated transportation, and industrial air conditioning.[6] The 100-year global warming potential (GWP) of HCFC-22, according to the 4th Assessment Report of the IPCC[7,8], is 1,810 (tonnes of CO_2e per tonne of HCFC-22). To date, Mexico is very close to completely phasing out the consumption (i.e., production + imports) of HCFC-22 for new refrigeration equipment.[9] The majority of the remaining consumption of HCFC-22 is for servicing pre-existing equipment. Only 237 tonnes of HCFC-22 were consumed for manufacturing refrigeration equipment in 2017 and, 4,460 tonnes were used for servicing.[9] HCFC-22 imports have ceased, for use in refrigeration and blowing agents, and production is only made by one company (Quimobásicos or CYDSA). HCFC-22 continues to be imported for uses that will not result in emissions to the atmosphere such as Teflon production. Given that the form of HCFC-22 for those purposes is not considered in the HCFC phaseout plans in Mexico, the Reserve did not include an assessment of HCFC imports for non-refrigeration purposes.

[6] SEMARNAT, 2019. Roadmap to implement the Kigali Amendment in Mexico.
[7] Table 2.14 (Errata) and Table 2.15 in Changes in Atmospheric Constituents and in Radiative Forcing. In IPCC. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.
[8] The Reserve Offset Program Manual references Global Warming Potentials from the IPCC's 4th AR, which is the common practice for most GHG emission reduction programs. When 4th AR GWP aren't available for a particular gas, GWP from the 5th AR are used.
[9] United Nations Programme, 2018. Comments and recommendations of the Secretariat on Mexico's HCFC phase-out management plan (stage II, third tranche). UNEP/OzL.Pro/ ExCom/81/45.

In its HCFC Phaseout Management Plan (HPMP), Mexico committed to a total reduction of 450 metric tonnes of HCFC-22 consumption by 2018 in comparison to its 2008 consumption.4 The starting point of comparison established in the HPMP (2008 consumption) were 7,140 metric tonnes.4 In 2017, Mexico reported a consumption of 4,694.12 tonnes of HCFC-22[9], which is 1,995.88 tonnes higher than the committed reduction under the HPMP.

3.2.2 HCFC-22 Lifecycle

Equipment that Reaches End of Life and Treatment of Gas

Because the production of new HCFC-22 is being phased out, any destruction of HCFC-22 from equipment that was at the end of its useful life will be substituted with a newer generation of refrigerants. Thus, it is relevant to know what commonly happens to this gas when refrigeration equipment reaches the end of its use life.

In Mexico, the vast majority of end of life (EOL) refrigeration equipment is sent to the landfill or junkyard.[10] The gas contained in equipment disposed at a landfill will fully leak to the atmosphere (minus a small amount which may be oxidized by soil bacteria) unless it is recovered and reclaimed or recycled.[11] Recovery, reclamation, and recycling are minimal in Mexico, according to representatives from CYDSA and Ecosave, a reclamation center in Celaya, Guanajuato. Ecosave, with some of the highest market shares of halocarbon recovery in Mexico, receives no more than two percent of the yearly halocarbon that would be available for recovery coming from EOL refrigeration equipment. Ecosave reclaims 90% of the gas it receives. According to Ecosave and CYDSA, only three reclamation centers in Mexico are actively collecting halocarbons, with a maximum potential recovery rate of two percent each. Based on this anecdotal information, it can be assumed that a maximum of six percent of all EOL halocarbon is reclaimed every year. The leftover 94% of halocarbons at EOL is vented to the atmosphere at the time of disposal in a landfill or junkyard. **The Reserve welcomes stakeholder support to identify official halocarbon recovery data to support the facts and conclusions of this paragraph.**

Destruction is minimal as there are no incentives or regulations that promote the activity. At this time, there are three halocarbon destruction facilities in Mexico, an argon plasma arc furnace (Quimobásicos), and two rotary cement kilns (Geocycle and Klinash).

Equipment Servicing

The main use of HCFC-22 in Mexico is for servicing existing equipment, as practically no new HCFC-22 equipment is being manufactured[9]. Gas for servicing comes from imported virgin refrigerant, virgin refrigerant produced in Mexico, and minor quantities of reclaimed refrigerant.[9] The continuous downward trend of HCFC-22 availability in the market has created demand for reclaimed refrigerant. However, given the minimal amount of recovered HCFC-22, the import and production of virgin refrigerant continues to be needed to meet the servicing demand. The

[10] Based on interviews with SEMARNAT, Quimobásicos and Ecosave (a reclamation center).
[11] Four events can happen with halocarbons at end of life, they can be recovered (collected), recycled (when a facility internally cleans the gas for its reuse) reclaimed (when the gas is removed from the facility, cleaned and then used for refrigeration at a different facility) or vented (released to the atmosphere at the time of disposal in a landfill or a junkyard).

only producer of this refrigerant in Mexico is Quimobásicos (a joint venture of CYDSA and Honeywell).

Recycling companies aren't required by regulation to identify if a gas is recycled when it is sold for servicing. Thus, HCFC-22, sometimes containing impurities, may be sold as new. No data were available on the refrigeration subsectors where servicing is used, nor their market shares.

<u>HCFC-22 Substitutes</u>

A report recently published by Mexico's government lists the HFCs that are consumed per refrigeration subsector. The blends used in each subsector have a lower ozone depleting potential than HCFC-22 but have a higher blended GWP than the GWP of HCFC-22, except for mobile air conditioning and domestic refrigeration. The refrigerant blends in Table 3.2 could be assumed to be the substitutes to HCFC-22 as they represent the current refrigeration consumption trends that resulted from the phaseout of CFC and HCFC. Based on the calculation of HCFC-22 substitutes and their market shares shown in Table 3.2 below, the phaseout of HCFC-22 in Mexico, while successful at limiting the damage from HCFC to the Ozone layer, has resulted in higher GHG emissions, at least in relation to the phaseout of HCFC-22. The blended GWP for HFCs substituting HCFC-22 in Mexico is 2,286.

Table 3.2. Proportion of HFC Use in Mexico per Refrigeration Subsector, 2017[6,12]

Refrigeration Subsector	**Market Share in Terms of CO_2e**					**Blended GWP**	**Relative Market Share in Terms of CO_2e[13]**
	R-404a[14]	**R-410a**	**HFC-134a**	**R-407c**	**R-507a**		
100-year GWP[7]	*3,922*	*2,088*	*1,430*	*1,774*	*3,985*		
Stationary Air Conditioning		92%	6%	2%		2,042	58.3%
Commercial Refrigeration[15]	80%		4%		13%	3,833	20.6%
Mobile Air Conditioning			100%			1,430	16.0%
Domestic Refrigeration			100%			1,430	4.6%
Transport Refrigeration	37%		63%			2,352	0.5%
Weighted GWP for all HCFC-22 substitutes						**2,286**	

3.3 The Status of HFCs in Mexico

3.3.1 Consumption

HFC-32, HFC-125, HFC-134a, HFC-143a are primarily used as refrigerants or components in blended refrigerants in domestic, commercial, and industrial refrigeration, as well as air

[12] Industrial refrigeration uses mainly ammonia, the use of HFC-134a in this sector can be considered *de minimis.*
[13] Market share corresponds only to refrigeration subsectors market shares. Other sectors like foams or aerosols are not considered.
[14] See Table 3.3 for the composition of HFC blends.
[15] The market shares for the three blends used for commercial refrigeration do not add up to 100%. The reference document did not provide information for the leftover 3%. To conservatively calculate the blended GWP for commercial refrigeration, the leftover 3% was assumed to correspond to the gas with the highest GWP, R-407a.

conditioning systems.[6] HFCs have ideal characteristics for their applications, but they also have a high GWP in comparison to other common GHG such as CO_2, CH_4 and N_2O. Many of these gases are used in blends. See Table 3.3 for the GWP and market share for Mexico-relevant HFCs and blends.[6]

Table 3.3. Global Warming Potential and Market Share of HFC-32, HFC-125, HFC-134a, HFC-143a, and their Blends[6]

Gas/ Blend	Composition				Global Warming Potential (4th AR)	Market Share[6][16]
	HFC-32	HFC-125	HFC-134a	HFC-143a		
HFC-32	100%				675	<1%
HFC-125		100%			3,500	<1%
HFC-134a			100%		1,430	24%
HFC-143a				100%	4,470	<1%
R-404A	44%	4%	52%		3,922	15%
R-407C	4%	25%	52%		2,107	1%
R-410A	50%	50%			2,088	46%
R-507a		50%		50%	3,985	2%

The consumption of HFCs in Mexico has had an average annual growth rate (in units of CO_2e) of 14.5% from 2007 to 2017.[6] In 2017, the HFCs and blends most consumed in Mexico's refrigeration sector were R-410A (used mainly for stationary air conditioning), HFC-134a (used for mobile air conditioning and domestic refrigeration), and R-404a (used for commercial refrigeration). Irrespective of the particular gas, 50.9% of the HFCs and their blends are destined for stationary air conditioning, 17.79% for commercial refrigeration, 14.23% for mobile air conditioning, 0.45% for transport refrigeration and 0.17% for industrial refrigeration (See Table 3.2).

Currently, there are at least 10 companies importing HFCs into Mexico, with no domestic HFC production.

3.3.2 HFC Lifecycle

Equipment that Reaches End of Use Life

As with HCFC-22, the equipment that reaches end of its use life is sent to the landfill where the gas is leaked to the atmosphere. The small amount of HFC-134a, R-410A and 404a that is collected (up to six percent, see Section 3.2.2) before reaching the landfill is being stockpiled. There is no market incentive to recycle and reuse these gases as virgin refrigerants are highly available at low prices.

HFC Substitutes

To this date, substitution of HFCs, particularly R-410A and HFC-134a, with newer refrigerants is rare. When gas replacement is needed, the market continues to use the same gases per

[16] Market share refers to the proportion that the HFC or its blend represents in respect to the overall HFC CO_2e in Mexico.

subsector as specified in Table 3.2. In addition, as the implementation of Mexico's HFC phasedown does not begin until 2024, HFC consumption continues to increase every year.

Mexico's HFC phaseout regulation following the Kigali Amendments will aim at having HFC substitutes of no more than 150 GWP.[6] Hydrofluoroolefins (HFOs) or Hydrocarbons (HCs) are examples of potential low GWP substitutes. However, most of the substitute technologies are still under development and it is not clear which gases will gain the most market share. The potential future substitutes that Mexico has identified per subsector are defined in Table 3.4.

Table 3.4. Potential Substitutes for HFC Refrigerants in Mexico, and their 100-year GWP[6]

Refrigeration Subsector	Gas	100-Year GWP (4AR)
Stationary Air Conditioning	HFC-32 R-290 HFO	675 3.3 ≤ 2
Commercial Refrigeration (standalone equipment)	R-290 R-744	3.3 1
Commercial Refrigeration (condensing units and centralized systems)	HFO R-744 Hydrocarbons	≤ 2 1 ≤11
Mobile Air Conditioning	HFO HFC-152a R-744	≤ 2 124 1
Domestic Refrigeration	R-600a HFO	3 ≤ 2
Transport Refrigeration	R-452a	2,139

3.4 Legal Requirement Test

The following two sections present the result of an update to the legal requirement test and the performance standard test in V1.0 of the protocol for halocarbon destruction.

Mexico is a signatory to the Montreal Protocol and its amendments. Mexico is then required to manage halocarbon consumption according to the Montreal Protocol phaseout agreements; in fact, Mexico committed to more ambitious phaseout schedules than those required for developing countries listed in Article 5. As the Montreal Protocol does not mandate destruction of halocarbons, the Reserve concludes that halocarbon destruction in Mexico is not mandated by international laws. See Sections 3.1.1 and 3.1.2 for more details on how Mexico complies with the Montreal Protocol agreements.

In Mexico, halocarbon banks are classified as hazardous, and several procedures must be followed by generators, importers, exporters and handling, transportation and disposal service providers. Transboundary movements of hazardous waste follow international policies, including Basel Convention requirements.[17] See Table 3.5 for a list of the applicable regulations to halocarbons at EOL in Mexico, adapted from UNIDO, 2017.

[17] UNIDO, 2017. Demonstration Project for Disposal of Unwanted ODS in Mexico.

Table 3.5. Applicable Regulations to Halocarbons at EOL in Mexico

Applicable Legislation	Description
Waste Management	
LGPGIR	General law that regulates solid waste management activities, including that of hazardous waste (generation, handling transportation and disposal).
NOM-052-SEMARNAT-2005	Classification and identification of hazardous waste (standard). It classifies halocarbons at EOL as hazardous waste.
NOM-002-SCT-2011	Transportation of hazardous materials and waste
NOM-003-SCT-2008	Packaging and labeling of hazardous materials and waste.
NOM-161-SEMARNAT-2011	Classification of special management waste and waste management plans, including refrigerators and air conditioners discarded by large generators.
Disposal and Destruction	
NOM-098-SEMARNAT-2002	Environmental criteria for waste incineration facilities
NOM-040-SEMARNAT-2002	Environmental criteria for cement manufacturing facilities, including co-processing
Import and Export	
Basel convention	Trans-boundary movements of hazardous waste (international treaty)
LGPGIR and its rules of procedure	Specifies obligations and procedures for hazardous waste import and export into and from Mexico

Though there are several regulations governing the proper management of halocarbons, neither Mexican domestic law nor the Montreal Protocol requires the destruction of extant stocks of halocarbons. Rather, virgin stockpiles may be sold for use, and installed banks may be recovered, recycled, reclaimed, and reused indefinitely. Because neither the Montreal Protocol nor Mexican law forbids the use of existing or recycled controlled substances beyond the phase-out dates, even properly managed halocarbon banks will eventually be released to the atmosphere during equipment servicing, use, and end-of-life.

The Reserve's review of domestic and international law continues to demonstrate that there are no regulations requiring destruction of halocarbons in Mexico. Therefore, destruction of halocarbons from Mexico meets the legal requirement test.

3.5 Performance Standard Test

For Version 1.0 of the protocol (adopted in 2015), the Reserve assessed the proportion of halocarbons that are destroyed based on the country's reports to the United Nations Environment Programme (UNEP). At that time, it was determined that in the upper bound of CFC destruction estimation, 0.02% of CFCs consumed were destroyed in 2008, the most recent year of available data.

In 2018, UNEP published an updated report that contained information on national halocarbon destruction. Mexico reported destruction of halocarbons in 2007, 2014, 2015 and 2016; there was no destruction in all other intervening years. As the destruction data are reported for all halocarbons irrespective of the specific gas, the Reserve estimated a conservative upper bound value for destruction for HCFC-22 and HFCs assuming that all destruction had been only for one type of gas.

No data were found on the amount of halocarbons at EOL that would be available for destruction every year. To estimate the value, the Reserve assumed that the average useful life of refrigeration equipment is 10 years. Under that assumption, the equipment from 2004 would be at the end of its useful life by 2014 and the halocarbon it contained could be available for destruction.

The results indicate that no more than 1.26% of HCFC-22 or HFC would have been destroyed annually under this assumption. The analysis demonstrates that destruction continues to be highly unusual and therefore additional in Mexico. In fact, Mexico continues to report destruction as isolated events that happen dependent on multilateral funding. See Table 3.6 for the calculation of the upper bound destruction estimate of HCFC-22 and HFC in Mexico.

Table 3.6. Halocarbon Destruction Relative to HCFC-22 and HFC at EOL in Mexico

Category	2014	2015	2016
Tonnes of destroyed halocarbons[18]	3.03	62.85	39.07
EOL HCFC-22 (consumption from year -10)[19]	4,848[20]	6,498	8,990
EOL HFC[21] (consumption from year -10)	NA	4,977	5,821
Relative Destruction[18]	**2014**	**2015**	**2016**
HCFC-22	0.05%	0.97%	0.43%
HFC	NA	1.26%	0.67%

4 Preliminary Conclusions

4.1 HCFC and HFC Baseline Description

The lifecycle for HCFC-22 in Mexico can be summarized as described in Figure 4.1 below. The cycle begins with the ongoing operation of refrigeration equipment that uses HCFC-22. Once the equipment reaches the end of its useful life, it is disposed at a landfill. Only a small fraction of equipment at EOL is collected for metals extraction, however no data were found on the proportion of collection. At the landfill, the gas will be fully released to the atmosphere, apart from some small amount of oxidation by soil bacteria. Based on our conclusions from Section 3.2.2 from this document, the Reserve is assuming that up to six percent of the gas is collected

[18] UNEP, 2018. Information provided by parties in accordance with Articles 7 and 9 of the Montreal Protocol on Substances that Deplete the Ozone Layer. Report of the Secretariat. Available at: https://ozone.unep.org/treaties/montreal-protocol/meetings/tenth-meeting-parties/decisions/decision-x2-data-and
[19] UNEP, 2011. Comments and recommendation of the Fund Secretariat on Mexico's HCFC phase-out management plan (stage I, first tranche). UNEP/OzL.Pro/ExCom/64/39
[20] The halocarbons at EOL in 2014 (HCFC-22 consumption in 2004) was estimated by assuming the consumption in 2004 was 90% of the consumption in 2005.
[21] Online Presentation by Ester Monroy on ODS Alternatives Surveys Results: Gaps, Challenges and Best Practices. Available at: https://www.unido.org/sites/default/files/2017-06/13June_ODSAlternatives_GeneralAnalysis_0.pdf. The presentation only provided the consumption for 2015. The 2016 HFC EOL value (consumption in 2006) was estimated backtracking consumption from 2015 by 14.5%.

prior to the disposal of the equipment. The collected gas is sent to a reclamation center. At the reclamation center, a portion of the gas is indefinitely saved in stockpiles (where it will continue to leak to the atmosphere over time) and another portion is reclaimed into saleable refrigerant. The reclaimed gas is used for servicing equipment that continues to be in operation. At the same time, new HCFC-22 continues to be produced by Quimobásicos to meet servicing demands and the demand for new refrigeration equipment is met using imported virgin HFCs.

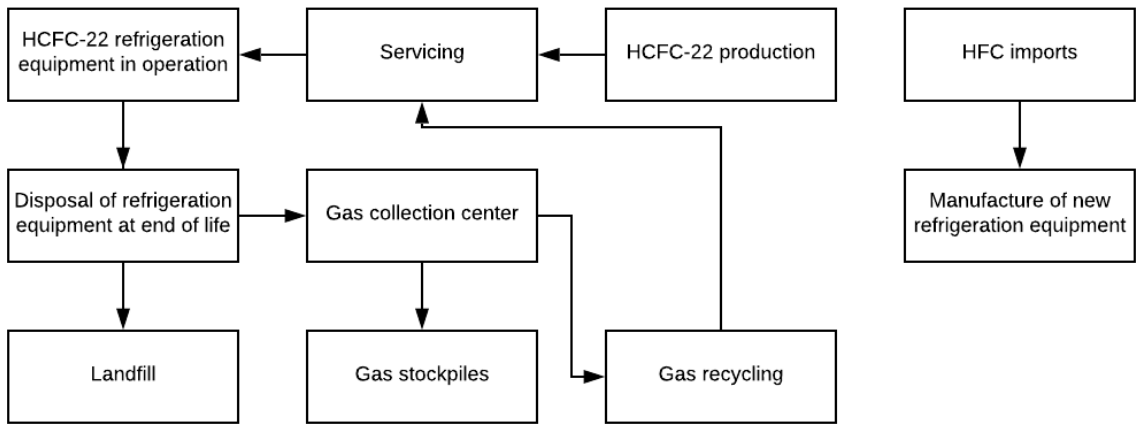

Figure 4.1. Lifecycle of HCFC-22 for Refrigeration in Mexico

The lifecycle of HFC in Mexico can be summarized as presented in Figure 4.2. At least ten companies in Mexico are permitted to import HFCs for different purposes, including for the manufacture of new refrigeration equipment. HFC refrigeration equipment continues to undergo servicing throughout its useful life with virgin imported HFCs. Once the equipment reaches the end of its useful life, it is disposed of at a landfill where the gas will be released to the atmosphere. Based on our conclusions from Section 3.2.2 from this document, the Reserve is assuming that up to six percent of the gas is collected prior to the disposal of the equipment. That six percent of the gas at EOL is collected at reclamation centers where it is mostly stockpiled until its eventual release to the atmosphere. The loss of HFC to the atmosphere is substituted with new imports of HFC to Mexico. The consumption levels of HFC follow an upward trend as there will not be any limits for HFC imports until 2024.

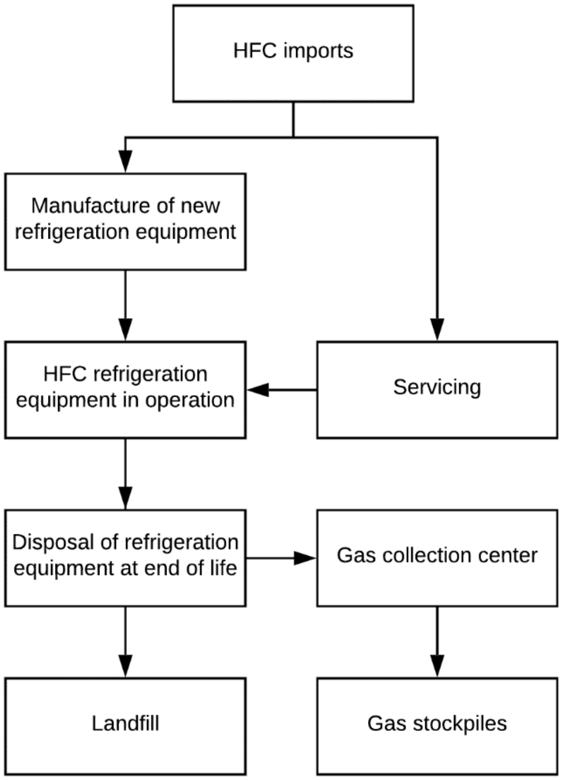

Figure 4.2. Lifecycle of HFC for Refrigeration in Mexico

4.2 Options for HCFC/HFC Destruction Projects

In Mexico, a high proportion of refrigerants are leaked to the atmosphere due to the low levels of recovery and reclamation. This paper estimates a maximum of six percent of halocarbons at EOL are recovered before reaching a landfill or a junkyard. In the case of HCFC-22, 90% of the recovered gas is used for servicing, which delays the release of this material to atmosphere. Once the serviced equipment reaches its EOL, presumably only six percent of that gas will be recovered again. This reflects that eventually, all HCFC-22 will be leaked to the atmosphere because the availability of virgin HCFC-22 in the market is diminishing every year. In the case of HFC, most of the recovered gas is stockpiled because there is no demand for its reuse. All stockpiles will eventually leak to the atmosphere. As new HFC comes into the market, halocarbon emissions continue to increase each year.

The leakage trends for both HCFC-22 and HFC demonstrate that any destruction of EOL refrigerant which would not otherwise be reclaimed would be beneficial. However, if the portion of the gas that would have been reclaimed (six percent) was destroyed, or gas in equipment that was not at the end of its useful life and was prematurely destroyed, the substitute gases may cause a negative net effect to the atmosphere if they had a higher GWP. Under an HCFC-22 destruction project, six percent of the destroyed material should be assumed to be substituted by a blend of halocarbons with a GWP of 2,286 (See Table 3.2). In the case of HFCs, the substitute refrigerant would be the same HFCs that were destroyed, and six percent of that should be accounted as project emissions.

If it were possible to ensure that the project only destroys HCFC/HFC which would not have otherwise been recovered or remained in service, then crediting can proceed without concern for substitute emissions. To ensure this, it would be critical to have reliable information to prove that, as business as usual, some refrigeration subsectors are not sending refrigerants to recovery centers. For example, if there were data that proved that only the commercial subsector is sending the HCFC/HFC at end of life to recovery centers, while most of the refrigerants from the domestic refrigeration subsector are being sent to the landfill, any documented halocarbon recovered from the domestic refrigeration subsector could be assumed to not cause a net negative effect to the atmosphere. The documented recovery of halocarbons from the domestic refrigeration subsector would be considered different to what would have happened in the absence of the project: leaked to the atmosphere from landfill disposal. Thus, its destruction would be assumed to not have been substituted with higher GWP refrigerants. **Stakeholder support and data are requested to identify which refrigerant sources are currently being recovered in Mexico.**

If project developers were able to demonstrate that the six percent of halocarbons that would have been reclaimed were substituted with refrigerants of low GWP such as HFOs or hydrocarbons, the substitute refrigerant would in fact support higher emission reductions generated by the project.

Description of an HCFC-22 Destruction Project

Figure 4.3 represents a hypothetical HCFC-22 destruction project. The shaded boxes highlight the project-specific activities. An HCFC-22 destruction project would consist of the destruction of HCFC-22 stockpiles or reclaimed gas before its use for servicing. To ensure that the destroyed gas is not replaced with further HCFC-22 production for servicing, the equipment at end of life must be destroyed, or retrofitted to use a lower-GWP refrigerant. A project developer would need to account six percent of the halocarbons destroyed as project emissions from substitute refrigerants or demonstrate that any new equipment replacing the baseline equipment used lower-GWP refrigerants.

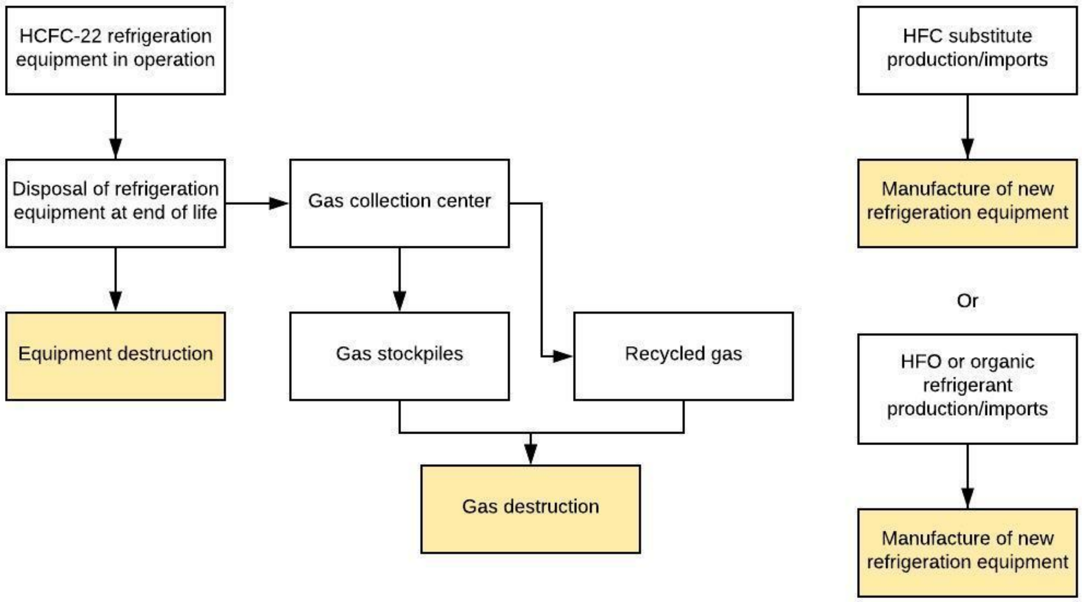

Figure 4.3. Hypothetical HCFC-22 Destruction Project

Description of an HFC Destruction Project

Figure 4.4 represents a hypothetical HFC destruction project. The shaded boxes highlight the project-specific activities. An HFC destruction project would consist of the destruction of recovered HFC taken from HFC refrigeration equipment at the end of its useful life. The equipment from where the gas came would have to be destroyed to ensure that it is replaced with new equipment using lower-GWP refrigerants such as HFOs or HCs. A project developer would need to account six percent of the halocarbons destroyed as project emissions from substitute refrigerants or demonstrate that any new equipment replacing the baseline equipment used lower-GWP refrigerants.

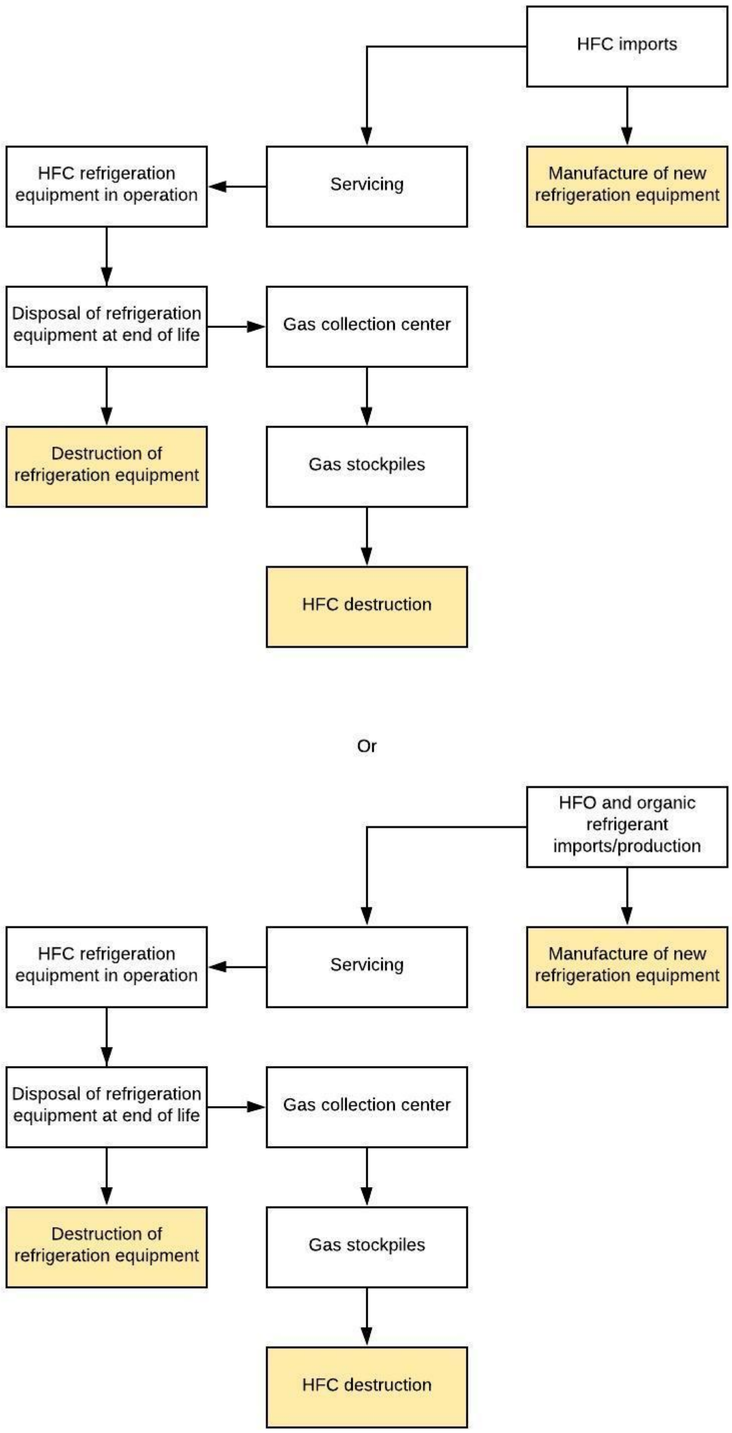

Figure 4.4. Hypothetical HFC Destruction Project

4.3 Are Halocarbon Destruction Projects Additional?

Based on the limited data available, the reported halocarbon destruction levels in Mexico demonstrate that the practice continues to be highly rare. The identified regulation to halocarbon handling and destruction also demonstrate that there is no legal requirement to destroy HCFC-22 nor HFCs. Therefore, HCFC-22 and HFC destruction would return additional emission reductions. The main concern with crediting for destruction of these project types is around GHG emissions leakage and the potential increased demand for virgin, high-GWP refrigerants. These risks can be controlled through additional safeguards in the protocol itself, although these will raise the cost and complexity of project development.