

Performance Standard Supplemental Description

GREENHOUSE GAS EMISSIONS REDUCTION METHODOLOGY FOR ADVANCED REFRIGERATION SYSTEMS

VERSION 2.1

2023-10-03

Introduction

ACR's Methodology for the Quantification, Monitoring, Reporting, and Verification of Greenhouse Gas Emissions Reductions and Removal from Advanced Refrigeration Systems v2.1 (ARS methodology) enables the issuance of carbon credits to projects in the U.S., Canada, and Mexico that deploy an advanced refrigeration system using a Significant New Alternatives Policy (SNAP) approved low-global warming potential (GWP) refrigerant in Large Commercial Refrigeration, Remote Condensing Units, or Stand-alone Commercial Refrigeration systems. The climate benefits of projects developed under this methodology are additional to what would have occurred under a business-as-usual scenario, current laws and regulations, and current industry practices, and without carbon market incentives. To demonstrate that the activities eligible under the ARS methodology are not common practice, ACR established a performance standard by evaluating adoption rates for low-GWP refrigerants and associated technologies in the applicable industry sectors and geographies. Performance standard baselines were also developed, taking into account existing legal and regulatory requirements.

This supplemental description of the performance standard and associated baselines aligns with and complements the ARS methodology. It is intended to supply additional details to interested parties about the sources consulted and analysis performed during methodology development to support the performance standard established therein. ACR was inspired to publish this document to provide even more transparency on a core component of the methodology and principle of the ACR Program. Project Proponents and Validation and Verification Bodies do not need to consult this supplemental when performing the work of developing and validating/verifying projects under the methodology.

Advanced Refrigeration Systems Methodology Performance Standard

To qualify as additional under the ARS methodology, projects must exceed the performance standard defined in the methodology and pass a regulatory additionality test. The ARS methodology establishes a practice-based performance standard developed by evaluating the market adoption rates of low GWP refrigerants and concludes that, based on low penetration rates within certain sectors and segments, any ARS project that meets the eligibility and other requirements of the methodology is additional.¹ The ARS methodology also provides GWPs for use in baseline calculations according to the location specific regulations banning certain refrigerants or establishing limits on refrigerant GWPs.

Adoption Rates for Practice-Based Performance Standard

U.S. market adoption rates for low-GWP refrigerants and associated technologies eligible under the ARS methodology are sourced from U.S. EPA statistics on their GreenChill Partnership program.² GreenChill is a voluntary U.S. EPA partnership program that works collaboratively with the food retail industry to reduce refrigerant emissions and decrease their impact on the ozone layer and climate change.

Since the program's launch in 2007, U.S. EPA has conducted over 100 webinars on various policy and technical topics for the retail food industry. The program provides information on alternative low-GWP refrigerants and associated technologies, policy changes, benefits of using low-GWP refrigerants, and the GreenChill store certification program. The store certification program recognizes individual food retailer stores for using environmentally friendlier commercial refrigeration systems. The highest store certification level is "Platinum-level" and is awarded to stores that use only non-ozone depleting refrigerants that have been found acceptable by the U.S. EPA's SNAP program for use in retail food refrigeration end-uses. In addition, the store must meet one of the following sets of conditions:

- The store must achieve an average HFC refrigerant charge equal to or less than 0.5 pounds of HFC refrigerant per 1,000 British Thermal Units per hour (BTUH) total evaporator cooling load and a store-wide annual HFC refrigerant emissions rate of 5% or less; or
- All refrigerants used in the store's commercial refrigeration system must have global warming potentials (GWPs) lower than 150.

Any food retail store that is in design phase, newly constructed, fully operational, or being remodeled can apply for GreenChill store certification. Given U.S. EPA's expansive outreach, the no-cost certification application and the benefits of certification to the store, there is strong incentive for

¹ See the eligible sectors and segments listed in Table 1 of the ARS methodology.

² U.S. EPA. GreenChill Partnership. <https://www.epa.gov/greenchill>.

qualifying stores to seek this certification. Hence the certification data provides an accurate representation of stores currently using low-GWP refrigerants.

According to data from December 2020 (available as of the August 2021 publication date), only 419 of the more than 38,500 food retailers³ in the U.S., or 1.09%, were certified at the platinum-level by GreenChill^{4,5} Note that the original source cited has been updated since the August 2021 publication date so the number of Platinum certifications is now higher but the penetration level increased by only 0.5% to 1.58%. It is important to note that even the “Platinum-level” certification only requires use of refrigerants with GWP less than 150, while the ARS methodology only allows projects that use refrigerants with GWP below 15 (one-tenth of the highest U.S. EPA GreenChill certification), so the market adoption for low GWPs eligible under the ARS methodology is assumed to be even lower.

Market adoption rates in Canada and Mexico were evaluating using data from ATMOSphere’s *Natural Refrigerants: State of the Industry* report. While the version consulted during methodology development is no longer freely available to the public, the most recent 2022 edition shows persistently low adoption rates of low-GWP refrigerants in these countries.

As of December 2022, 575 stores in Canada have installed transcritical CO₂ based refrigeration systems⁶ (i.e., the most commonly used low-GWP commercial refrigeration system in supermarkets and grocery stores). This represents just a 2% penetration level among the 26,475 food and beverage retailers in Canada.⁷

The same ATMOSphere report states that there is only one store in Mexico that has installed a transcritical CO₂ system and a few instances of ammonia/CO₂ systems installed by a cold storage operator.⁸ If evaluated only against the 3,435 supermarket chain stores^{9, 10} the penetration level is 0.1%.

³ This conservatively excludes the more than 100,000 convenience stores that are also eligible to participate.

⁴ U.S. EPA. GreenChill Certified Stores. <https://www.epa.gov/greenchill/greenchill-certified-stores>.

⁵ U.S. EPA. GreenChill Advanced Refrigeration. <https://www.epa.gov/greenchill/advanced-refrigeration>.

⁶ ATMOSphere. Natural Refrigerants: State of the Industry, 2022 Edition. <https://atmosphere.cool/marketreport-2022/>.

⁷ Statistics Canada. Canadian Business Counts, with employees, June 2021. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3310039501&pickMembers%5B0%5D=2.1&pickMembers%5B1%5D=3.70>.

⁸ ATMOSphere. Natural Refrigerants: State of the Industry, 2022 Edition. <https://atmosphere.cool/marketreport-2022/>.

⁹ U.S. Department of Agriculture, Foreign Agriculture Service. Retail Foods, Mexico (2021). <https://www.fas.usda.gov/data/mexico-retail-foods-5>.

¹⁰ This conservatively excludes other non-supermarket food retailers.

The extremely low 0.1% - 2% penetration levels for the U.S., Canada, and Mexico demonstrate that the use of low-GWP refrigerant for commercial refrigeration purposes is not common practice in these countries. Adoption rates are expected to remain low in the near future as a result of market entry barriers, including the high upfront costs, limited technology options, and a technician shortage for these systems.¹¹

As a result of the analysis and findings described above, the ARS methodology concludes that, based on low penetration levels for such projects, any Advanced Refrigeration System project that meets the eligibility and other requirements of the methodology is additional.

Legal and Regulatory Requirements for Performance Standard Baseline

The ARS methodology takes existing legal and regulatory requirements into account, including bans on certain refrigerants or limits on refrigerant GWPs enacted in U.S. states, Canada, and Mexico. This analysis resulted in a diversity of baseline refrigerant GWPs, depending on where the project is located and implementation date, as depicted in Tables 5 and 6 of the methodology and presented below.

¹¹ North American Sustainable Refrigeration Council. Connecting the Pieces for sustainable supermarket refrigeration solutions, 2022 Annual Report.
https://static1.squarespace.com/static/55a672f1e4b06d4dd52f83de/t/63ed175599be0844e1ff0c89/1676482401028/NASRC_Annual+Report_2022.pdf.

Table 1: Baseline Refrigerant (GWP) for Stand-Alone Commercial Refrigeration

SEGMENT	US STATE(S)/ COUNTRIES	BASELINE REFRIGERANT (GWP)		
		2019	2020	2021 ¹²
Stand-Alone Commercial Refrigeration	California	1453 (A) 2053 (B)	850 (C)	773 (D) 1306 (E)
	Washington	2053	850	773 1306
	Colorado, Delaware, Maryland, Massachusetts, New Jersey, New York, Vermont	2053	2053	773 1306
	All other US States and Territories	2053	2053	1962
	Canada	2053	1425 (F)	1425
	Mexico	2053	2053	1962

(A) Stand-Alone Medium-Temperature Units with a compressor capacity below 2,200 Btu/hour and not containing a flooded evaporator (New); R-513A (75%) and R-404A (25%)

(B) Stand-Alone Medium-Temperature Units with a compressor capacity equal to or greater than 2,200 Btu/hour and Stand-Alone Medium-Temperature Units containing a flooded evaporator (New); HFC-134A (75%) and R-404A (25%)

(C) R-513A (75%) and R-426A (25%)

¹² AR5 100-year GWP values are used for year 2021 as per ACR standard 7.0

(D) Up to June 6, 2021; R-513A (75%) and R-426A (25%)

(E) After June 6, 2021; Average of R-448A, R-449A, R-449B (75%) and R-426A (25%)

(F) GWP limit for medium temperature units: 1400 (75%) and GWP limit for low temperature units: 1500 (25%)

Table 2: Baseline Refrigerant (GWP) for Large Commercial Refrigeration and Remote Condensing Units

SEGMENT	US STATE(S)/ COUNTRIES	BASELINE REFRIGERANT (GWP)		
		2019	2020	2021 ¹³
LARGE COMMERCIAL REFRIGERATION AND REMOTE CONDENSING UNITS	California	2110 (G)	2110	1923
	Washington, New Jersey, Vermont	3015 (H)	2110	1923
	Colorado, Delaware, Maryland, Massachusetts, New York	3015	3015	1923
	All other US States and Territories	3015	3015	2934
	Canada	3015	2200 (I)	2200
	Mexico	3015	3015	2934

(G) R-407A

(H) R-407A (50%) and R-404A (50%)

¹³ AR5 100-year GWP values are used for year 2021 as per the ACR Standard.

- (l) GWP limit for centralized refrigeration systems that are generally used for storing and displaying food, beverages, and other perishables in convenience stores and supermarkets, using HFCs as refrigerants.

In determining appropriate baseline GWPs based on locally applicable regulations, legislation, and rules, ACR staff assessed the regulatory landscape. The table below presents the background information to further substantiate the content previously presented in the methodology.

Regulatory Requirements Applicable to Baseline Refrigerant GWPs

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
US-CALIFORNIA	California Cooling Act (Senate Bill 1013, Health & Saf. Code § 39734) and through a regulation approved by the California Air Resources Board (Cal. Code Regs., tit. 17, §§ 95371, et seq). Bill Text - SB-1013 Fluorinated refrigerants. (ca.gov)	01/01/2019 to 01/01/2024	The federal prohibitions California adopted under SB 1013 originated from the U.S. EPA’s Significant New Alternative Policy (SNAP) Program, Rules 20 and 21, which were partially vacated in 2017. Similar to the federal SNAP Rules, the California prohibitions are end-use and sector-specific.
US-WASHINGTON	Engrossed Second Substitute House Bill 1112 1112-S2.SL.pdf (wa.gov)	July 28, 2019	Intent of the legislature is to transition to the use of less damaging hydrofluorocarbons or suitable substitutes in various applications in Washington, in a manner similar to the regulations that were adopted by the U.S. EPA’s rules 20 and 21.
US-COLORADO	Regulation Number 22: Colorado GHG Reporting and Emission Reduction	01/01/2021 to 01/01/2023	Adopts U.S. EPA SNAP rules 20 and 21 to prohibit use of certain refrigerants in specific end-uses by different effective dates.

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
	Requirements (5 CCR 1001-26) https://www.sos.state.co.us/CCR/DisplayRule.do?action=ruleinfo&ruleId=3325		
US-DELAWARE	1151 Prohibitions on Use of Certain Hydrofluorocarbons in Specific End-Uses untitled (delaware.gov)	9/1/2021 to 1/1/2023	This regulation establishes the prohibitions and requirements for the use and manufacture of hydrofluorocarbons in the State of Delaware according to their specific end usage (including air conditioning and refrigeration equipment, aerosol propellants, and foam end-uses) and adopts specific U.S. EPA SNAP Program prohibitions. This regulation is designed to support greenhouse gas emission reductions in the State of Delaware.
US-MARYLAND	Regulations .01—.06 under COMAR 26.11.33 Prohibitions on Use of Certain Hydrofluorocarbons in Aerosol Propellants, Chillers, Foam, and Stationary Refrigeration End-Uses. Pages - 26.11.33.03.aspx (maryland.gov)	1/1/2021 to 1/1/2023	Adopts U.S. EPA SNAP rules 20 and 21 to prohibit use of certain refrigerants in specific end-uses by different effective dates.

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
US-MASSACHUSETTS	310 CMR 7.76 Prohibitions on Use of Certain Hydrofluorocarbons in Refrigeration, Chillers, Aerosol Propellants, and Foam End-Uses https://www.mass.gov/doc/310-cmr-776-prohibitions-on-use-of-certain-hydrofluorocarbons/download	1/1/2021 to 1/1/2023	The purposes of 310 CMR 7.76 are to prevent and control pollution to the atmosphere as required by Sections 142A and 142B of Chapter 111 of the General Laws, to support Massachusetts in achieving greenhouse gas emissions reductions goals established pursuant to Chapter 21N of the General Laws and to reduce hydrofluorocarbon emissions by adopting (per U.S. EPA SNAP 20 and 21) specific prohibitions for certain substances in refrigeration equipment, chillers, aerosol propellants, and foam end-uses.
US-NEW JERSEY	Assembly, No. 5583 State of New Jersey, 218th Legislature https://pub.njleg.gov/bills/2018/A9999/5583_11.HTM	1/1/2020 to 1/1/2024	Prohibits sale, lease, rent, or installation of certain equipment or products containing hydrofluorocarbons or other greenhouse gases (per U.S. EPA SNAP rules 20, 21).
US-NEW YORK	6 NYCRR Part 494 Hydrofluorocarbon Standards and Reporting Express Terms - Adopted Part 494 - NYS Dept. of Environmental Conservation	1/1/2021 to 1/1/2023	This Part adopts prohibitions (per U.S. EPA SNAP rules 20 and 21) for certain hydrofluorocarbon substances in air conditioning and refrigeration equipment, aerosol propellants, and foam end-uses.
US-VERMONT	Act No. 65. An act relating to the	1/1/2021 to 1/1/2024	Adopts U.S. EPA SNAP rules 20 and 21 to prohibit use of certain

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COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
	regulation of hydrofluorocarbons. https://legislature.vermont.gov/Documents/2020/Docs/ACTS/ACT065/ACT065%20As%20Enacted.pdf		refrigerants in specific end-uses by different effective dates.
US-RHODE ISLAND	250-RICR-120-05-53 Prohibition of Hydrofluorocarbons in Specific End-Uses Prohibition of Hydrofluorocarbons in Specific End-Uses - Rhode Island Department of State (ri.gov)	1/1/2022 to 1/1/2023	The purpose of this regulation is to reduce hydrofluorocarbon emissions by adopting specific prohibitions (per U.S. EPA SNAP rules 20 and 21) for certain substances in air conditioning and refrigeration equipment, aerosol propellants, and foam end-uses.
US-MAINE	An Act To Limit the Use of Hydrofluorocarbons To Fight Climate Change, Sec. 1. 38 MRSA §1612 https://www.legislature.maine.gov/legis/bills/getPDF.asp?paper=HP0161&item=3&snum=130	1/1/2022 to 1/1/2023	Adopts U.S. EPA SNAP rules 20 and 21 to prohibit use of certain refrigerants in specific end-uses by different effective dates.
US-VIRGINIA	9VAC5-145. Regulations for Control of Greenhouse Gases (Rev. D20) (adding 9VAC5-145-100 through 9VAC5-145-150)	1/1/2022	The sale, lease, rent, installation, or entry into commerce in the Commonwealth of Virginia by any person of any products or equipment that use or will use hydrofluorocarbons for the

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
	https://register.dls.virginia.gov/details.aspx?id=9644		applications and end-uses restricted by Appendix U and Appendix V of Subpart G of 40 CFR Part 82 (EPA SNAP rules 20 and 21), as those read on January 3, 2017, is prohibited after the effective date specified in 9VAC5-145-120.
CANADA	Ozone-depleting Substances and Halocarbon Alternatives Regulations (ODSHAR), SOR/2016-137 SOR-2016-137.pdf (justice.gc.ca)	1/1/2020 to 1/1/2025	Sets GWP limits for refrigerants used in different commercial refrigeration products by specific dates.
MEXICO	SEMARNAT: Roadmap to implement the Kigali Amendment in Mexico http://dsiappsdev.semarnat.gob.mx/datos/portal/publicaciones/2019/Roadmap_EK_English_May_2019.pdf	TBD	Per Kigali Amendment to the Montreal Protocol, HFC consumption in Mexico freezes in 2024 and 10% reduction should be achieved by 2029. The roadmap document details how Mexico plans to reduce consumption of HFC. Specific regulations aimed at prohibiting use of HFCs have not been published yet but is expected to come out ahead of the 2029 phase down deadline.

NOTE: In February of 2021, ACR temporarily suspended new listings of projects using this methodology while ACR reviewed the American Innovation in Manufacturing (AIM) Act and subsequent potential

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regulation in the United States as well as regulations in Canada and Mexico for potential impacts to additionality, eligibility, or baselines. In July of 2021, ACR returned to accepting new listings for these projects and released a policy update for methodologies related to HFCs available at <https://acrcarbon.org/news/policy-update-methodologies-related-to-hfcs/>.