Climate Benefits of the SNAP Program Status Change Rule

March 2016

U.S. Environmental Protection Agency
Stratospheric Protection Division
Office of Atmospheric Programs
Office of Air and Radiation

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Executive Summary

The U.S. Environmental Protection Agency (EPA) is issuing a proposed rule that would change the status of certain alternatives[1] previously found acceptable under the Significant New Alternatives Policy (SNAP) program and would find certain other alternatives acceptable. The EPA is modifying the listings from acceptable to unacceptable for certain hydrofluorocarbons (HFCs) and HFC blends in foam blowing, refrigeration and air conditioning, and fire suppression end-uses where other alternatives are available or potentially available that pose overall lower risk to human health and the environment. The emissions avoided associated with the proposed rule are estimated to be 6 to 7 million metric tons (i.e., teragrams) of carbon dioxide equivalent ($MMTCO_2eq$) in 2025 and 10 to 11 $MMTCO_2eq$ in 2030.

Background

In June 2013, the President announced the Climate Action Plan (CAP) stating that "while no single step can reverse the effects of climate change, we have a moral obligation to future generations to leave them a planet that is not polluted and damaged. Through steady, responsible action to cut carbon pollution, we can protect our children's health and begin to slow the effects of climate change so that we leave behind a cleaner, more stable environment."[2] Among the many actions called for, the CAP outlined a set of measures to address hydrofluorocarbons (HFCs). In the United States, emissions of HFCs are expected to double from current levels of 1.5 percent of greenhouse gas (GHG) emissions to 3 percent by 2020 and nearly triple by 2030.[3] HFCs are rapidly accumulating in the atmosphere. For example, the atmospheric concentration of HFC-134a, the most abundant HFC, has increased by about 10% per year from 2006 to 2012, and the concentrations of HFC-143a and HFC-125 rose over 13% and 16% per year, respectively, from 2007 to 2011.[4,5]

The President directed the executive branch of the United States government to lead through both international diplomacy and domestic action in addressing HFCs. In particular, he directed the EPA to use its authority through the Significant New Alternatives Policy (SNAP) Program to "encourage private sector investment in low-emissions technology by identifying and approving climate-friendly chemicals while prohibiting certain uses of the most harmful chemical alternatives."[6]

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[1] For purposes of this document, the terms "substitutes" and "alternatives" are used interchangeably.
[2] The President's Climate Action Plan, Executive Office of the President, June 2013. Available at http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf
[3] Ibid.
[4] Montzka, S.A.: HFCs in the Atmosphere: Concentrations, Emissions and Impacts, ASHRAE/NIST Conference 2012
[5] NOAA data at ftp://ftp.cmdl.noaa.gov/hats/hfcs/
[6] The President's Climate Action Plan, Executive Office of the President, June 2013, page 10. Available at http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

Under the authority of Section 612 of the Clean Air Act (CAA), the EPA is both expanding the list of acceptable alternatives and also changing the status of certain alternatives from acceptable to unacceptable. The analysis presented here concerns the EPA's proposed action to modify the listings from acceptable to unacceptable for certain HFCs and HFC blends foam blowing, refrigeration and air conditioning, and fire suppression end-uses where other alternatives are available or potentially available that pose less overall risk to human health and the environment. The agency considers the intersection between the specific HFC or HFC blend and the particular end-use. In this action, the EPA is not listing any specific HFCs as unacceptable across all sectors and end-uses, nor is the EPA determining, for any specific sector, that no HFCs are acceptable substitutes. The EPA recognizes that both fluorinated substitutes (e.g., HFCs, hydrofluoroolefins (HFOs)) and non-fluorinated substitutes (e.g., hydrocarbons (HCs), carbon dioxide (CO_2)) can be used. Thus, consistent with CAA Section 612, the existing SNAP regulations, and historical practice under the SNAP program, the EPA has considered the intersection among each substitute being evaluated, the particular end-use, the SNAP criteria for evaluation, and the current suite of other available and potentially available substitutes in each particular end use.

Analysis of Climate Benefits

The EPA's SNAP Program, pursuant to CAA Section 612, evaluates whether substitutes are safer overall for human health and the environment than other available substitutes. For each end-use, SNAP lists substitutes as either acceptable, acceptable subject to use conditions, acceptable subject to narrowed use limits, or unacceptable. SNAP's evaluation of the overall safety of a substitute considers its toxicity, flammability, ozone depletion potential, and global warming potential (GWP), among other factors. The CAP directs the EPA to use the SNAP Program to encourage private sector investment in low-emissions technology by identifying and approving climate-friendly chemicals while prohibiting certain uses of the most harmful chemical alternatives. To this end, SNAP's Status Change Rule changes the listing of certain alternatives in the foams, refrigeration and air conditioning, and fire suppression sectors from acceptable to unacceptable, from acceptable to acceptable subject to use conditions, or from acceptable to acceptable subject to narrowed use limits. The specific listing changes for each end-use can be found in Appendix A.

Methodology

To estimate the climate benefits of the rule, the EPA compared a business-as-usual (BAU) forecast of HFC emissions with those derived under various scenarios conforming to the rule. In developing both the BAU forecast and the scenarios, the EPA used its Vintaging Model,[7] an emission estimation tool used to derive HFC emission inventories for reporting to the Intergovernmental Panel on Climate Change (IPCC) as part of the United States' obligations under the United Nations Framework Convention on Climate Change (UNFCCC).

[7] VM IO file_v4.4_12.16.09_GER_IMAC_Domestic_2013 Options Update_AR4_11-21-13.xlsm

The Vintaging Model was developed as a tool for estimating the annual chemical emissions from industrial sectors that have historically used ozone depleting substances (ODS) in their products. Under the terms of *The Montreal Protocol on Substances that Deplete the Ozone Layer* and the Clean Air Act, the production and import of ODS have been greatly reduced, motivating these industrial sectors to transition to more ozone-friendly chemicals. As these industries have moved toward ODS alternatives, including HFCs, the Vintaging Model has evolved into a tool for estimating the rise in emissions of these alternatives and the decline of ODS emissions.

The Vintaging Model estimates emissions from five ODS and ODS-substitute sectors: air-conditioning and refrigeration, foams, aerosols, solvents, and fire suppression. Within these sectors, there are 60 independently modeled end-uses. The model requires information on the market growth for each of the end-uses, a history of the market transition from ODS to alternatives, and the characteristics of each end-use such as market size or charge sizes and loss rates. As ODS are phased out, a percentage of the market share originally filled by the ODS is allocated to each of its substitutes.

The model, named for its method of tracking the emissions of annual "vintages" of new equipment that enter into service, is a "bottom-up" model. It models the emissions of ODS and ODS substitutes based on estimates of the quantity of equipment or products sold, serviced, and retired each year; the amount of the chemical required to manufacture and/or maintain the equipment; and the amount emitted during specific time periods. The Vintaging Model makes use of this market information to build an inventory of the in-use stocks of the equipment and ODS and ODS substitute(s) in each of the end-uses. The simulation is considered to be a BAU baseline case, and it does not incorporate measures to reduce or eliminate the emissions of these gases other than those currently required by statute or regulation, or otherwise common in the industry. Emissions are estimated by applying annual leak rates, service emission rates, and disposal emission rates to each population of equipment. By aggregating the emission output from the different end-uses, the model produces estimates of total annual emissions of each chemical.

The Vintaging Model synthesizes data from a variety of sources, including data from the ODS Tracking System maintained by the EPA's Stratospheric Protection Division and information from submissions to the EPA under the SNAP program. Published sources include documents prepared by the United Nations Environment Programme (UNEP) Technical Options Committees, reports from the Alternative Fluorocarbons Environmental Acceptability Study (AFEAS), and conference proceedings from the International Conferences on Ozone Protection Technologies and Earth Technologies Forums. The EPA also coordinates extensively with numerous trade associations and individual companies. For example, the Alliance for Responsible Atmospheric Policy; the Air-Conditioning, Heating and Refrigeration Institute; the Association of Home Appliance Manufacturers; the American Automobile Manufacturers Association; and many of their member companies have provided valuable information over the years.

Because the Vintaging Model follows a bottom-up approach, scenarios of alternate pathways may be developed by changing transition timing, chemical(s) chosen, and emission patterns. For example, because the proposed rule does not allow certain HFCs to be used in certain end-uses, a scenario can be run in the Vintaging Model that assumes that a particular end-use transitions to an alternative that would remain acceptable. As a specific example, the scenario may assume that all household refrigerators utilizing HFC-134a switch to using R-600a. That scenario could vary in timing; for instance, by assuming this transition only begins in 2021 or by assuming it starts earlier, with some new refrigerators using R-600a in 2020 and the rest in 2021. Either such transition would be in compliance with the proposed rule assuming the transition is complete by the required date. Likewise, a scenario could assume transition of some refrigerators to R-450A instead of R-600a.

To analyze the potential emissions reductions of the proposed rule, scenarios were developed to estimate the rate at which transition away from higher-GWP HFCs would progress and what would be used in place of the higher-GWP HFCs. The analysis includes three scenarios for comparison: the most likely transition scenario; a higher, more aggressive transition scenario; and a lower, less aggressive transition scenario.[8] The scenarios differ in their assumptions on transition away from higher-GWP HFCs in four ways:

- earlier/later start of transitions,
- faster/slower rise to saturation,
- higher/lower saturation level, and
- higher/lower preference for lower GWPs in end-uses where the options analyzed vary.

The specific transitions assumed for each scenario are detailed in Table 1.

Table 1: Transition Scenarios

End-Use	Option	Lower Option Description	Most Likely Option Description	Higher Option Description
Centrifugal Chillers	HFC-134a to R-450A/R-513A[a]	Overnight transition to 90% in 2024	0% in 2019, Linear increase to 90% by 2024	0% in 2019, Linear increase to 45% by 2024
	HFC-134a to HFO-1234yf	NA	NA	Overnight transition to 45% in 2024
	HFC-245fa to Solstice™-1233zd(*E*) [a]	Overnight transition to 90% in 2024	0% in 2019, Linear increase to 90% by 2024	0% in 2017, Linear increase to 90% by 2024
Positive Displacement Chillers	R-410A/R-407C to R-450A/R-513A[a]	Overnight transition to 90% in 2024	0% in 2019, Linear increase to 90% by 2024	Linear 0% in 2019, Linear increase to 45% by 2024
	R-410A/R-407C to HFO-1234yf	NA	NA	Overnight transition to 45% in 2024
	HFC-134a to R-450A/R-513A[b]	NA	NA	NA
Cold Storage	R-404A/R-507A to R-407F	Overnight transition to 100% in 2023	0% in 2016, Linear increase to 50% by 2023	NA
	R-404A/R-507A to R-448A/R-449A	NA	0% in 2017, Linear increase to 50% by 2023	0% in 2017, Linear increase to 100% by 2023
Household Refrigerators and Freezers[c]	HFC-134a to R-450A/ R-513A	Overnight transition to 28% in 2021	Overnight transition to 14% in 2021	NA
	HFC-134a to R-600a	Overnight transition to 72% in 2021	Overnight transition to 86% in 2021	Overnight transition to 100% in 2021

[8] The scenarios analyzed here reflect possible transitions for compliance based on considerations of the market and activity towards lower-GWP solutions. A separate technical support document analyzes the cost of complying with the proposed rule.

End-Use	Option	Lower Option Description	Most Likely Option Description	Higher Option Description
Refrigerated Food Processing and Dispensing Equipment[d]	R-404A/R-507A to R-450A	NA	NA	NA
Polyurethane Rigid Spray Foam	(High-pressure, two-component) HFC-245fa and HFC-245fa/CO_2 to Solstice™-1233zd(*E*)	Overnight transition to 70% in 2020	0% in 2017, Linear increase to 70% by 2020	0% in 2015, Linear increase to 70% by 2020
	(Low-pressure, two-component) HFC-134a to HFO-1234ze(*E*)[e]	Overnight transition to 30% in 2021	0% in 2017, Linear increase to 30% by 2021	0% in 2015, Linear increase to 30% by 2021
Polyurethane Rigid One Component Foam	HFC-134a to HFO-1234ze(*E*)	Overnight transition to 100% in 2020	0% in 2017, Linear increase to 100% by 2020	0% in 2015, Linear increase to 100% by 2020
Flexible PU Foam: Slabstock Foam, Moulded Foam	Methylene Chloride to HCs[b]	NA	NA	NA
Flexible PU Foam: Integral Skin Foam	Methylene Chloride to HCs or CO_2[b]	NA	NA	NA
Polyolefin Foam	Methylene Chloride to HCs[b]	NA	NA	NA
Fire Suppression: Total Flooding	Perfluorocarbons (C_3F_8 and C_4F_{10}) to fluoroketone, CO_2, or water mist[b]	NA	NA	NA

[a] In the absence of this proposed rulemaking, by 2022 it is assumed that 10% of the positive displacement and centrifugal chillers markets will have already transitioned away from HFCs or would remain in HFCs under a narrowed use limit. This transition is not reflected in the baseline. This assumption is based on the current commercial availability of R-513A and Solstice™-1233zd(*E*) chillers as well as commitments from chiller manufacturers to introduce lower-GWP refrigerants in their product lines (https://www.whitehouse.gov/the-press-office/2015/10/15/fact-sheet-obama-administration-and-private-sector-leaders-announce)

[b] Zero penetration for original fluorinated or chlorinated compound currently assumed in Vintaging Model; Option not applied.

[c] This analysis assumes that in the lower option transition scenario small manufacturers of household refrigerators and freezers will transition from HFC-134a to either R-450A or R-513A and large business manufacturers will transition to isobutane (R-600a). The market penetration assumptions are based on the market share of new sales of household refrigerators and freezers by manufacturer developed for the *Draft 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* for this proposed rulemaking.

[d] Refrigerated food processing and dispensing equipment options were not analyzed, as this end-use was not modeled in this version of the Vintaging Model.

[e] The Vintaging Model spray foam end-use, which assumes the use of HFC-245fa and HFC-245fa co-blown with CO_2 blowing agents, does not disaggregate spray foam into high-pressure, two-component and low-pressure, two-component foam applications. Low-pressure, two-component foam primarily uses HFC-134a as the blowing agent; however, the model does not model any use of HFC-134a in the spray foam end-use. As a proxy, this analysis assumes a portion of the currently modeled blowing agent market (i.e., HFC-245fa and HFC-245fa/CO_2) represents low-pressure, two-component spray foam that would transition to HFO-1234ze. Because this portion of the market would actually be transitioning from HFC-134a, this analysis underestimates potential reductions from this transition by approximately 50% per year due to the GWP differential between HFC-245fa and HFC-245fa co-blown with CO_2 and HFC-134a (i.e., GWPs of 1,030, 550, and 1,430, respectively) and the assumed market share of these blowing agents (i.e., 33% HFC-245fa and 67% HFC-245fa co-blown with CO_2).

The U.S. emissions of HFCs from each end-use were estimated for these scenarios and the baseline scenario (i.e., BAU scenario without the rule) using the EPA's Vintaging Model, and the total GWP-weighted emissions were calculated in MMTCO$_2$eq as shown below in Table 2 and Figures 1 and 2.[9] The version of the Vintaging Model used is consistent with previous EPA analyses of non-CO$_2$ GHG abatement options.[10]

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$_2$eq and 10 to 11 MMTCO$_2$eq 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

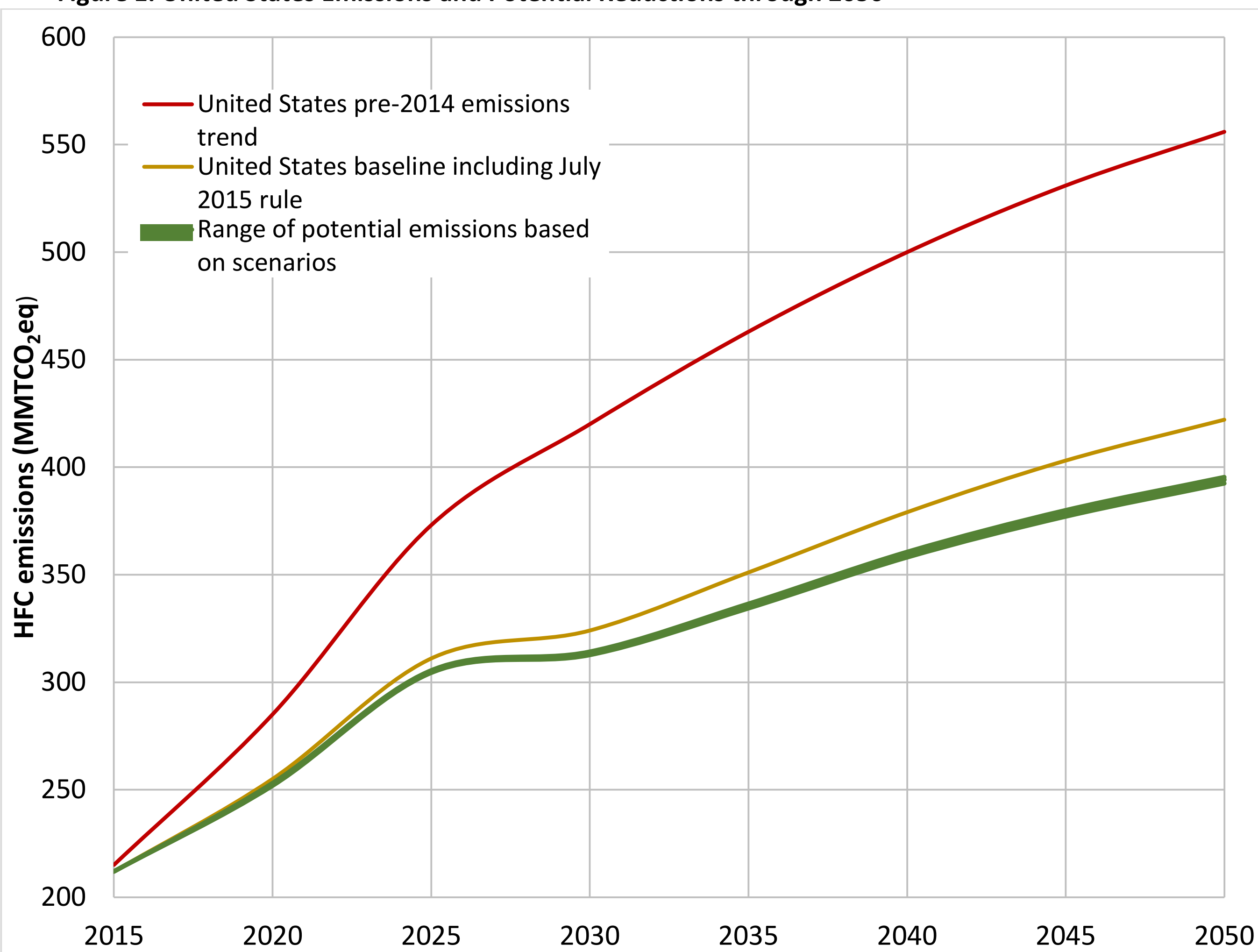
Year	2015	2020	2025	2030	2035	2040	2045	2050
Pre-2014 emissions trend	**215**	**285**	**373**	**420**	**463**	**500**	**531**	**556**
United States baseline including July 2015 rule	**212**	**255**	**311**	**324**	**351**	**379**	**403**	**422**
Lower Scenario Emissions	**212**	**253**	**306**	**314**	**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)

As seen in 2020, under the "most likely" transition scenario, emissions are projected to be reduced to 252 $MMTCO_2eq$ out of baseline emissions of 255 $MMTCO_2eq$ This represents a 1% reduction in emissions. After 2020, emission reductions steadily increase to 7% of baseline through 2050 with some growth in emissions due to continued market growth with all options fully implemented. Figure 1 below shows the potential range in emissions following the adoption of either the lower, most likely, or higher scenario. In addition, the emissions trend as calculated before the 2015 Status Change Rule is shown for comparison.

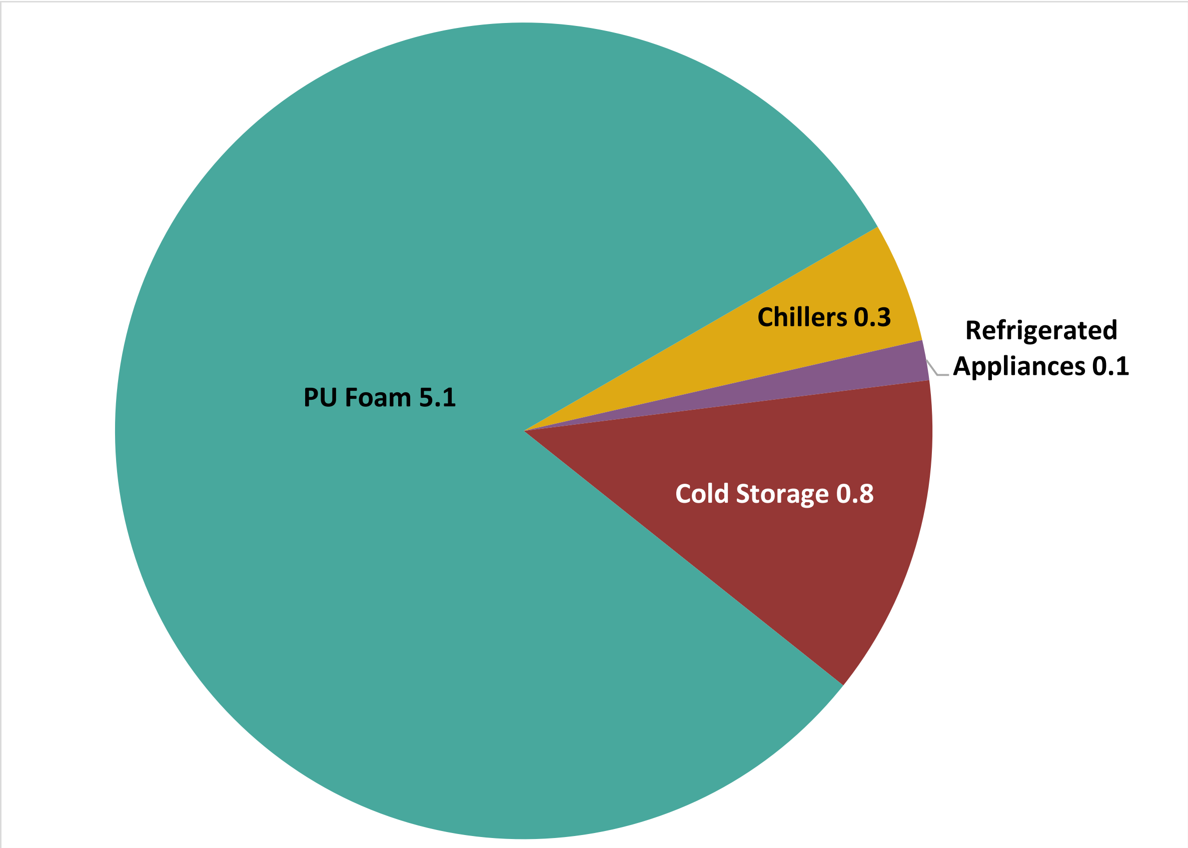
Figure 1. United States Emissions and Potential Reductions through 2050



The growth in emissions reductions can be seen in Figure 2. A short period of transition, during which the implementation of lower-GWP alternatives is increasing, is complete in all end-uses by 2023. After 2023, emission reductions steadily increase to 5% of baseline through 2050 with some growth in emissions due to continued market growth with all options fully implemented.

By 2023, most of the provisions in the proposed rule would be in effect. The differences in the three scenarios in 2025 and other years are significant mostly because of the lag between when alternatives are introduced in new equipment and foams, and when the emission reductions are realized. The later and slower transitions in the lower scenario have not yet accrued emissions reductions by 2025 to the extent of those accrued under the most likely scenario, which in turn has not yet reached the levels seen in the higher scenario.

Figure 2. Emissions Reductions by Sector in 2025 (MMTCO$_2$eq), Most Likely Scenario



Conclusion

The EPA anticipates that 6 to 7 MMTCO$_2$eq is the most likely estimate for the climate benefits associated with avoided emissions for the SNAP Status Change Rule in 2025 and 10 to 11 MMTCO$_2$eq in 2030. Three scenarios the EPA considered were developed and compared with a business-as-usual scenario. If the EPA were to consider the emissions reductions in 2035 or another later date, the climate benefits would be greater.

Appendix A

Proposed Listing Changes in the Status Change Rule by Sector

Option	Description of Regulatory Change
Refrigeration and Air-Conditioning	
1*	For new centrifugal chillers, list unacceptable FOR12A, FOR12B, HFC-134a, HFC-227ea, HFC-236fa, HFC-245fa, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R-438A, R-507A, RS-44 (2003 composition), and THR-03 in 2024.
2	For retrofit centrifugal chillers, list unacceptable FOR12A, FOR12B, HFC-134a, HFC-236fa, HFC-245fa, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-417A, R-417C, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R-438A, R-507A, RS-44 (2003 composition), and THR-03 in 2024.
3*	For new positive displacement chillers, list unacceptable FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 composition), SP34E, and THR-03 in 2024.
4	For retrofit positive displacement chillers, list unacceptable FOR12A, FOR12B, HFC-134a, KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-417A, R-417C, R-421A, R-422B, R-422C, R-422D, R-424A, R-427A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 composition), SP34E, and THR-03 in 2024.
5*	For new retail food refrigeration (refrigerated food processing and dispensing equipment), list unacceptable HFC-227ea, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-428A, R-434A, R-437A, R-438A, R-507A, and RS-44 (2003 formulation) in 2021.
6	For retrofit retail food refrigeration (refrigerated food processing and dispensing equipment), list unacceptable R-404A and R-507A one year after publication of a final rule.
7a*	For new household refrigerators and freezers, list unacceptable FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03 in 2021.
7b	For new household refrigerators and freezers, list unacceptable FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-428A, R-434A, R-437A, R-450A, R-438A, R-507A, R-513A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03 in 2021.
7c	For new household refrigerators and freezers, list unacceptable FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-450A, R-507A, R-513A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03 in 2025.
8	For retrofit household refrigerators and freezers, list unacceptable FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-427A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), and SP34E in 2021.
9a*	For new cold storage warehouses, list unacceptable HFC-227ea, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-438A, R-507A, and RS-44 (2003 composition) in 2021.

Option	Description of Regulatory Change
9b	For new cold storage warehouses, list unacceptable HFC-227ea, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-437A, R-438A, R-507A, and RS-44 (2003 composition) in 2021.
10	For retrofit cold storage warehouses, list unacceptable R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-438A, R-507A, and RS-44 (2003 composition) in 2021.
Foam Blowing	
11a	For rigid polyurethane high-pressure two-component spray foam, list unacceptable HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least 4% HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13% HFC-227ea and the remainder HFC-365mfc; and Formacel TI, in 2019, except as allowed under a narrowed use limit for military or space-and aeronautics–related applications.
11b*	For rigid polyurethane high-pressure two-component spray foam, list unacceptable HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least 4% HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13% HFC-227ea and the remainder HFC-365mfc; and Formacel TI in 2020, except as allowed under a narrowed use limit for military or space-and aeronautics–related applications.
12a	For rigid polyurethane low-pressure two-component spray foam, list unacceptable HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least 4% HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13% HFC-227ea and the remainder HFC-365mfc; and Formacel TI in 2020, except as allowed under a narrowed use limit for military or space-and aeronautics–related applications.
12b*	For rigid polyurethane low-pressure two-component spray foam, list unacceptable HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least 4% HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13% HFC-227ea and the remainder HFC-365mfc; and Formacel TI in 2021, except as allowed under a narrowed use limit for military or space-and aeronautics–related applications.
13a	For rigid polyurethane one-component foam sealants, list unacceptable HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least 4% HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13% HFC-227ea and the remainder HFC-365mfc; and Formacel TI in 2019, except as allowed under a narrowed use limit for military or space-and aeronautics–related applications.
13b*	For rigid polyurethane one-component foam sealants, list unacceptable HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least 4% HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13% HFC-227ea and the remainder HFC-365mfc; and Formacel TI in 2020, except as allowed under a narrowed use limit for military or space-and aeronautics–related applications.
14*	In flexible polyurethane foam, list methylene chloride as unacceptable 30 days after publication of a final rule.
15*	In integral skin polyurethane foam, list methylene chloride as unacceptable in 2017.
16*	In polyolefin foam, list methylene chloride as unacceptable in 2020.
Fire Suppression and Explosion Prevention	
17a*	For total flooding uses, list unacceptable perfluorocarbons (C_3F_8 and C_4F_{10}) one year after publication of a final rule.
17b	For total flooding uses, list unacceptable perfluorocarbons (C_3F_8 and C_4F_{10}) and SF_6 one year after publication of a final rule and list HFC-23 as acceptable, subject to narrowed use limits one year after publication of a final rule.
18	For streaming uses, list unacceptable perfluorocarbon (C_6F_{14}) one year after publication of a final rule.