An Economic Impact Analysis:

Proposed Regulation

Title 250 – Department of Environmental Management

Chapter 120 – Air Resources

Subchapter 05 – Air Pollution Control

Part 53 – Prohibition of Hydrofluorocarbons in Specific End-Uses

Rhode Island Department of Environmental Management

Office of Air Resources

March 19th, 2021

Executive Summary

An analysis of Proposed Air Pollution Control Regulation 53 (250-RICR-120-05-53), "Prohibition of Hydrofluorocarbons in Specific End-Uses" ("Part 53") determines that no unreasonable costs are placed on businesses within Rhode Island. Costs and benefits are estimated by referencing analyses and tools completed by ICF International, the United States Environmental Protection Agency ("EPA"), and the United States Climate Alliance ("USCA"). For this report, benefits are left as unmonetized greenhouse gas reductions due to uncertainty surrounding the social cost of carbon.

The analysis below determines that net present costs to manufacturers and end-users in Rhode Island are estimated to be $6,658,250 over a lifetime of 25-years and Part 53 will result in the cumulative greenhouse gas reductions of 774,000 metric tons of CO_2e through 2046.

Introduction and Background

The purpose of this economic analysis is to determine if the Rhode Island Department of Environmental Management's ("RIDEM") Office of Air Resources ("OAR") Proposed Air Pollution Control Regulation 53 (250-RICR-120-05-53), "Prohibition of Hydrofluorocarbons in Specific End-Uses," will result in significant adverse impacts for businesses in Rhode Island. An analysis of costs and benefits directly associated with the regulation are discussed in this report.

Hydrofluorocarbons ("HFCs") are potent greenhouse gases with the potential to heat the atmosphere hundreds to thousands of times more than carbon dioxide ("CO_2") by mass [1]. Greenhouse gases are the main contributor to climate change known to cause adverse health effects, environmental damage, and monetary loss. HFCs are estimated to produce 3% of nationwide greenhouse gas emissions in 2020 and HFC use is expected to continue rising through 2030 [2]. Projections estimate Rhode Island's HFC emissions to be 660,000 metric tons of carbon dioxide equivalent in 2020 [2]. Part 53 is designed to support Rhode Island greenhouse gas emission reductions as one of twenty-five states and territories within the USCA, a bipartisan coalition of governors committed to greenhouse gas reductions consistent with the goals of the Paris Agreement of 2015. Part 53 provides a list of prohibited HFCs and effective dates after which the sale of a product using prohibited HFCs is not allowed.

Part 53 prohibits the use of certain hydrofluorocarbons from consumer products within Rhode Island. Products include aerosol propellants, chillers, foams, and refrigeration units. Businesses in these industries are required to use low global warming potential ("GWP") HFCs or alternative substitutes after the effective dates listed in § 53.6. This regulation applies to any person who sells, offers for sale, leases, rents, installs, uses, manufacturers, or otherwise causes to be entered into commerce, within the State of Rhode Island, any product or equipment that uses or will use a substance in end-uses listed in § 53.6.

The EPA established Significant New Alternatives Program ("SNAP") Rules 20 and 21 to regulate HFCs under the Clean Air Act ("CAA") beginning in 2016 [3]. Section 612(c) of the CAA authorizes the EPA to create lists of banned substances and acceptable substitutes [3]. The additional rules listed 24 hydrofluorocarbons as unacceptable for specific end-uses. On August 8, 2017, the D.C. Circuit decided to limit EPA's authority to regulate HFCs under the SNAP Rules [4]. Without SNAP being enforced by the EPA, states have recognized the need to address this issue. In addition to Rhode Island, states such as California, Colorado, Delaware, Maine, Maryland, Massachusetts, and Vermont are supporting greenhouse gas reductions by creating similar legislation to lead the transition to refrigerants with lower global warming potentials.

Businesses Impacted

This analysis determines the impact of phasing-down hydrofluorocarbons on Rhode Island's economy. Determining the level of burden placed on businesses and citizens is crucial before regulatory action. In particular, the sectors affected by the control of hydrofluorocarbons are:

- Air conditioning (centrifugal and positive displacement chillers)
- Refrigeration (household refrigerators and freezers, food processing and dispensing, cold storage warehouses)
- Commercial refrigeration (supermarket systems, stand-alone equipment, vending machines)
- Foams (high-pressure two-component spray, low-pressure two-component spray, one-component foam, flexible polyurethane foam, polystyrene foam product manufacturing, household fridge/freezer manufacturing, commercial and industrial manufacturing, urethane, and other foam product manufacturing)
- Aerosols
- Other businesses that may be impacted such as HVAC service companies and refrigerant manufacturers

<u>Air Conditioning</u>

Centrifugal and positive displacement chillers are equipment used in air conditioning systems for large buildings. There are no proposed changes to residential A/C manufacturing as part of this rule. This is because unlike most residential air conditioning units, chillers use between hundreds and thousands of pounds of refrigerants [5]. If the refrigerants leak or are improperly disposed of, the lower global warming potential refrigerants will emit fewer greenhouse gases. In 2016, EPA determined nine manufacturers of centrifugal and positive displacement chillers operate in the United States [6]. The Rhode Island Department of Environmental Management ("Department") has not identified any centrifugal or positive displacement chiller manufacturers operating in Rhode Island.

<u>Refrigeration Equipment</u>

Refrigeration includes residential and commercial equipment used to keep products cold or frozen. Residential refrigeration includes household refrigerator and freezer combinations as well as mini-refrigerators and open-top freezers. Residential refrigeration manufacturers will be required to replace HFC-134a under Part 53; manufacturers will likely substitute HFC-134a for R-450A or R-513A [6]. Large manufacturers may transition to isobutane (R-600a) [6]. There are an estimated twenty-three household refrigeration manufacturers nationwide of which twenty are considered small businesses [6]. No refrigeration manufacturers have been identified in the state.

Cold storage warehouses are also required to be updated with low-GWP HFCs, but 90% of cold storage warehouses nationwide already rely on systems that use ammonia [7]. Ammonia is not ozone-depleting and has a GWP of 0, therefore, only 10% of cold storage warehouses nationwide will be affected by this regulation [7]. Nationwide, a total of four cold storage warehouses will be required to upgrade to an acceptable refrigerant and all four of these warehouses are considered small businesses [7]. Food processing equipment includes units that dispense food or beverages at a desired temperature such as soda machines, ice cream machines, and common drink machines found in convenience stores. Food processing manufacturers will see an increase in refrigerant costs used to charge their products [7]. EPA states that nineteen small business food processing equipment manufacturers will be affected nationwide [7]. The Department has identified no cold storage warehouses or food processing manufacturers within Rhode Island.

Commercial refrigeration includes refrigeration equipment used to store or display commercial goods for sale. Stand-alone equipment includes refrigerators, freezers, and coolers where all refrigeration components are integrated; the equipment only requires electricity to begin operation [8]. Supermarket systems are centralized units with a network providing refrigeration to necessary display cases. While over 640,000 businesses such as convenience stores and supermarkets may be affected nationwide, nearly all commercial equipment can be updated with an approved drop-in refrigerant at no extra cost to businesses [8].

Foams

Foam blowing agents have a variety of uses such as refrigerator insulation and building insulation but are also used in vehicles and furniture [5]. High-pressure two-component spray foam, one-component foam, and low-pressure two-component spray foam will likely incur costs transitioning product facilities from HFC-134a and HFC-245fa to Solstice Liquid Blowing Agent ("LBA") or Solstice Gaseous Blowing Agent ("GBA") [7]. Polystyrene foam is used for Styrofoam and building insulation, but polystyrene manufacturers and urethane product manufacturers have already transitioned away from high-GWP HFCs because the transition occurred before SNAP Rules 20 and 21 were vacated in June 2017 [5]. Rigid polyurethane foam is used to insulate household refrigeration appliances and commercial refrigeration equipment. In total, forty-five small business foam manufacturers will be affected by this rule nationwide [7]. It is uncertain if any foam manufacturers operate in Rhode Island.

Aerosols

Aerosol manufacturing does not use a significant portion of HFCs because nearly all manufacturers have already transitioned from high-GWP HFCs. The rule will prevent future HFC use in the aerosol industry.

NAICS (North American Industry Classification System) Codes are used for business identification purposes and to analyze business information at the federal level. NAICS Codes helped identify businesses that could be affected by Part 53 in Rhode Island. The total number of businesses that will be affected by Part 53 is uncertain because some businesses have already transitioned away from HFCs, some businesses do not use HFCs, and some businesses have offices and locations in Rhode Island without manufacturing sites. The estimated number of businesses impacted using NAICS is not an accurate portrayal of the actual businesses impacted because the value estimates the total number of businesses that have the potential to be impacted. The NAICS estimate is the likely worst-case scenario for Rhode Island business.

4,651 businesses in Rhode Island may be affected by Part 53. Of the 4,651 businesses, 4,429 of the businesses are grocery stores, convenience stores, restaurants, bars, and other businesses that commonly use refrigeration equipment to store or sell goods. EPA states that, "Compliance costs are based on the assumption that end-users (e.g., supermarkets) will use R-407A in new systems in place of R-404A and R-507A, and that the incremental cost of using this alternative instead of R-404A or R-507A is negligible (i.e. zero dollars) since, given that the composition of R-404A and R-407A are similar, the cost of the refrigerant is assumed to be the same. Therefore, no annual costs or savings are assumed" [8]. End-users of commercial refrigeration should experience minimal costs when phasing down HFCs. For A/C, foam, and refrigeration manufacturers nationwide, "89 small businesses could be subject to this rulemaking, although roughly 76% of small businesses subject to this rulemaking would be expected to incur compliance costs that are estimated to be less than 1% of annual sales" [7]. The number and types of businesses in Rhode Island that may be affected by Part 53 are listed below.

- 195 businesses identified in Rhode Island are classified as businesses that may use or create products containing aerosols. This includes pharmaceutical manufacturing, chemical manufacturing businesses, and other related aerosol businesses.
- 11 businesses identified in Rhode Island are classified as businesses that may use or create products containing foam. This includes polystyrene and urethane product manufacturers that have already transitioned away from using HFCs [5]. EPA estimates 50 foam manufacturers will be affected nationwide [7].
- 4,429 businesses identified in Rhode Island are classified as businesses that may use refrigeration equipment. These businesses include supermarkets, restaurants, convenience stores, hotels, florists, bars, and other businesses that commonly use refrigeration equipment. Businesses using retail food refrigeration units and systems are expected to have $0 in costs as a result of Part 53 [8]. Units can be updated with a drop-in refrigerant at no additional costs [5]. Businesses and end-users that use refrigeration equipment can continue using equipment without issue after the prohibition date.

- 0 businesses identified in Rhode Island are classified as manufacturers of household refrigeration equipment.
- 16 businesses identified in Rhode Island are classified as installing, repairing, or manufacturing A/C and warm air heating equipment and industrial refrigeration equipment. The 16 businesses identified in Rhode Island are found under NAICS Code 333415.

52.1

$2020 Annualized Net Costs to Phase-down HFCs in Rhode Island (Referencing national data using population as scale)			
Sector and Prohibition Dates	**$2020 Net Costs (Nationwide)[7,8]**	**$2020 Net Costs (Rhode Island)**	**Percent of Total Costs**
Air Conditioning - (January 2024)	**$69,260,877**	**$223,533**	**83.9%**
Centrifugal Chillers	$32,199,443	$103,921	39.0%
Positive Displacement Chillers	$37,061,433	$119,612	44.9%
Refrigeration - (January 2022 - January 2023)	**$6,985,958**	**$22,546**	**8.5%**
Food Processing and Dispensing	$459,444	$1,483	0.6%
Houshold Refrigerators and Freezers	$6,370,808	$20,561	7.7%
Cold Storage Warehouses	$155,706	$503	0.2%
Commercial Refrigeration - (January 2022)	**$4,053,190**	**$13,081**	**4.9%**
New Equipment	$2,026,595	$6,541	2.5%
Supermarket Systems	$0	$0	0%
Remote Condensing Units	$0	$0	0%
Stand-alone Equipment	$1,711,347	$5,523	2.1%
Vending Machines	$315,248	$1,017	0.4%
Retrofits	$0	$0	0%
Supermarket Systems	$0	$0	0%
Remote Condensing Units	$0	$0	0%
Stand-alone Equipment	$0	$0	0%
Vending Machines	$0	$0	0%
Foams - (January 2022)	**$2,221,559**	**$7,170**	**2.7%**
High-Pressure Two-Component Spray	$1,550,486	$5,004	1.9%
Low-Pressure Two-Component Spray	$664,494	$2,145	0.8%
One-Component Foam	$6,579	$21	0%
Flexible Polyurethane Foam	$0	$0	0%
Polystyrene Foam Product Manufacturing	$0	$0	0%
Household Fridge/Freezer Manufacturing	$0	$0	0%
Commercial and Industrial Refrigeration Equipment Manufacturing	$0	$0	0%
Urethane and Other Foam Product (except polystyrene) Manufacturing	$0	$0	0%
Aerosols - (January 2022)	**$0**	**$0**	**0%**
Annualized Net Costs	**$82,521,583**	**$266,330**	**100%**

Costs

Graphic 52.1. Nationwide costs are apportioned to Rhode Island by population. As of July 1, 2019, Rhode Island's population was 1,059,361 [9]. It is assumed that costs are directly proportional to population and Rhode Island is estimated to hold 0.323% of nationwide HFC costs. Rhode Island estimates the proposed HFC rule will cost $266,330 annually over the 25-year lifetime of the rule.

Total net costs to manufacturers and end-users in Rhode Island is estimated to be $6,658,250 over a 25-year period. Net costs in Rhode Island are estimated using ICF's two-part analysis of EPA's SNAP Rules 20 and 21. Net costs are calculated by including all initial costs, operational and maintenance costs, and any ongoing costs throughout the lifetime of the rule. Some manufacturers may see incremental savings as a result of Part 53 and any savings are subtracted from the total costs. ICF's analyses of SNAP Rules 20 and 21 estimate costs at a federal level; federal costs are scaled to Rhode Island by population. This has been a common approach among other states estimating costs to manufacturers and end-users as a result of an HFC phase-down.

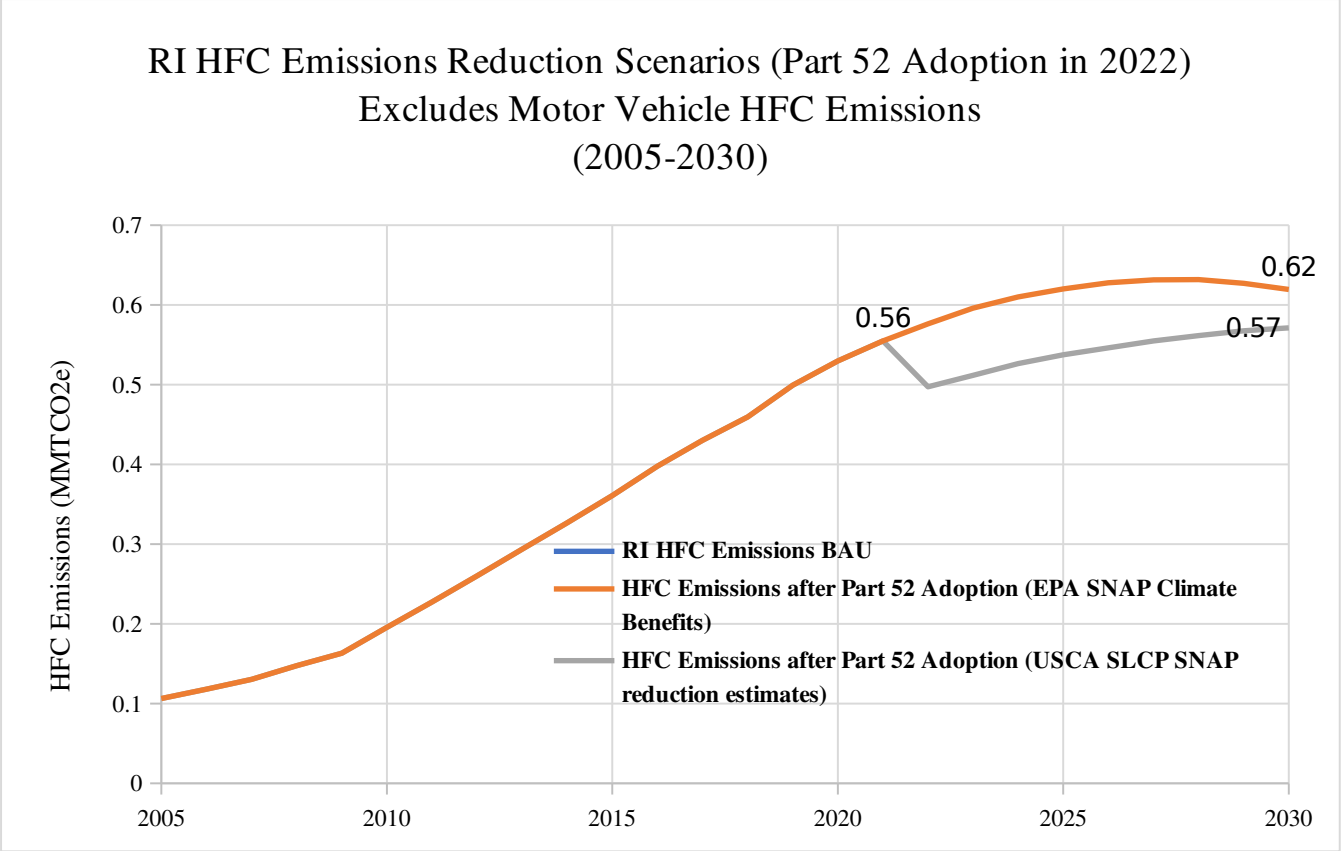
Some manufacturers are required to update production facilities as a result of this rule. Updates to production facilities may result in additional costs such as new equipment, an increase in refrigerant costs, and other costs such as reporting and recordkeeping. These costs may be offset by manufacturers increasing the product prices for consumers and end-users. Therefore, even without identifying any manufacturing sites in Rhode Island, all costs are included in this analysis because product manufacturers may pass costs to end-users at the point of sale.

- A 7% discount rate is used by EPA to calculate nationwide costs [7,8]. Nationwide costs are updated to 2020-dollars using the rate of inflation, 1.86%, between 2015 and 2020 [10].
- The lifetime of costs varies based on the lifetime of each sector's manufacturing equipment. For example, equipment is replaced on average 10 years for aerosols, 20 years for commercial and household refrigeration, and 25 years for foam manufacturing and chiller manufacturers [6,8].
- There will be no cost to polystyrene manufacturers, urethane manufacturers, and other foam manufacturers as a result of this rule. This is because the prohibition dates passed for polystyrene and urethane products prior to the SNAP Rules being vacated, therefore, it is assumed that polystyrene and urethane product manufacturers have transitioned away from using HFCs [5].
- Manufacturers and end-users of air conditioning chillers will account for over 80% of costs associated with the phase-down of HFCs in Rhode Island. Chillers manufacturers will see an increase in refrigerant prices and a one-time cost to convert production lines [7].
- Businesses such as supermarkets and convenience stores can continue using existing equipment under normal circumstances. Businesses are not required to update equipment after a prohibition date, but any new equipment installations or retrofits after a prohibition date must adhere to Part 53 guidelines.
- Some alternative refrigerants are more energy efficient than their predecessors. It thus comes as no surprise that HFC regulations enjoy wide support from both industry stakeholders and the environmental community [11].
- The Department is requesting information from any manufacturer of air conditioning, refrigeration, foams, or aerosols that operates in Rhode Island. Information is requested to further understand Part 53's impact on Rhode Island business.

Environmental Benefits

52.2

Graphic 52.2. Rhode Island's historical estimated HFC emissions are highlighted in green. RI's BAU HFC emissions are highlighted in blue. Historical HFC emissions (green), BAU emissions (blue), and SNAP reductions (grey) are estimated using USCA's SLCP Tool [2]. The orange line subtracts RI's portion of EPA's nationwide greenhouse gas reductions (RI's share of emissions reductions by population) from Rhode Island BAU emissions.



Greenhouse gas reductions are crucial to preserve Rhode Island's natural landscape, economy, and health because Rhode Island is at a high risk to experience the effects of climate change. Erosion, storms, and sea level rise threaten Rhode Island's shoreline resulting in property loss and an altered landscape, leading to damage that disrupts economic livelihood and can result in costly repairs. Residents also face hospitalizations and health complications from heat and respiratory related illnesses as a result of poor air quality. The proposed regulation aims to reduce the impacts of climate change, which would otherwise be expected to exacerbate or create environmental injustice. There are no known negative environmental justice impacts that have been identified regarding the proposed regulation. While air quality improvements may be subtle from Part 53, in conjunction with other ongoing air quality initiatives and legislation, Rhode Island will likely see noticeable air quality improvements and greenhouse gas reductions. Therefore, when determining the benefits of Part 53, unmonetized environmental benefits are an important consideration.

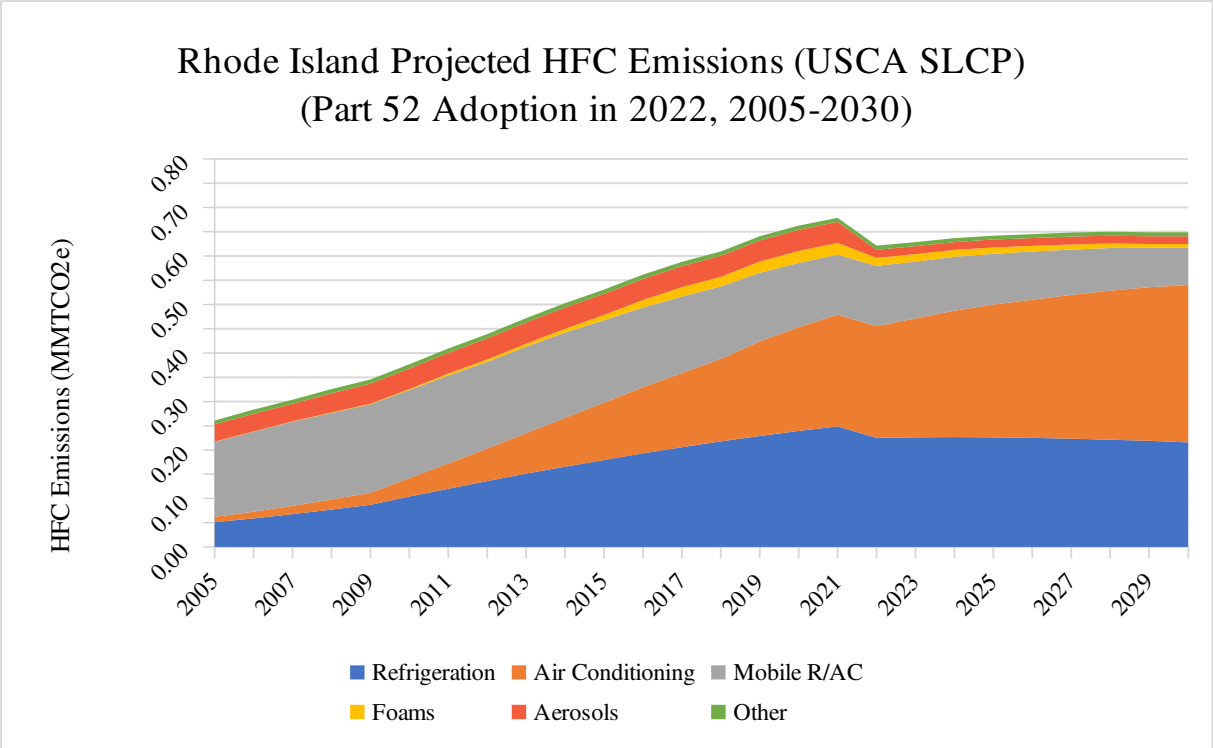
EPA's SNAP climate benefits report is the primary source used to estimate cumulative HFC reductions in Rhode Island from 2022 through 2046. The report estimates greenhouse gas reductions under the enforcement of SNAP Rules 20 and 21 on a national level [3]. Rhode Island assumes 0.323% of nationwide greenhouse gas reductions by using the same population-based approach to scale down benefits. Rhode Island shifts EPA's climate reductions seven years after the reported dates because the climate benefit model assumed regulatory action beginning in

2015. Cumulative greenhouse gas reductions in Rhode Island as a result of Part 53 are estimated at 774,000 metric tons of CO_2e from 2022 through 2046.

The Short-Lived Climate Pollutants ("SLCP") Tool created by the USCA is used by states and regions to estimate HFC emissions under a variety of different regulation scenarios. The tool also allows states to estimate business as usual ("BAU") HFC emissions between 2005 and 2030. Rhode Island BAU HFC emissions are the continued use of current HFCs with no changes or new regulations. Information is collected from states such as light duty vehicle populations, resident populations, and number of households and the data is multiplied by the HFC emissions per capita rates established by the California Air Resources Board ("CARB"). The per capita emissions rates created by CARB represents the average HFC emissions per person, per end-use and are derived from California's Gas Inventory [2]. Per capita HFC values are equal for all states using the SLCP Tool. The SLCP Tool estimates HFC emissions reductions of about 140,000 metric tons of CO_2e in 2030 compared to BAU [2].

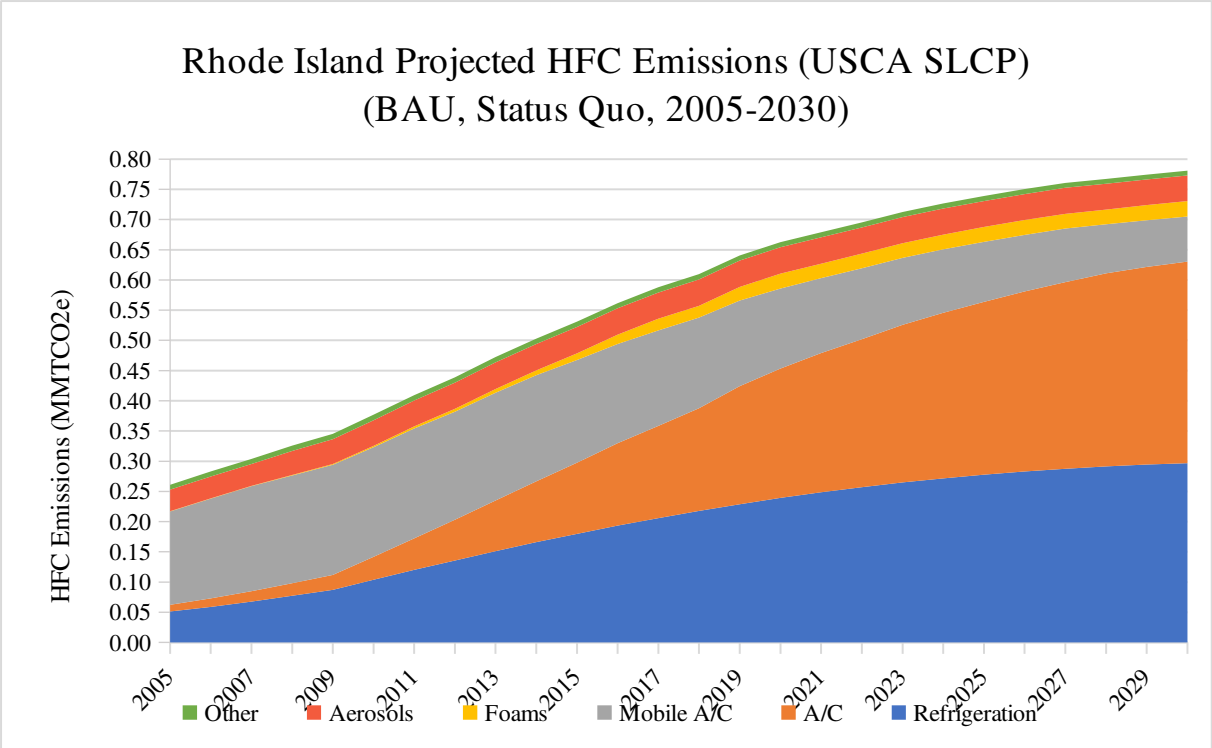
There are two important variables to this regulation that influence greenhouse gas reductions under Part 53. First, the Department understands the proper disposal and recycling of HFC products and refrigerants is essential to see significant greenhouse gas reductions under Part 53. The proper disposal of a refrigerated appliance and incentives for disposal vary from region to region, but the improper disposal of equipment causes the release of hazardous pollutants. Equipment leakage of HFCs is another source of avoidable greenhouse gas pollution and leaks are currently regulated by the EPA. A strong prevention system in place that captures refrigerants at the end of their useful life and raises preventative measures to curb leakage will aid Part 53 by facilitating further greenhouse gas reductions. Conversely, a weak system in place for capturing refrigerants may limit any greenhouse gas reductions under Part 53.

Another variable that will determine real greenhouse gas reductions are the refrigerants and products that manufacturers use in place of prohibited HFCs. Refrigerants that have no/low-GWP such as isobutane, carbon dioxide, and ammonia could yield the greatest greenhouse gas reductions. Some of these alternatives are not affordable or available in every sector, but in certain instances it can be a practical choice.



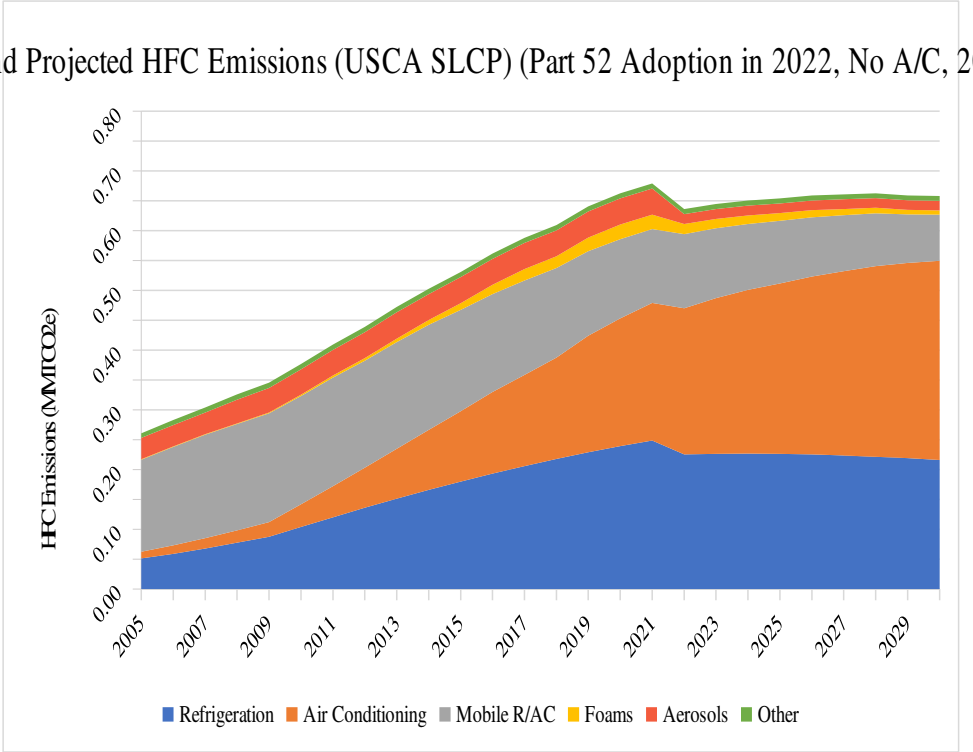
Graphic 52.3. HFC BAU emissions broken out by sector (2005-2030) [2]. HFCs from motor vehicles are included in this graph. All data collected from USCA SLCP Tool.

Graphic 52.4. HFC emissions broken out by sector after Part 52 regulation in 2022 (2005-2030) [2]. HFCs from motor vehicles are included in this graph. All data collected from USCA SLCP Tool.



Alternatives to the Proposed Regulation

One alternative to the proposed regulation is to allow certain sectors to continue manufacturing products containing HFCs. Allowing the air conditioning sector to continue manufacturing under current operating procedures would significantly reduce costs associated with Part 53 in Rhode Island because chiller manufacturers account for over 80% of annualized costs. The decision to allow air conditioning manufacturers to continue using high-GWP HFCs would result in a cost savings of $2,011,797 through 2030. The choice to exclude air conditioning manufacturers from this regulation would increase GHG emissions by 114,000 metric tons of CO_2e through 2030.



This alternative would provide savings to end-users required to purchase chillers for large buildings and businesses, but would also weaken greenhouse gas reductions. The graph below provides a detailed view of greenhouse gas emissions through 2030 if air conditioning manufacturers are not subject to the proposed regulation.

Other alternatives to the proposed regulation include pushing back effective dates. If effective dates are changed, both costs and benefits would be moved into the future. It is unlikely that a change in an effective date would provide additional costs or benefits in Rhode Island.

The Department is not currently considering any changes to the proposed regulation to maintain conformity with other states proposing similar action to phase-down HFCs. Conformity amongst states allows regulated entities to comply without unnecessary confusion. Proposing regulations similar to other states also helps reduce costs and save time for businesses.

Recommendation

The Department recommends that Part 53 goes into effect as outlined in the final rule. Total estimated costs of Part 53 are $6,658,250 over 25 years or $266,330 annually. An annual cost of $266,330 accounts for about 0.00043% of Rhode Island's 2019 GDP ($61,883,000,000) [12]. The phase-down of HFCs will reduce greenhouse gas emissions by 774,000 metric tons of CO_2e over 25 years. Cumulative greenhouse gas reductions are necessary to meet Rhode Island's ambitious climate goals. The result of the analysis determines that Rhode Island businesses will

not be significantly impacted by the rule and greenhouse gas emissions reductions will provide significant benefits to Rhode Island.

References

[1] "Reducing Hydrofluorocarbon (HFC) Use and Emissions in the Federal Sector through SNAP." United State Environmental Protection Agency. https://www.epa.gov/snap/reducing-hydrofluorocarbon. Website accessed 30 October 2020.

[2] "Short Lived Climate Pollutants Tool." United States Climate Alliance. Tool accessed 13 December 2020.

[3] "Climate Benefits of the SNAP Program Status Change Rule." U.S. Environmental Protection Agency, September 2016.

[4] "Court Strikes Down U.S. Restrictions on HFCs." Chemical and Engineering News. https://cen.acs.org/articles. Website accessed 30 October 2020.

[5] "Economic Impact Analysis for Part B.I. Hydrofluorocarbons in Aerosol, Propellants, Chillers, Foam, and Stationary Refrigeration End-Uses (HFC Rule)." Colorado Air Quality Control Commission, February 2020.

[6] "Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression." ICF International, September 2016.

[7] "Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression." ICF International, September 2016.

[8] "Revised Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives." ICF International, July 2015.

[9] U.S. Census Bureau. https://www.census.gov/popclock/. Website accessed on October 19th, 2020.

[10] "CPI Inflation Calculator." https://www.officialdata.org/us/inflation/2015. Website accessed on 19 October 2020.

[11] "Economic Impacts of U.S. Ratification of the Kigali Amendment." http://www.ahrinet.org/App_Content. Interindustry Forecasting at the University of Maryland (INFORUM) and JMS Consulting, April 2018.

[12] "Regional Data: GDP and Personal Income." https://apps.bea.gov/iTable. United States Bureau of Economic Analysis (BEA). Website accessed 18 February 2021.

Outside Analysis

The outside analysis section is reserved for references heavily consulted during Rhode Island's HFC economic analysis.

"Revised Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives." ICF International, July 2015.

Prepared for: United States Environmental Protection Agency

Table 2: Estimated Compliance Cost of the Regulatory Changes using a 7% Discount Rate

Sector	Estimated Number of Businesses Potentially Impacted by the Rule	Higher			Lower		
		Annualized Upfront Costs[a]	Annual Savings[b]	Annualized Upfront Cost and Annual Savings[d]	Annualized Upfront Costs[a]	Annual Savings[b]	Annualized Upfront Cost and Annual Savings[b]
Motor Vehicle Air Conditioning - Exports[e]	**240**	**$8,760,000**	**$0**	$8,760,000	**$0**	**$0**	**$0**
Aerosols	**<10**	**$1,040,000**	**($5,250,000)**	$0[d]	**$250,000**	**($5,250,000)**	**($5,000,000)**
Foams	**120**	**$38,990,000**	**($14,090,000)**	$32,120,000	**$27,200,000**	**($14,090,000)**	**$13,110,000**
Polystyrene foam product manufacturing	<10	$27,490,000	$0	$27,490,000	$17,640,000	$0	$17,640,000
Household refrigerator and freezer manufacturing	<10	$3,090,000	($6,600,000)	$0[d]	$2,580,000	($6,600,000)	($4,020,000)
Commercial and industrial refrigeration equipment manufacturing	50	$3,760,000	($7,480,000)	$0[d]	$3,130,000	($7,480,000)	($4,350,000)
Urethane and other foam product (except polystyrene) manufacturing	60	$4,640,000	($10,000)	$4,630,000	$3,850,000	($10,000)	$3,840,000
Commercial Refrigeration	**644,500[c]**	**$1,800,000**	**$0**	$1,800,000	**$570,000**	**$0**	**$570,000**
New equipment	**474,900**	**$1,800,000**	**$0**	$1,800,000	**$570,000**	**$0**	**$570,000**
Supermarket systems	29,300	$0	$0	$0	$0	$0	$0
Remote condensing units	445,500	$0	$0	$0	$0	$0	$0
Stand-alone equipment	30	$1,520,000	$0	$1,520,000	$450,000	$0	$450,000
Vending machines	10	$280,000	$0	$280,000	$110,000	$0	$110,000
Retrofits	**169,600**	**$0**	**$0**	$0	**$0**	**$0**	**$0**
Supermarket systems	10,500	$0	$0	$0	$0	$0	$0
Remote condensing units	159,100	$0	$0	$0	$0	$0	$0
Stand-alone equipment	0	$0	$0	$0	$0	$0	$0
Vending machines	0	$0	$0	$0	$0	$0	$0
ALL SECTORS	**644,800**	**$50,590,000**	**($19,340,000)**	**$42,690,000**	**$28,030,000**	**($19,340,000)**	**$8,680,000**

Totals may not sum due to independent rounding.
[a] Includes annualized upfront capital costs as well as recurring annual costs.
[b] Savings are shown as negative values; costs are shown as positive values.
[c] It is possible that some businesses will be affected for multiple types of equipment, resulting in a lower total number of discrete businesses affected by the rule. However, since it is not known how many businesses would be affected by multiple equipment types, the total maximum number of businesses that could be affected is shown.
[d] Annualized upfront costs and annual savings have been rounded to zero rather than a negative combined annualized upfront costs and annual savings for the higher estimate. The rounding assumes that at least some portion of the industry would have made the change even in the absence of the regulation.
[e] Costs are estimated on a per vehicle basis and are assumed for a subset of the export market only.

"Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression." ICF International, September 2016.

Prepared for: United State Environmental Protection Agency

Table 2: Estimated Compliance Cost of the Regulatory Changes using a 7% Discount Rate

Sector	Estimated Number of Businesses Impacted by the Rule[a]	Higher Annualized Costs[b]	Lower Annualized Costs[b]
Refrigeration and Air Conditioning	**50**	**$69,878,000**	**$58,288,000**
Centrifugal Chillers	<10	$29,365,000	$25,892,000
Positive Displacement Chillers		$33,799,000	$27,039,000
Food Processing and Dispending Equipment	20	$419,000	$335,000
Household Refrigerators and Freezers	20	$5,810,000	$4,678,000
Cold Storage Warehouses	<10	$142,000	$69,000
Foams	**50**	**$2,026,000**	**$1,452,000**
High-Pressure Two-Component Spray Foam	40	$1,414,000	$943,000
Low-Pressure Two-Component Spray Foam	<10	$606,000	$505,000
One-Component Foam	<10	$6,000	$4,000
Flexible Polyurethane Foam	0	$0	$0
Fire Suppression	**0**	**$0**	**$0**
Total Flooding	0	$0	$0
ALL SECTORS	**100**	**$71,904,000**	**$59,739,000**

Totals may not sum due to independent rounding.

[a] It is possible that some businesses will be affected for multiple types of equipment, resulting in a lower total number of discrete businesses affected by the rule. However, since it is not known how many businesses would be affected by multiple equipment types, the total maximum number of businesses that could be affected is shown.

[b] Includes annualized upfront capital costs as well as recurring annual costs.

"Climate Benefits of the SNAP Program Status Change Rule." U.S. Environmental Protection Agency: Stratospheric Protection Division, Office of Atmospheric Programs, Office of Air Radiation, September 2016.

Climate Benefits

As shown in Table 2, implementation of the Status Change Rule is estimated to reduce net HFC emissions in 2025 by 6 to 7 $MMTCO_2eq$ and 10 to 11 $MMTCO_2eq$ in 2030, relative to the baseline. Note that this baseline assumes some reductions due to the July 2015 Climate Benefits of the SNAP Program Status Change Rule [EPA-HQ-OAR-2014-0198-0239]. For this reason the projected trend of HFC emissions from modeling performed in 2014 for that earlier rule is also shown for comparison. The most likely transition scenario was developed based on EPA experience in the sectors and knowledge of the available, SNAP-acceptable alternatives that are currently being tested and implemented.

Table 2. Emissions Profile of Affected Sectors/Applications in Transition Scenarios and Baseline

Year	2015	2020	2025	2030	2035	2040	2045	2050
Pre-2014 emissions trend	**215**	**285**	**373**	**420**	**463**	**500**	**531**	**556**
United States baseline including July 2015 rule	**212**	**255**	**311**	**324**	**351**	**379**	**403**	**422**
Lower Scenario Emissions	**212**	**253**	**306**	**314**	**337**	**361**	**380**	**395**
Lower Scenario Percent Reduction	0%	-1%	-2%	-3%	-4%	-5%	-6%	-6%
Most Likely Scenario Emissions	**212**	**252**	**305**	**313**	**335**	**359**	**379**	**394**
Most Likely Scenario Percent Reduction	0%	-1%	-2%	-3%	-4%	-5%	-6%	-7%
Higher Scenario Emissions	**212**	**252**	**304**	**313**	**334**	**358**	**377**	**393**
Higher Scenario Percent Reduction	0%	-1%	-2%	-3%	-5%	-6%	-6%	-7%

[9] GWPs used are direct, 100-year values from 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 [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Where GWPs are not available from that source, values are taken from the literature as referenced in the SNAP decisions first listing such substances as acceptable.

[10] *Global Mitigation of Non-CO_2 Greenhouse Gases: 2010–2030* (EPA Report 430-R-13-011, September 2013)