Performance Standard Supplemental Description

GREENHOUSE GAS EMISSIONS REDUCTION METHODOLOGY FOR TRANSITION TO ADVANCED FORMULATION BLOWING AGENTS IN FOAM MANUFACTURING AND USE

VERSION 3.0

2023-10-03

Introduction

ACR's Methodology for the Quantification, Monitoring, Reporting, and Verification of Greenhouse Gas Emissions Reductions and Removal from the Transition to Advanced Formulation Blowing Agents in Foam Manufacturing and Use, v3.0 (FBA methodology) enables the issuance of carbon credits to projects in the U.S., Canada, and Mexico that transition to the use of an eligible advanced formulation blowing agent[1] to produce foam for eligible applications,[2] including XPS boardstock, two-component rigid PU spray foam, rigid PU injected foam, and rigid PUF residential refrigerators and freezers. 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 FBA methodology are not common practice, ACR established a performance standard by evaluating adoption rates of advanced formulation blowing agents for various applications in the applicable 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 FBA methodology. It is intended to supply additional details to interested parties about the sources consulted and analysis performed during methodology development to support

[1] Eligible blowing agents are those that have a GWP less than 30, ODP less than 0.01, not a saturated hydrofluorocarbon, not a hydrocarbon, and not prevented from use by any regulation affecting the project.

[2] See the eligible foam applications listed in Table 1 of the FBA methodology.

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.

Formulation Blowing Agents Methodology Performance Standard

To qualify as additional under the FBA methodology, projects must exceed the performance standard defined in the methodology and pass a regulatory additionality test. The FBA methodology establishes a practice-based performance standard developed by evaluating the market adoption rates of eligible blowing agents and concludes that, based on low penetration rates for certain foam applications, any FBA project that meets the eligibility and other requirements of the methodology is additional. The FBA 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

ACR gathered and reviewed information about blowing agent use in the foam industries of the U.S., Canada, and Mexico to determine the market adoption rates of blowing agents that are listed as acceptable substitutes under the U.S. EPA Significant New Alternatives Policy (SNAP) program[3] and meet the eligibility criteria named in the FBA methodology. The market adoption rates of low advanced formulation blowing agents used in Poly Urethane Foam (PUF) manufacturing are based on published market research[4] and additional research by the same authors commissioned for this methodology. The report assessed twelve (12) different applications of blowing agents in North America.[5] For XPS applications, the penetration rate is based on data collected on blowing agent use by four main XPS boardstock manufacturers in North America. This data showed a limited increase in use since publication of a report prepared for the California Air Resources Board and California Environmental Protection Agency that showed HFC-134a as having a 100% penetration rate for XPS

[3] U.S. EPA. Significant New Alternatives Policy (SNAP), substitutes in foam blowing agents. https://www.epa.gov/snap/substitutes-foam-blowing-agents.

[4] Prescient & Strategic Intelligence. Global Foam Blowing Agents Market Analysis, Size, Share, Development, Growth and Demand Forecast to 2020 – Industry Insights by Product Type (HFCs, HCFCs, HCs, Others) by Application (Polyurethane Foam, Polyolefin Foam, Polystyrene Foam, Phenolic Foam, Others) (January 2016). https://www.psmarketresearch.com/market-analysis/foam-blowing-agents-market.

[5] These 12 applications generally covered the same segments assessed by the IPCC Guidelines for National GHG Inventories. The 12 applications investigated were: PU Spray, XPS, Rigid PUF injected, Rigid PUF discontinuous panel, Rigid PUF continuous laminate/boardstock, PUF integral skin, Rigid PUF residential appliances, Rigid PUF block for pipe sections, Rigid PUF discontinuous block for panels, Rigid PUF pipe-in-pipe, Rigid PUF discontinuous block for pipe sections, Rigid PUF continuous block.

manufacturing with in 2010.[6] This same report shows HFC-245fa as having 100% penetration rate for blowing agent used in polyurethane (PU) spray foam manufacturing.[7] A more recent assessment affirms that widespread use of HFC-245fa as blowing agent in spray foam continues.[8] Additional insight was gathered from conversations with industry experts, regulatory personnel, and foam manufacturers, including Honeywell, Daikin Industries, Harp International, Solvay S.A., and Arkema. The ACR peer review process was also relied upon to identify the market penetration of all blowing agents and further refine the list of eligible foam applications (i.e., those applications for which there was a low adoption rate of eligible advanced formulation blowing agents).

Market adoption rates were compared across a variety of foam applications to identify those foam applications that have low market adoption rates of advanced formulation blowing agents. The applications deemed eligible on account of having low penetration levels are displayed in Table 8 of the FBA methodology and presented below.

Table 1 Market Penetration Rate of Eligible BAs[9]

APPLICATION	2013	2014	2015	2016	2017
Rigid PUF injected foam – Marine flotation and buoyancy	1.29%	1.61%	2.04%	2.51%	2.89%
Rigid PUF injected foam – Heating, Ventilation, Air Conditioning and Air Handling Systems	2.06%	2.52%	3.21%	3.84%	4.41%
Rigid PUF injected foam – Refrigerated Transport	1.46%	1.80%	2.30%	2.77%	3.21%

[6] Caleb Management Services. Developing a California inventory for ozone depleting substances (ODS) and hydrofluorocarbon (HFC) foam banks and emissions from foams (2011), Table 3-6, page 30. https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/07-312.pdf.

[7] Caleb Management Services. Developing a California inventory for ozone depleting substances (ODS) and hydrofluorocarbon (HFC) foam banks and emissions from foams(2011), Table 3-8, page 31. https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/07-312.pdf.

[8] American Chemistry Council. 2021 End-Use Market Survey on the Polyurethanes Industry (2022), page 45. https://store.americanchemistry.com/collections/polyurethanes/products/2021-cpi-eums.

[9] Eligible BAs assessed in the market analysis included all known HFOs, Methyl Formate, and inert gases.

APPLICATION	2013	2014	2015	2016	2017
Rigid PUF injected foam – Industrial Refrigeration Systems	1-2%	1-2%	1-2%	1-2%	1-2%
Rigid PUF injected foam – Retail Food Refrigeration	1.56%	1.91%	2.45%	2.88%	3.32%
Rigid PUF injected foam – Garage and Entry Doors	1.61%	2.14%	3.03%	3.88%	4.65%
Rigid PUF residential refrigerators and freezers	1.18%	1.48%	1.92%	2.34%	2.75%
XPS (Board, Billet, and Block only)	7-8%	7-8%	7-8%	7-8%	7-8%
Two-component Rigid PU Spray Foam	5%	5%	5%	5%	5%

The low 1-8% penetration levels for the eligible advanced formulation blowing agents demonstrate that the use of low-GWP blowing agents for the eligible foam applications is not common practice in the U.S., Canada, and Mexico. Adoption rates are expected to remain low in the near future as a result of market barriers, including the higher costs and limited supply of eligible blowing agents.[10]

As a result of the analysis and findings described above, the FBA methodology concludes that, based on low penetration levels for such projects, any Foam Blowing Agents project that meets the eligibility and other requirements of the methodology is additional.

As part of the research and evaluation of market adoption rates, low GWP blowing agents (primarily hydrocarbon blowing agents which are commonly considered to be lower GWP blowing agents) were determined to have high penetration rates in other foam applications. Transition to advanced formulation blowing agents for the following foam applications is considered common practice and therefore do not meet the methodology's performance standard and are not eligible for crediting under the methodology: PU Spray, other than two-component PU Spray, Rigid PUF discontinuous panel, Rigid PUF continuous laminate/boardstock, Rigid PUF block for pipe sections, Rigid PUF

[10] American Chemistry Council. 2021 End-Use Market Survey on the Polyurethanes Industry (2022), page 46. https://store.americanchemistry.com/collections/polyurethanes/products/2021-cpi-eums.

discontinuous block for panels, Rigid PUF pipe-in-pipe, Rigid PUF discontinuous block for pipe sections, Rigid PUF continuous block, and XPS sheet.

Legal and Regulatory Requirements for Performance Standard Baseline

The FBA methodology takes existing legal and regulatory requirements into account, including bans on certain blowing agents in specific end-uses enacted in U.S. states, Canada, and Mexico. This analysis resulted in a diversity of baseline blowing agents, depending on where the project is located and implementation date, as depicted in Table 4 of the methodology and presented below.

Table 2: Eligibility of Baseline BAs by State, Country, Year and End-use Category

STATES	BASELINE BA			
	2020		2021[11]	
End-use Categories[12]	(A), (B), (C)	(D), (E)	(A), (B), (C)	(D), (E)
California, Washington New Jersey (from July 1, 2020 for categories A, B, C)	HFC-152a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a	HFC-152a
Colorado, New York, Vermont Delaware (from Sep 1, 2021 for all categories) Maryland (from July 1, 2021 for categories C, D, E) Massachusetts (from July 1, 2021 for category E)	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a	HFC-152a
All other US states and territories	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a

[11] 100-year GWP values for year 2021 are based on IPCC AR5.

[12] This does not include all end-use categories listed by SNAP (EPA). See the full list https://www.epa.gov/snap/substitutes-foam-blowing-agents.

Canada[13]	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	150 (GWP)	150 (GWP)
Mexico	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a	HFC-152a, HFC-365mfc, HFC-245fa, HFC-134a

(A) Rigid PUF: Residential refrigerators and freezers

(B) Rigid PU Injected Foam

(C) Two-component Rigid PU Spray Foam – High Pressure

(D) Two-component Rigid PU Spray Foam – Low Pressure

(E) XPS Boardstock

In determining appropriate baseline blowing agents 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 Blowing Agents

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).	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.

[13] Canada has set limit of GWP <150 from year 2021, section 64.5 (1), page 23, SOR-2016-137.pdf (justice.gc.ca)

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
	Bill Text - SB-1013 Fluorinated refrigerants. (ca.gov)		
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 Requirements (5 CCR 1001-26) https://www.sos.state.co.us/CCR/DisplayRule.do?action=ruleinfo&ruleId=3325	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.
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

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
			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.
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.

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
US-NEW JERSEY	Assembly, No. 5583 State of New Jersey, 218th Legislature https://pub.njleg.gov/bills/2018/A9999/5583_I1.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 regulation of hydrofluorocarbons. https://legislature.vermont.gov/Documents/2020/Docs/ACTS/ACT065/ACT065%20As%20Enacted.pdf	1/1/2021 to 1/1/2024	Adopts U.S. EPA SNAP rules 20 and 21 to prohibit use of certain 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 -	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

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
	Rhode Island Department of State (ri.gov)		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) https://register.dls.virginia.gov/details.aspx?id=9644	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 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	1/1/2020 to 1/1/2025	Sets GWP limits for refrigerants used in different commercial refrigeration products by specific dates.

COUNTRY-STATE	NAME OF REGULATION	EFFECTIVE DATE	REGULATION SUMMARY
	(ODSHAR), SOR/2016-137 SOR-2016-137.pdf (justice.gc.ca)		
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 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/.*