This document is a prepublication version, signed by Administrator Gina McCarthy on 7/2/2015. We have taken steps to ensure the accuracy of this version, but it is not the official version.

The EPA Administrator, Gina McCarthy, signed the following document on 7/2/2015, and the Agency is submitting it for publication in the Federal Register (FR). While we have taken steps to ensure the accuracy of this Internet version of the document, it is not the official version. Please refer to the official version in a forthcoming FR publication, which will appear on the Government Printing Office's FDSys website (http://fdsys.gpo.gov/fdsys/search/home.action) and on Regulations.gov (www.regulations.gov) in Docket No. EPA-HQ-OAR-2014-0198. Once the official version of this document is published in the FR, this version will be removed from the Internet and replaced with a link to the official version.

6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 82

[EPA–HQ–OAR–2014–0198; FRL-9926-55-OAR]

RIN 2060-AS18

Protection of Stratospheric Ozone: Change of Listing Status for Certain Substitutes under the Significant New Alternatives Policy Program

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This action changes the status from acceptable to unacceptable; acceptable, subject to use conditions; or acceptable, subject to narrowed use limits for a number of substitutes, pursuant to the U.S. Environmental Protection Agency's Significant New Alternatives Policy program. We make these changes based on information showing that other substitutes are available for the same uses that pose lower risk overall to human health and the environment. Specifically, this action changes the listing status for certain hydrofluorocarbons in various end-uses in the aerosols, refrigeration and air conditioning, and foam blowing sectors. This action also changes the status from acceptable to unacceptable for certain hydrochlorofluorocarbons being phased out of production under the Montreal Protocol on Substances that Deplete the Ozone Layer and section 605(a) of the Clean Air Act.

DATES: This rule is effective on [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA–HQ–OAR–2014–0198. All documents in the docket are listed in the index. Although listed in the index, some information is not publicly available, *i.e.*, Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed in the electronic docket and will be publicly available only in hard copy form. Publicly available docket materials are available either electronically or in hard copy at the Air and Radiation Docket, EPA/DC, EPA West, Room 3334, 1301 Constitution Avenue, NW. Washington, D.C. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the Air and Radiation Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: Margaret Sheppard, Stratospheric Protection Division, Office of Atmospheric Programs, Mail Code 6205J, Environmental Protection Agency, 1200 Pennsylvania Avenue, NW. Washington, DC 20460; telephone number (202) 343–9163; fax number (202) 343–2338, e-mail address: *sheppard.margaret@epa.gov.* Notices and rulemakings under EPA's Significant New Alternatives Policy (SNAP) program are available on EPA's Stratospheric Ozone website at *www.epa.gov/ozone/snap/regs*.

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I. General Information

A. Executive Summary

Under section 612 of the Clean Air Act (CAA), EPA reviews substitutes within a comparative risk framework. More specifically, section 612 provides that EPA must prohibit the use of a substitute where EPA has determined that there are other available substitutes that pose less overall risk to human health and the environment. Thus, EPA's Significant New Alternatives Policy (SNAP) program, which implements section 612, does not provide a static list of alternatives but instead evolves the list as the EPA makes decisions informed by our overall

understanding of the environmental and human health impacts as well as our current knowledge about available substitutes. In the more than twenty years since the initial SNAP rule was promulgated, EPA has modified the SNAP lists many times, most often by expanding the list of acceptable substitutes, but in some cases by prohibiting the use of substitutes previously listed as acceptable. Where EPA is determining whether to add a new substitute to the list, EPA compares the risk posed by that new substitute to the risks posed by other alternatives on the list and determines whether that specific new substitute poses more risk than already-listed alternatives for the same use. As the lists have expanded, EPA has not reviewed the lists in a broader manner to determine whether substitutes added to the lists early in the program pose more risk than substitutes that have more recently been added. EPA is now beginning this process.

Global warming potential (GWP) is one of several criteria EPA considers in the overall evaluation of the alternatives under the SNAP program. The President's June 2013 Climate Action Plan (CAP) states that, "to reduce emissions of HFCs, the United States can and will lead both through international diplomacy as well as domestic actions." Furthermore, the CAP states that EPA will "use its authority through the Significant New Alternatives Policy 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." In our first effort to take a broader look at the SNAP lists, we have focused on those listed substitutes that have a high GWP relative to other alternatives in specific end-uses. In determining whether to change the status of these substitutes for particular end-uses, we performed a full comparative risk analysis, based on our criteria for review, with other available alternatives also listed as acceptable for these end-uses.

In an August 6, 2014, *Federal Register* Notice of Proposed Rulemaking (79 FR 46,126), the U.S. Environmental Protection Agency (hereafter referred to as EPA or the Agency) proposed to change the status of certain substitutes[1] that at that time were listed as acceptable under the SNAP program. After reviewing public comments and available information, in today's action, EPA is modifying the listings from acceptable to unacceptable; acceptable, subject to use conditions; or acceptable, subject to narrowed use limits for certain hydrofluorocarbons (HFCs) and HFC blends in various end-uses in the aerosols, foam blowing, and refrigeration and air conditioning sectors where other alternatives are available or potentially available that pose lower overall risk to human health and the environment. Per the guiding principles of the SNAP program, this action does not specify that any HFCs are unacceptable across all sectors and end-uses. Instead, in all cases, EPA considered the intersection between the specific HFC or HFC blend and the particular end-use and the availability of substitutes for those particular end-uses. EPA is also not specifying that, for any sector, the only acceptable substitutes are HFC-free. EPA recognizes that both fluorinated (e.g., HFCs, hydrofluoroolefins (HFOs)) and non-fluorinated (e.g., hydrocarbons (HCs) and carbon dioxide (CO_2)) substitutes may pose lower overall risk to human health and the environment, depending on the particular use. Instead, consistent with CAA section 612 as we have historically interpreted it under the SNAP program, EPA is making these modifications based on our evaluation of the substitutes addressed in this action using the SNAP criteria for evaluation and considering the current suite of other available and potentially available substitutes.

On that basis, EPA is modifying the following listings by sector and end-use as of the

[1] The terms "substitutes" and "alternatives" are used interchangeably.

dates indicated. EPA will continue to monitor the development and deployment of other alternatives as well as their uptake by industries affected by today's action. If EPA receives new information indicating that other alternatives will not be available by the change of status dates specified, EPA may propose further action to adjust the relevant dates.

1) Aerosols

- EPA is listing HFC-125 as unacceptable for use as an aerosol propellant as of January 1, 2016.
- EPA is listing HFC-134a, HFC-227ea, and blends of HFC-134a and HFC-227ea as unacceptable for use as aerosol propellants as of [**insert date one year after publication in the Federal Register**], except for those uses specifically listed as acceptable, subject to use conditions.
- EPA is listing HFC-227ea and blends of HFC-134a and HFC-227ea as acceptable, subject to use conditions, as of [**insert date one year after publication in the Federal Register**], for use in metered dose inhalers (MDIs) approved by the U.S. Food and Drug Administration (FDA).
- EPA is listing HFC-134a as acceptable, subject to use conditions, as of [**insert date one year after publication in the Federal Register**], until January 1, 2018, for the following specific uses:
    - products for which new formulations require federal governmental review, including: EPA pesticide registration, military or space agency specifications, or FDA approval (aside from MDIs); and
    - products for smoke detector functionality testing.
- EPA is listing HFC-134a as acceptable, subject to use conditions, as of [**insert date one**

year after publication in the Federal Register], for the following specific uses:

- cleaning products for removal of grease, flux and other soils from electrical equipment or electronics;
- refrigerant flushes;
- products for sensitivity testing of smoke detectors;
- sprays containing corrosion preventive compounds used in the maintenance of aircraft, electrical equipment or electronics, or military equipment;
- duster sprays specifically for removal of dust from photographic negatives, semiconductor chips, and specimens under electron microscopes or for use on energized electrical equipment;
- adhesives and sealants in large canisters;
- lubricants and freeze sprays for electrical equipment or electronics;
- sprays for aircraft maintenance;
- pesticides for use near electrical wires or in aircraft, in total release insecticide foggers, or in certified organic use pesticides for which EPA has specifically disallowed all other lower-GWP propellants;
- mold release agents and mold cleaners;
- lubricants and cleaners for spinnerettes for synthetic fabrics;
- document preservation sprays;
- MDIs approved by the FDA for medical purposes;
- wound care sprays;
- topical coolant sprays for pain relief; and
- products for removing bandage adhesives from skin.

2) Refrigeration and air conditioning sector; Motor vehicle air conditioning (MVAC) systems for newly manufactured light-duty vehicles

EPA is listing HFC-134a as unacceptable for newly manufactured light-duty motor vehicles beginning in Model Year (MY) 2021 except as allowed under a narrowed use limit for use in newly manufactured light-duty vehicles destined for use in countries that do not have infrastructure in place for servicing with other acceptable refrigerants. This narrowed use limit will be in place through MY 2025. Beginning in MY 2026, HFC-134a will be unacceptable for use in all newly manufactured light-duty vehicles. EPA is also listing the use of certain refrigerant blends as unacceptable in newly manufactured light-duty motor vehicles starting with MY 2017.

3) Refrigeration and air conditioning sector; Retail food refrigeration and vending machines

EPA is listing a number of refrigerants as unacceptable in a number of retail food refrigeration categories and in the vending machines end-use, as follows:

- Retrofitted supermarket systems: R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A as of [**insert date one year after publication in the Federal Register**]
- New supermarket systems: HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A as of January 1, 2017
- Retrofitted remote condensing units: R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A as of [**insert date one year after publication in the Federal Register**]
- New remote condensing units: HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C,

R-422D, R-428A, R-434A, and R-507A as of January 1, 2018

- Retrofitted vending machines: R-404A and R-507A as of [**insert date one year after publication in the Federal Register**]
- New vending machines: FOR12A, FOR12B, HFC-134a, KDD6, 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-426A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), and SP34E as of January 1, 2019
- Retrofitted stand-alone retail food refrigeration equipment: R-404A and R-507A as of [**insert date one year after publication in the Federal Register**]
- New stand-alone medium-temperature units with a compressor capacity below 2,200 Btu/hr and not containing a flooded evaporator: FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03 as of January 1, 2019
- New stand-alone medium-temperature units with a compressor capacity equal to or greater than 2,200 Btu/hr and stand-alone medium-temperature units containing a flooded evaporator: FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03 as of January 1, 2020
- New stand-alone low-temperature units: 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) as of January 1, 2020

We are also providing clarification on several questions identified during the comment period. Specifically, we are providing clarification of the terms we are using for the various end-use categories covered by this rule, including "supermarket systems," "remote condensing units," and "stand-alone equipment." We are also providing clarification on certain types of equipment that do not fall within the categories and end-uses covered by this rule, including blast chillers, certain ice makers, very-low temperature refrigeration equipment, and equipment that dispenses chilled beverage or food (e.g., soft-serve ice cream) via a nozzle. Finally, we are also providing clarification regarding our use of the terms "new" and "retrofit" and how those terms relate to service of existing equipment.

4) Foams

EPA is listing a number of foam blowing agents unacceptable in each foams end-use excluding rigid PU spray foam, except as allowed under a narrowed use limit for military or space- and aeronautics-related applications. For military or space- and aeronautics-related applications, we are changing the listing status to acceptable, subject to a narrowed use limit, as of the status change date for the remainder of each end-use (January 1 of 2017, 2019, 2020 or 2021) and then to unacceptable as of January 1, 2022. We are not taking final action on rigid PU spray foam at this time. The unacceptable listing for all other end-uses is as follows:

- Rigid polyurethane (PU) appliance foam: HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6, as of January 1, 2020
- Rigid PU commercial refrigeration and sandwich panels: HFC-134a, HFC-245fa, HFC-

365mfc, and blends thereof; Formacel TI, and Formacel Z-6, as of January 1, 2020

- Rigid PU slabstock and other: HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6, as of January 1, 2019
- Rigid PU and polyisocyanurate laminated boardstock: HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; as of January 1, 2017
- Flexible PU: HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; as of January 1, 2017
- Integral skin PU: HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6, as of January 1, 2017
- Polystyrene extruded sheet: HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6, as of January 1, 2017
- Polystyrene extruded boardstock and billet (XPS): HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel B, and Formacel Z-6, as of January 1, 2021
- Polyolefin: HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6, as of January 1, 2020
- Phenolic insulation board and bunstock: HFC-143a, HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; as of January 1, 2017
- Rigid PU marine flotation foam: HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6, as of January 1, 2020

While EPA proposed and requested comments on interpreting the SNAP unacceptability determinations to apply to the import of foam products that retain the blowing agents (i.e., closed cell foams), EPA is not finalizing that change in this rulemaking.

5) Hydrochlorofluorocarbons (HCFCs)

As proposed, EPA is also modifying the listings for HCFC-141b, HCFC-142b, and HCFC-22, as well as blends that contain these substances in aerosols, foam blowing agents, fire suppression and explosion protection agents, sterilants, and adhesives, coatings and inks. These modifications align the SNAP listings with other parts of the stratospheric protection program, specifically section 605 and the implementing regulations at 40 CFR part 82 subpart A and section 610 and the implementing regulations at 40 CFR part 82 subpart C. The modified listings will apply 60 days following publication of this final rule.

6) Overview of public comments

EPA received over 7,500 comments on the proposed rule. EPA requested and received comments on the proposed listing decisions as well as the proposed change of status dates. As noted in response to comments throughout this document, the decision on modifying each listing is based on the SNAP program's comparative risk framework. This includes information concerning whether there are alternatives available with lower overall risk to human health and the environment for the end-uses considered. As part of our consideration of the availability of those alternatives, we considered all available information, including information provided during the public comment period, and information claimed as confidential and provided during meetings, regarding technical challenges that may affect the time at which the alternatives can be used safely and used consistent with other requirements such as testing and code compliance obligations. We grouped comments together and responded to the issues raised by the comments in the sections that follow, or in a separate response to comments document which is included in the docket for this rule (EPA, 2015a). This final rule reflects some changes to our proposal, based on information and data received during the public comment period.

The sections that follow describe EPA's final action for each of the three sectors covered

in this rulemaking – aerosols; foam blowing; and refrigeration and air-conditioning, including commercial refrigeration and motor vehicle air conditioning. For the end-uses addressed within each sector we explain the change of status determination and the dates when the change of status will apply. EPA has updated documentation for this rule including market characterizations, analyses of costs associated with sector transitions, estimated benefits associated with the transition to other alternatives, and potential small business impacts.[2,3,4,5,6,7,8,9,10,11,12] These documents are available in the docket. EPA provided separate market characterizations by sector for the proposed rule but is providing a single document consolidating this information, and updated to reflect information received during the public comment period, for this final action. The emissions avoided from this final rule are estimated to be 26 to 31 million metric tons of carbon dioxide equivalent ($MMTCO_2eq$) in 2020. The avoided emissions are estimated to be 54 to 64 $MMTCO_2eq$ in 2025 and 78 to 101 $MMTCO_2eq$ in 2030 (EPA, 2015b).

[2] ICF, 2014a. Market Characterization of the U.S. Aerosols Industry. May 2014.

[3] ICF, 2014b. Market Characterization of the U.S. Foams Industry. May 2014.

[4] ICF, 2014c. Market Characterization of the U.S Commercial Refrigeration Industry. May 2014.

[5] ICF, 2014d. Market Characterization of the Motor Vehicle Air Conditioning Industry. May 2014.

[6] ICF, 2014f. Economic Impact Screening Analysis for Regulatory Options to Change Listing Status of High-GWP Alternatives. June 2014.

[7] EPA, 2014a. Climate Benefits of the SNAP Program Status Change Rule, June 2014.

[8] ICF, 2014g. Revised Preliminary Cost Analysis for Regulatory Options to Change Listing Status of High-GWP Alternatives. June 2014.

[9] ICF, 2015a. Market Characterization of the U.S. Motor Vehicle Air Conditioning Industry, U.S. Foams Industry, U.S. Aerosols Industry, and U.S. Commercial Refrigeration Industry. July 2015

[10] ICF, 2015b. Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives--Revised. July 2015.

[11] EPA, 2015b. Climate Benefits of the SNAP Program Status Change Rule, July 2015.

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

B. Does this action apply to me?

Potential entities that may be affected by this final rule include:

TABLE 1—POTENTIALLY REGULATED ENTITIES BY NORTH AMERICAN INDUSTRIAL CLASSIFICATION SYSTEM (NAICS) CODE

Category	NAICS code	Description of regulated entities
Industry	238220	Plumbing, Heating, and Air Conditioning Contractors
Industry	324191	Petroleum Lubricating Oil and Grease Manufacturing
Industry	325199	All Other Basic Organic Chemical Manufacturing
Industry	325412	Pharmaceutical Preparation Manufacturing
Industry	325510	Paint and Coating Manufacturing
Industry	325520	Adhesive Manufacturing
Industry	325612	Polishes and Other Sanitation Goods
Industry	325620	Toilet Preparation Manufacturing
Industry	325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing
Industry	326140	Polystyrene Foam Product Manufacturing
Industry	326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing
Industry	333415	Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing
Industry	336211	Motor Vehicle Body Manufacturing
Industry	3363	Motor Vehicle Parts Manufacturing
Industry	336611	Ship Building and Repairing
Industry	336612	Boat Building
Industry	339113	Surgical Appliance and Supplies Manufacturing
Retail	423620	Household Appliances, Electric Housewares, and Consumer Electronics Merchant Wholesalers
Retail	423740	Refrigeration Equipment and Supplies Merchant Wholesalers
Retail	44511	Supermarkets and Other Grocery (except Convenience) Stores
Retail	445110	Supermarkets and Other Grocery (except Convenience) Stores
Retail	445120	Convenience Stores
Retail	44521	Meat Markets
Retail	44522	Fish and Seafood Markets
Retail	44523	Fruit and Vegetable Markets
Retail	445291	Baked Goods Stores
Retail	445292	Confectionary and Nut Stores
Retail	445299	All Other Specialty Food Stores
Retail	4453	Beer, Wine, and Liquor Stores
Retail	446110	Pharmacies and Drug Stores
Retail	44711	Gasoline Stations with Convenience Stores
Retail	452910	Warehouse Clubs and Supercenters
Retail	452990	All Other General Merchandise Stores
Services	72111	Hotels (except Casino Hotels) and Motels
Services	72112	Casino Hotels
Retail	72241	Drinking Places (Alcoholic Beverages)
Retail	722513	Limited-Service Restaurants
Retail	722514	Cafeterias, Grill Buffets, and Buffets
Retail	722515	Snack and Nonalcoholic Beverage Bars

This table is not intended to be exhaustive, but rather a guide regarding entities likely to use the substitute whose use is regulated by this action. If you have any questions about whether this action applies to a particular entity, consult the person listed in the above section, **FOR FURTHER INFORMATION CONTACT.**

C. What acronyms and abbreviations are used in the preamble?

Below is a list of acronyms and abbreviations used in the preamble of this document:

AAM—Alliance of Automobile Manufacturers

ACGIH—American Conference of Governmental Industrial Hygienists

AGC—Asahi Glass Company

AHAM—Association of Home Appliance Manufacturers

AHRI— Air-Conditioning, Heating, and Refrigeration Institute

AIHA—American Industrial Hygiene Association

The Alliance—Alliance for Responsible Atmospheric Policy

ARPI—Automotive Refrigeration Products Institute

ASHRAE—American Society of Heating, Refrigerating and Air-Conditioning Engineers

CAA—Clean Air Act

CAP—Climate Action Plan

CARB—California Air Resource Board

CAS Reg. No.—Chemical Abstracts Service Registry Identification Number

CBI—Confidential Business Information

CFC—Chlorofluorocarbon

CFESA— Commercial Food Equipment Service Association

CFR—Code of Federal Regulations

CH_4—Methane

CO_2—Carbon Dioxide

CO_2eq—Carbon dioxide equivalent

CRA—Congressional Review Act

CSPA—Consumer Specialty Products Association

DME—Dimethyl ether

DoD—United States Department of Defense

DOE—United States Department of Energy

DX—Direct expansion

EIA—Environmental Investigation Agency-US

EO—Executive Order

EPA—United States Environmental Protection Agency

EU—European Union

FDA—United States Food and Drug Administration

FM—Factory Mutual

FMI—Food Marketing Institute

FR—Federal Register

GHG—Greenhouse Gas

Global Automakers—Association of Global Automakers

GWP—Global Warming Potential

HC—Hydrocarbon

HCFC—Hydrochlorofluorocarbon

HFC—Hydrofluorocarbon

HFO—Hydrofluoroolefin

ICF—ICF International, Inc.

IGSD—Institute for Governance and Sustainable Development

IPAC—International Pharmaceutical Aerosol Consortium

IPCC—Intergovernmental Panel on Climate Change

LCCP— Life Cycle Climate Performance

LD GHG—Light-Duty Greenhouse Gas

MAC Directive—Directive on Mobile Air Conditioning

MDI—Metered Dose Inhaler

Mexichem—Mexichem Fluor, Inc.

MMTCO$_2$eq—Million Metric Tons of Carbon Dioxide equivalent

MVAC—Motor vehicle air conditioning

MY—Model Year

N$_2$—Nitrogen

N$_2$O—Nitrous Oxide

NAA—National Aerosol Association

NADA—National Automobile Dealers Association

NAICS—North American Industrial Classification System

NAFEM—North American Association of Food Equipment Manufacturers

NAM— National Association of Manufacturers

NAMA—National Automatic Merchandising Association

NASA—National Aeronautics and Space Administration

This document is a prepublication version, signed by Administrator Gina McCarthy on 7/2/2015. We have taken steps to ensure the accuracy of this version, but it is not the official version.

NFPA—National Fire Protection Association

NHTSA—National Highway Traffic Safety Administration

NIOSH—United States National Institute for Occupational Safety and Health

NMMA—National Marine Manufacturers Association

NPRM—Notice of proposed rulemaking

NRA—National Restaurant Association

NRDC—Natural Resources Defense Council

NSF—National Sanitation Foundation

NTTAA—National Technology Transfer and Advancement Act

OEM—Original Equipment Manufacturer

ODP—Ozone Depletion Potential

ODS—Ozone-depleting Substance

OMB—United States Office of Management and Budget

OSHA—United States Occupational Safety and Health Administration

PEL—Permissible Exposure Limit

PFC—Perfluorocarbons

PU—Polyurethane

RCRA—Resource Conservation and Recovery Act

REACH—Registration, Evaluation, Authorization and Restriction of Chemicals

RfC—Reference Concentration

RRR—Recovery, Recycling and Recharging

RSC—Radiator Specialty Company

RSES— Refrigeration Service Engineers Society

SIP—State Implementation Plan

SAE ICCC—SAE International's Interior Climate Control Committee

SF_6—Sulfur Hexafluoride

SBREFA—Small Business Regulatory Enforcement Fairness Act

SISNOSE—Significant impact on a substantial number of small entities

SNAP—Significant New Alternatives Policy

SRES—Special Report on Emissions Scenarios

TEAP—Technical and Economic Assessment Panel

TEWI— Total Equivalent Warming Impact

TLV—Threshold Limit Value

TXV—Thermostatic Expansion Valve

UL—Underwriters Laboratories, Inc.

UMRA—Unfunded Mandates Reform Act

UNEP—United Nations Environmental Programme

VOC—Volatile Organic Compounds

WEEL—Workplace Environmental Exposure Limit

XPS—Extruded Polystyrene Boardstock and Billet

XPSA—Extruded Polystyrene Association

II. How does the SNAP program work?

A. What are the statutory requirements and authority for the SNAP program?

CAA section 612 requires EPA to develop a program for evaluating alternatives to ozone-depleting substances (ODS). This program is known as the SNAP program. The major provisions of section 612 are:

1. Rulemaking

Section 612(c) requires EPA to promulgate rules making it unlawful to replace any class I (chlorofluorocarbon, halon, carbon tetrachloride, methyl chloroform, methyl bromide, hydrobromofluorocarbon, and chlorobromomethane) or class II (HCFC) substance with any substitute that the Administrator determines may present adverse effects to human health or the environment where the Administrator has identified an alternative that (1) reduces the overall risk to human health and the environment and (2) is currently or potentially available.

2. Listing of Unacceptable/Acceptable Substitutes

Section 612(c) requires EPA to publish a list of the substitutes that it finds to be unacceptable for specific uses and to publish a corresponding list of acceptable substitutes for specific uses. The list of "acceptable" substitutes is found at *www.epa.gov/ozone/snap/lists* and the lists of "unacceptable," "acceptable subject to use conditions," and "acceptable subject to narrowed use limits" substitutes are found in the appendices to 40 CFR part 82 subpart G.

3. Petition Process

Section 612(d) grants the right to any person to petition EPA to add a substance to, or delete a substance from, the lists published in accordance with section 612(c). The Agency has 90 days to grant or deny a petition. Where the Agency grants the petition, EPA must publish the revised lists within an additional six months.

4. 90-day Notification

Section 612(e) directs EPA to require any person who produces a chemical substitute for a class I substance to notify the Agency not less than 90 days before new or existing chemicals are introduced into interstate commerce for significant new uses as substitutes for a class I substance. The producer must also provide the Agency with the producer's unpublished health

and safety studies on such substitutes.

5. Outreach

Section 612(b)(1) states that the Administrator shall seek to maximize the use of federal research facilities and resources to assist users of class I and II substances in identifying and developing alternatives to the use of such substances in key commercial applications.

6. Clearinghouse

Section 612(b)(4) requires the Agency to set up a public clearinghouse of alternative chemicals, product substitutes, and alternative manufacturing processes that are available for products and manufacturing processes which use class I and II substances.

B. What are EPA's regulations implementing CAA section 612?

On March 18, 1994, EPA published the initial SNAP rule (59 FR 13,044) which established the process for administering the SNAP program and issued EPA's first lists identifying acceptable and unacceptable substitutes in major industrial use sectors (40 CFR part 82, subpart G). These sectors are the following: refrigeration and air conditioning; foam blowing; solvents cleaning; fire suppression and explosion protection; sterilants; aerosols; adhesives, coatings and inks; and tobacco expansion. These sectors comprise the principal industrial sectors that historically consumed the largest volumes of ODS.

C. How do the regulations for the SNAP program work?

Under the SNAP regulations, anyone who produces a substitute to replace a class I or II ODS in one of the eight major industrial use sectors must provide the Agency with notice and the required health and safety information on the substitute at least 90 days before introducing it into interstate commerce for significant new use as an alternative. 40 CFR 82.176(a). While this requirement typically applies to chemical manufacturers as the person likely to be planning to

introduce the substitute into interstate commerce,[13] it may also apply to importers, formulators, equipment manufacturers, or end users[14] when they are responsible for introducing a substitute into commerce. The 90-day SNAP review process begins once EPA receives the submission and determines that the submission includes complete and adequate data. 40 CFR 82.180(a). The CAA and the SNAP regulations, 40 CFR 82.174(a), prohibit use of a substitute earlier than 90 days after a complete submission has been provided to the Agency.

The Agency has identified four possible decision categories for substitute submissions: acceptable; acceptable, subject to use conditions; acceptable, subject to narrowed use limits; and unacceptable.[15] 40 CFR 82.180(b). Use conditions and narrowed use limits are both considered "use restrictions" and are explained below. Substitutes that are deemed acceptable without use conditions can be used for all applications within the relevant end-uses within the sector and without limits under SNAP on how they may be used. Substitutes that are acceptable subject to use restrictions may be used only in accordance with those restrictions. Substitutes that are found to be unacceptable may not be used after the date specified in the rulemaking adding such substitute to the list of unacceptable substitutes.[16]

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[13] As defined at 40 CFR 82.104 "interstate commerce" means the distribution or transportation of any product between one state, territory, possession or the District of Columbia, and another state, territory, possession or the District of Columbia, or the sale, use or manufacture of any product in more than one state, territory, possession or District of Columbia. The entry points for which a product is introduced into interstate commerce are the release of a product from the facility in which the product was manufactured, the entry into a warehouse from which the domestic manufacturer releases the product for sale or distribution, and at the site of United States Customs clearance.

[14] As defined at 40 CFR 82.172 "end-use" means processes or classes of specific applications within major industrial sectors where a substitute is used to replace an ozone-depleting substance.

[15] The SNAP regulations also include "pending," referring to submissions for which EPA has not reached a determination, under this provision.

[16] As defined at 40 CFR 82.172, "use" means any use of a substitute for a Class I or Class II ozone-depleting compound, including but not limited to use in a manufacturing process or product, in consumption by the end-user, or in intermediate uses, such as formulation or packaging for other subsequent uses. This definition of use encompasses manufacturing process of products both for domestic use and for export. Substitutes manufactured

After reviewing a substitute, the Agency may determine that a substitute is acceptable only if certain conditions in the way that the substitute is used are met to ensure risks to human health and the environment are not significantly greater than other available substitutes. EPA describes such substitutes as "acceptable subject to use conditions." Entities that use these substitutes without meeting the associated use conditions are in violation of section 612 of the CAA and EPA's SNAP regulations. 40 CFR 82.174(c).

For some substitutes, the Agency may permit a narrow range of use within an end-use or sector. For example, the Agency may limit the use of a substitute to certain end-uses or specific applications within an industry sector. The Agency requires a user of a narrowed use substitute to demonstrate that no other acceptable substitutes are available for their specific application. EPA describes these substitutes as "acceptable subject to narrowed use limits." A person using a substitute that is acceptable subject to narrowed use limits in applications and end-uses that are not consistent with the narrowed use limit is using these substitutes in violation of section 612 of the CAA and EPA's SNAP regulations. 40 CFR 82.174(c).

The section 612 mandate for EPA to prohibit the use of a substitute that may present risk to human health or the environment where a lower risk alternative is available or potentially available[17] provides EPA with the authority to change the listing status of a particular substitute if such a change is justified by new information or changed circumstance. The Agency publishes its SNAP program decisions in the *Federal Register*. EPA uses notice-and-comment rulemaking

within the United States exclusively for export are subject to SNAP requirements since the definition of use in the rule includes use in the manufacturing process, which occurs within the United States.

[17] In addition to acceptable commercially available substitutes, the SNAP program may consider potentially available substitutes. The SNAP program's definition of "potentially available " is "any alternative for which adequate health, safety, and environmental data, as required for the SNAP notification process, exist to make a determination of acceptability, and which the Agency reasonably believes to be technically feasible, even if not all testing has yet been completed and the alternative is not yet produced or sold." (40 CFR 82.172)

to place any alternative on the list of prohibited substitutes, to list a substitute as acceptable only subject to use conditions or narrowed use limits, or to remove a substitute from either the list of prohibited or acceptable substitutes.

In contrast, EPA publishes "notices of acceptability" to notify the public of substitutes that are deemed acceptable with no restrictions. As described in the preamble to the rule initially implementing the SNAP program (59 FR 13,044; March 18, 1994), EPA does not believe that rulemaking procedures are necessary to list substitutes that are acceptable without restrictions because such listings neither impose any sanction nor prevent anyone from using a substitute.

Many SNAP listings include "comments" or "further information" to provide additional information on substitutes. Since this additional information is not part of the regulatory decision, these statements are not binding for use of the substitute under the SNAP program. However, regulatory requirements so listed are binding under other regulatory programs (e.g., worker protection regulations promulgated by the U.S. Occupational Safety and Health Administration (OSHA)). The "further information" classification does not necessarily include all other legal obligations pertaining to the use of the substitute. While the items listed are not legally binding under the SNAP program, EPA encourages users of substitutes to apply all statements in the "further information" column in their use of these substitutes. In many instances, the information simply refers to sound operating practices that have already been identified in existing industry and/or building codes or standards. Thus, many of the statements, if adopted, would not require the affected user to make significant changes in existing operating practices.

D. What are the guiding principles of the SNAP program?

The seven guiding principles of the SNAP program, elaborated in the preamble to the initial SNAP rule and consistent with section 612, are discussed below.

- *Evaluate substitutes within a comparative risk framework*

The SNAP program evaluates the risk of alternative compounds compared to available or potentially available substitutes to the ozone depleting compounds which they are intended to replace. The risk factors that are considered include ozone depletion potential as well as flammability, toxicity, occupational health and safety, and contributions to climate change and other environmental factors.

- *Do not require that substitutes be risk free to be found acceptable*

Substitutes found to be acceptable must not pose significantly greater risk than other substitutes, but they do not have to be risk free. A key goal of the SNAP program is to promote the use of substitutes that minimize risks to human health and the environment relative to other alternatives. In some cases, this approach may involve designating a substitute acceptable even though the compound may pose a risk of some type, provided its use does not pose significantly greater risk than other alternatives.

- *Restrict those substitutes that are significantly worse*

EPA does not intend to restrict a substitute if it has only marginally greater risk. Drawing fine distinctions would be extremely difficult. The Agency also does not want to intercede in the market's choice of substitutes by listing as unacceptable all but a few substitutes for each end-use, and does not intend to do so unless a substitute has been proposed or is being used that is clearly more harmful to human health or the environment than other available or potentially available alternatives.

- *Evaluate risks by use*

Central to SNAP's evaluations is the intersection between the characteristics of the substitute itself and its specific end-use application. Section 612 requires that substitutes be evaluated by use. Environmental and human health exposures can vary significantly depending on the particular application of a substitute. Thus, the risk characterizations must be designed to represent differences in the environmental and human health effects associated with diverse uses. This approach cannot, however, imply fundamental tradeoffs with respect to different types of risk to either the environment or to human health.

- *Provide the regulated community with information as soon as possible*

The Agency recognizes the need to provide the regulated community with information on the acceptability of various substitutes as soon as possible. To do so, EPA issues notices or determinations of acceptability and rules identifying substitutes as unacceptable, acceptable to use conditions or acceptable subject to narrowed use limits in the *Federal Register*. In addition, we maintain lists of acceptable and unacceptable alternatives on our website, *www.epa.gov/ozone/snap*.

- *Do not endorse products manufactured by specific companies*

The Agency does not issue company-specific product endorsements. In many cases, the Agency may base its analysis on data received on individual products, but the addition of a substitute to the acceptable list based on that analysis does not represent an endorsement of that company's products.

- *Defer to other environmental regulations when warranted*

In some cases, EPA and other federal agencies have developed extensive regulations under other sections of the CAA or other statutes that address potential environmental or human health effects that may result from the use of alternatives to class I and class II substances. For example,

use of some substitutes may in some cases entail increased use of chemicals that contribute to tropospheric air pollution. The SNAP program takes existing regulations under other programs into account when reviewing substitutes.

E. What are EPA's criteria for evaluating substitutes under the SNAP program?

EPA applies the same criteria for determining whether a substitute is acceptable or unacceptable. These criteria, which can be found at §82.180(a)(7), include atmospheric effects and related health and environmental effects, ecosystem risks, consumer risks, flammability, and cost and availability of the substitute. To enable EPA to assess these criteria, we require submitters to include various information including ozone depletion potential (ODP), GWP, toxicity, flammability, and the potential for human exposure.

When evaluating potential substitutes, EPA evaluates these criteria in the following groupings:

- *Atmospheric effects*- The SNAP program evaluates the potential contributions to both ozone depletion and climate change. The SNAP program considers the ozone depletion potential and the 100-year integrated GWP of compounds to assess atmospheric effects.
- *Exposure assessments*- The SNAP program uses exposure assessments to estimate concentration levels of substitutes to which workers, consumers, the general population, and the environment may be exposed over a determined period of time. These assessments are based on personal monitoring data or area sampling data if available. Exposure assessments may be conducted for many types of releases including:
    1) Releases in the workplace and in homes;
    2) Releases to ambient air and surface water;

3) Releases from the management of solid wastes.

- *Toxicity data*- The SNAP program uses toxicity data to assess the possible health and environmental effects of exposure to substitutes. We use broad health-based criteria such as:

    1) Permissible Exposure Limits (PELs) for occupational exposure;
    2) Inhalation reference concentrations (RfCs) for non-carcinogenic effects on the general population;
    3) Cancer slope factors for carcinogenic risk to members of the general population.

  When considering risks in the workplace, if OSHA has not issued a PEL for a compound, EPA then considers Recommended Exposure Limits from the National Institute for Occupational Safety and Health (NIOSH), Workplace Environmental Exposure Limits (WEELs) set by the American Industrial Hygiene Association (AIHA), or threshold limit values (TLVs) set by the American Conference of Governmental Industrial Hygienists (ACGIH). If limits for occupational exposure or exposure to the general population are not already established, then EPA derives these values following the Agency's peer reviewed guidelines. Exposure information is combined with toxicity information to explore any basis for concern. Toxicity data are used with existing EPA guidelines to develop health-based limits for interim use in these risk characterizations.

- *Flammability*-The SNAP program examines flammability as a safety concern for workers and consumers. EPA assesses flammability risk using data on:

    1) Flash point and flammability limits (e.g. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) flammability/combustibility classifications);

2) Data on testing of blends with flammable components;
3) Test data on flammability in consumer applications conducted by independent laboratories; and
4) Information on flammability risk mitigation techniques.

- *Other environmental impacts*- The SNAP program also examines other potential environmental impacts like ecotoxicity and local air quality impacts. A compound that is likely to be discharged to water may be evaluated for impacts on aquatic life. Some substitutes are volatile organic compounds (VOC). EPA also notes whenever a potential substitute is considered a hazardous or toxic air pollutant (under CAA sections 112 (b) and 202 (l)) or hazardous waste under the Resource Conservation and Recovery Act (RCRA) subtitle C regulations.

Over the past twenty years, the menu of substitutes has become much broader and a great deal of new information has been developed on many substitutes. Because the overall goal of the SNAP program is to ensure that substitutes listed as acceptable do not pose significantly greater risk to human health and the environment than other available substitutes, the SNAP criteria should be informed by our current overall understanding of environmental and human health impacts and our experience with and current knowledge about available and potentially available substitutes. Over time, the range of substitutes reviewed by SNAP has changed, and, at the same time, scientific approaches have evolved to more accurately assess the potential environmental and human health impacts of these chemicals and alternative technologies.

F. How are SNAP determinations updated?

Three mechanisms exist for modifying the list of SNAP determinations. First, under section 612(d), the Agency must review and either grant or deny petitions to add or delete

substances from the SNAP list of acceptable or unacceptable substitutes. That provision allows any person to petition the Administrator to add a substance to the list of acceptable or unacceptable substitutes or to remove a substance from either list. The second means is through the notifications which must be submitted to EPA 90 days before introduction of a substitute into interstate commerce for significant new use as an alternative to a class I or class II substance. These 90-day notifications are required by section 612(e) of the CAA for producers of substitutes to class I substances for new uses and, in all other cases, by EPA regulations issued under sections 114 and 301 of the Act to implement section 612(c).

Finally, since the inception of the SNAP program, we have interpreted the section 612 mandate to find substitutes acceptable or unacceptable to include the authority to act on our own to add or remove a substance from the SNAP lists. In determining whether to add or remove a substance from the SNAP lists, we consider whether there are other available substitutes that pose lower overall risk to human health and the environment. In determining whether to modify a listing of a substitute we undertake the same consideration, but do so in the light of new data not considered at the time of our original listing decision, including information on new substitutes and new information on substitutes previously reviewed.

G. What does EPA consider in deciding whether to modify the listing status of an alternative?

As described in this document and elsewhere, including in the initial SNAP rule published in the *Federal Register* on March 18, 1994 (59 FR 13,044), CAA section 612 requires EPA to list as unacceptable any substitute substance where it finds that there are other substitutes currently or potentially available that reduce overall risk to human health and the environment.

The initial SNAP rule included submission requirements and presented the environmental

and health risk factors that the SNAP program considers in its comparative risk framework. Environmental and human health exposures can vary significantly depending on the particular application of a substitute; therefore, EPA makes decisions based on the particular end-use where a substitute is to be used. EPA has, in many cases, found certain substitutes acceptable only for limited end-uses or subject to use restrictions.

It has now been over twenty years since the initial SNAP rule was promulgated. In that period, the menu of available alternatives has expanded greatly and now includes many substitutes with diverse characteristics and varying effects on human health and the environment. When the SNAP program began, the number of substitutes available for consideration was, for many end-uses, somewhat limited. While the SNAP program's initial comparative assessments of overall risk to human health and the environment were rigorous, often there were few substitutes upon which to apply the comparative assessment. The immediacy of the class I phaseout often meant that SNAP listed class II ODS (i.e., HCFCs) as acceptable, recognizing that they too would be phased out and were only an interim solution. Other Title VI provisions such as the section 610 Nonessential Products Ban and the section 605 Use Restriction made clear that a listing under the SNAP program could not convey permanence.

Since EPA issued the initial SNAP rule in 1994, the Agency has issued 19 rules and 30 notices that generally expand the menu of options for all SNAP sectors and end-uses. Comparisons today apply to a broader range of options – both chemical and non-chemical – than was available at the inception of the SNAP program. Industry experience with these substitutes has also grown during the history of the program. This varies by sector and by end-use.

In addition to an expanding menu of substitutes, developments over the past 20 years have improved our understanding of global environmental issues. With regard to that

information, our review of substitutes in this rule includes comparative assessments that consider our evolving understanding of a variety of factors, including climate change. GWPs and climate effects are not new elements in our evaluation framework, but as is the case with all of our review criteria, the amount and quality of information has expanded.

To the extent possible, EPA's ongoing management of the SNAP program considers new information and improved understanding of the risk to the environment and human health. EPA previously has taken several actions revising listing determinations from acceptable or acceptable with use conditions to unacceptable based on information made available to EPA after a listing was issued. For example, on January 26, 1999, EPA listed the refrigerant blend known by the trade name MT-31 as unacceptable for all refrigeration and air conditioning end-uses. EPA previously listed this blend as an acceptable substitute in various end-uses within the refrigeration and air conditioning sector (June 3, 1997; 62 FR 30,275). Based on new information about the toxicity of one of the chemicals in the blend, EPA subsequently removed MT–31 from the list of acceptable substitutes and listed it as unacceptable in all refrigeration and air conditioning end-uses (January 26, 1999; 64 FR 3,861).

Another example of EPA revising a listing determination occurred in 2007 when EPA listed HCFC–22 and HCFC–142b as unacceptable for use in the foam sector (March 28, 2007; 72 FR 14,432). These HCFCs, which are ozone depleting and subject to a global production phaseout, were initially listed as acceptable substitutes since they had a lower ODP than the substances they were replacing and there were no other available substitutes that posed lower overall risk at the time of EPA's listing decision. HCFCs offered a path forward for some sectors and end-uses at a time when substitutes were far more limited. In light of the expanded availability of other substitutes with lower overall risk to human health and the environment in

specific foam end-uses, and taking into account the 2010 class II ODS phase-down step, EPA changed the listing for these HCFCs in relevant end-uses from acceptable to unacceptable. In that rule, EPA noted that continued use of these HCFCs would contribute to unnecessary depletion of the ozone layer and delay the transition to substitutes that pose lower overall risk to human health and the environment. EPA established a change of status date that recognized that existing users needed time to adjust their manufacturing processes to safely accommodate the use of other substitutes.

H. Where can I get additional information about the SNAP program?

For copies of the comprehensive SNAP lists of substitutes or additional information on SNAP, refer to EPA's website at *www.epa.gov/ozone/snap*. For more information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the initial SNAP rule published March 18, 1994 (59 FR 13,044), codified at 40 CFR part 82, subpart G. A complete chronology of SNAP decisions and the appropriate citations are found at *www.epa.gov/ozone/snap/chron.html*.

III. What actions and information related to greenhouse gases have bearing on this final action to modify prior SNAP determinations?

GWP is one of several criteria EPA considers in the overall evaluation of alternatives under the SNAP program. During the past two decades, the general science on climate change and the potential contributions of greenhouse gases (GHGs) such as HFCs to climate change have become better understood.

On December 7, 2009, at 74 FR 66,496, the Administrator issued two distinct findings

regarding GHGs[18] under section 202(a) of the CAA:

- **Endangerment Finding:** the current and projected concentrations of the six key well-mixed greenhouse gases in the atmosphere — CO_2, methane (CH_4), nitrous oxide (N_2O), HFCs, perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) — threaten the public health and welfare of current and future generations.
- **Cause or Contribute Finding:** the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare.

Like the ODS they replace, HFCs are potent GHGs.[19] Although they represent a small fraction of the current total volume of GHG emissions, their warming impact is very strong. The most commonly used HFC is HFC-134a. HFC-134a is 1,430 times more damaging to the climate system than carbon dioxide. HFC emissions are projected to increase substantially and at an increasing rate over the next several decades if left unregulated. In the United States, emissions of HFCs are increasing more quickly than those of any other GHGs, and globally they are increasing 10-15% annually.[20] At that rate, emissions are projected to double by 2020 and triple by 2030.[21] HFCs are rapidly accumulating in the atmosphere. The atmospheric concentration of HFC-134a, the most abundant HFC, has increased by about 10% per year from 2006 to 2012,

[18] The relevant scientific and technical information summarized to support the Endangerment Finding and the Cause or Contribute Finding can be found at: *www.epa.gov/climatechange/Downloads/endangerment/Endangerment_TSD.pdf*

[19] IPCC/TEAP (2005) Special Report: Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons (Cambridge Univ Press, New York).

[20] UNEP 2011. HFCs: A Critical Link in Protecting Climate and the Ozone Layer. United Nations Environment Programme.

[21] Akerman, Nancy H. Hydrofluorocarbons and Climate Change: Summaries of Recent Scientific and Papers, 2013.

and the concentrations of HFC-143a and HFC-125 have risen over 13% and 16% per year from 2007-2011, respectively.[22, 23]

Annual global emissions of HFCs are projected to rise to about 6.4 to 9.9 Gt CO_2eq in 2050,[24] which is comparable to the drop in annual GHG emissions from ODS of 8.0 GtCO_2eq between 1988 and 2010 (UNEP, 2011). By 2050, the buildup of HFCs in the atmosphere is projected to increase radiative forcing by up to 0.4 W m^{-2}. This increase may be as much as one-fifth to one-quarter of the expected increase in radiative forcing due to the buildup of CO_2 since 2000, according to the Intergovernmental Panel on Climate Change's (IPCC's) Special Report on Emissions Scenarios (SRES) (UNEP, 2011). To appreciate the significance of the effect of projected HFC emissions within the context of all GHGs, HFCs would be equivalent to 5 to 12% of the CO_2 emissions in 2050 based on the IPCC's highest CO_2 emissions scenario and equivalent to 27 to 69% of CO_2 emissions based on the IPCC's lowest CO_2 emissions pathway.[25,26] Additional information concerning the peer-reviewed scientific literature and emission scenarios is available in the docket for this rulemaking.

IV. What petitions has EPA received requesting a change in listing status for HFCs?

A. Summary of petitions

[22] Montzka, S.A.: HFCs in the Atmosphere: Concentrations, Emissions and Impacts, ASHRAE/NIST Conference 2012.

[23] NOAA data at ftp://ftp.cmdl.noaa.gov/hats/hfcs/.

[24] Velders, G. J. M., D. W. Fahey, J. S. Daniel, M. McFarland, S. O. Andersen (2009) The large contribution of projected HFC emissions to future climate forcing. *Proceedings of the National Academy of Sciences USA* 106: 10949–10954.

[25] HFCs: A Critical Link in Protecting Climate and the Ozone Layer. United Nations Environment Programme (UNEP), 2011, 36pp

[26] IPCC, 2013: Annex II: Climate System Scenario Tables [Prather, M., G. Flato, P. Friedlingstein, C. Jones, J.-F. Lamarque, H. Liao and P. Rasch (eds.)]. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

EPA received three petitions requesting EPA to modify certain acceptability listings of HFC-134a and HFC-134a blends. These petitions are more fully described in the notice of proposed rulemaking (NPRM). The first petition was submitted on May 7, 2010, by Natural Resources Defense Council (NRDC) on behalf of NRDC, the Institute for Governance and Sustainable Development (IGSD), and the Environmental Investigation Agency-US (EIA). The petition requested that EPA remove HFC-134a from the list of acceptable substitutes in multiple end-uses and move it to the list of unacceptable substitutes in those end-uses. In support of their petition, the petitioners identified other substitutes that they claimed were available for use in those end-uses and they claimed these other substitutes present much lower risks to human health and environment than HFC-134a.

On February 14, 2011, EPA found the petition complete for MVAC in new passenger cars and light-duty vehicles and determined it was incomplete for other uses of HFC-134a. EPA noted in its response that, at a future date, the Agency would initiate a notice-and-comment rulemaking in response to the one complete aspect of the petition, noting in particular that EPA would evaluate and take comment on many factors, including, but not limited to, the timeframe for introduction of newer substitutes for MVAC systems into the automotive market and potential lead time for manufacturers of motor vehicles to accommodate such substitutes.

On April 26, 2012, EPA received a second petition submitted by EIA. EIA stated that, in light of the comparative nature of the SNAP program's evaluation of substitutes and given that other acceptable substitutes are on the market or soon to be available, EPA should remove HFC-134a and HFC-134a blends from the list of acceptable substitutes for uses where EPA found chlorofluorocarbons (CFCs) and HCFCs to be nonessential under section 610 of the Act. EIA also requested that the schedule for moving HFC-134a and HFC-134a blends from the list of

acceptable to unacceptable substitutes be based on the "most rapidly feasible transitions to one or more of the" acceptable substitutes for each use. The petitioner noted that initial approvals of HFC-134a for a number of end-uses occurred in the 1990s and were based on the assessment made then that 1) HFC-134a does not contribute to ozone depletion; 2) HFC-134a's GWP and atmospheric lifetime were close to those of other substitutes that had been determined to be acceptable for the end-uses; and 3) HFC-134a is not flammable, and its toxicity is low.[27] The petitioner stated that the analysis used in the listing decisions may have been appropriate in the 1990s but was no longer so today given the range of other available or potentially available substitutes at present.

On August 7, 2012, EPA notified the petitioner that this petition was incomplete. EPA and the petitioner have exchanged further correspondence that can be found in the docket.

A third petition was filed on April 27, 2012, by NRDC, EIA and IGSD. They requested that EPA:

- Remove HFC-134a from the list of acceptable substitutes for CFC-12 in household refrigerators and freezers and stand-alone retail food refrigerators and freezers;
- Restrict the sales of SNAP-listed refrigerants to all except certified technicians with access to service tools required under existing EPA regulations;
- Adopt a standardized procedure to determine the speed of transition from obsolete high-GWP HFCs to next-generation alternatives and substitutes;
- Remove, in addition to HFC-134a, all other refrigerants with 100-year GWPs greater than 150 from the acceptable list for household refrigerators and freezers and stand-alone

[27] See, e.g., 60 FR at 31,097.

retail food refrigerators and freezers.

On August 7, 2013, EPA found this petition to be incomplete. EPA and the petitioner have exchanged further correspondence that can be found in the docket.

B. How this action relates to the Climate Action Plan and petitions

This action is consistent with a provision in the President's CAP announced June 2013: Moving forward, the Environmental Protection Agency will use its authority through the Significant New Alternatives Policy 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.

The CAP further states: "to reduce emissions of HFCs, the United States can and will lead both through international diplomacy as well as domestic actions." This rule is also consistent with that call for leadership through domestic actions. As regards international leadership, for the past five years, the United States, Canada, and Mexico have proposed an amendment to the Montreal Protocol to phase down the production and consumption of HFCs. Global benefits of the amendment proposal would yield significant reductions of over 90 gigatons of carbon dioxide equivalent (CO_2eq) through 2050.

This action also addresses certain aspects of the three petitions referred to above. First, this action responds to the one aspect of the three petitions that EPA found complete, namely petitioners' request that EPA change the listing of HFC-134a from acceptable to unacceptable in new MVAC systems. (See section V.B.) Second, regarding the remaining aspects of the three petitions, which EPA found to be incomplete, EPA has independently acquired sufficient information to address certain other requests made by the petitioners. EPA's action in this final rule may be considered responsive to certain aspects of those petitions such as: changing the

listing of certain HFCs used in specific aerosol uses from acceptable to unacceptable or acceptable, subject to use conditions; changing the listing of certain HFCs used in specific foams end-uses from acceptable to unacceptable for most uses; changing the listing of HFC-134a from acceptable to unacceptable for new stand-alone retail food refrigerators and freezers; and changing the listing of a number of refrigerant blends with higher GWPs from acceptable to unacceptable for new and retrofit stand-alone retail food refrigerators and freezers. Specifically, as explained in more detail in the sector-specific sections of this document, we are revising the listings for substitutes in the aerosols, foams, and refrigeration and air conditioning sectors that pose significantly greater overall risk to human health and the environment as compared with other available or potentially available substitutes in the specified end-uses.

Throughout the process of our discussions with the regulated community, we have sought to convey our continued understanding of the role that certainty plays in enabling the robust development and uptake of alternatives. Unfortunately, some of the key strengths of the SNAP program, such as its chemical and end-use specific consideration, its multi-criteria basis for action, and its petition process, tend to militate against some measures that could provide more certainty, such as setting specific numerical criteria for environmental evaluations (e.g., all compounds with GWP greater than 150). That being said, we believe that the action we are taking today, and future action we may take, does provide additional certainty in the specific cases addressed. In addition, we remain committed to continuing to actively seek stakeholder views and to share our thinking at the earliest moment practicable on any future actions, as part of our commitment to provide greater certainty to producers and consumers in SNAP-regulated industrial sectors.

V. What is EPA's final action concerning the HFCs addressed in this rule?

A. Aerosols

1. Background

The SNAP program provides listings for two aerosol end-uses: propellants and solvents. Aerosols typically use a liquefied or compressed gas to propel active ingredients in liquid, paste, or powder form. In the case of duster sprays used to blow dust and contaminants off of surfaces, the propellant is also itself the active ingredient. Some aerosols also contain a solvent, which may be used in manufacturing, maintenance and repair to clean off oil, grease, and other soils.

Historically, a variety of propellants and solvents have been available to formulators. HCs (e.g., propane, isobutane) and compressed gases (e.g., CO_2, N_2, N_2O, and compressed air) have long been used as propellants. Prior to 1978, the aerosol industry predominantly used CFCs. In 1978, in response to evidence regarding depletion of the earth's ozone layer, the United States banned CFC propellants, with few exceptions.

Many consumer products that previously used CFC propellants were reformulated or replaced with a variety of alternatives, including not-in-kind substitutes, such as pump sprays or solid and roll-on deodorants. Aerosol propellant substitutes included HCFCs, HCs, HFCs, compressed gases, and oxygenated organic compounds. However, since the 1990s HCFCs have been controlled substances under the Montreal Protocol and subject to regulation under the CAA, as amended in 1990, including a phaseout of production and import under section 605(b)-(c) and use restrictions under section 605(a).

2. What is EPA finalizing concerning aerosols?

For aerosol propellants, EPA proposed to list, as of January 1, 2016:

- HFC-125 as unacceptable;

- HFC-134a as acceptable, subject to use conditions, allowing its use only in specific types of technical and medical aerosols (e.g., MDIs) and
- HFC-227ea as acceptable, subject to use conditions, allowing its use only in MDIs.[28]

Today's action changes the status of HFC-125; HFC-227ea; blends of HFC-134a and HFC-227ea; and HFC-134a, as follows:

- We are changing the status of the aerosol propellant HFC-125 from acceptable to unacceptable as of January 1, 2016.
- We are changing the status of HFC-134a, HFC-227ea, and blends of HFC-134a and HFC-227ea from acceptable to unacceptable for use as aerosol propellants as of [**insert date one year after publication in the Federal Register**] except for those uses specifically listed as acceptable, subject to use conditions.
- We are changing the status of the aerosol propellant HFC-227ea and for blends of HFC-227ea and HFC-134a from acceptable to acceptable, subject to use conditions, as of [**insert date one year after publication in the Federal Register**], for use in MDIs approved by FDA.
- We are changing the status of the aerosol propellant HFC-134a from acceptable to acceptable, subject to use conditions, as of [**insert date one year after publication in the Federal Register**], until January 1, 2018, for the following specific uses: products for which new formulations require federal governmental review, including: EPA pesticide registration, military (U.S. Department of Defense (DoD)) or space agency (National

[28] EPA did not explicitly state in our proposal whether blends of HFC-134a and HFC-227ea would also be acceptable subject to use conditions. However, in general in the SNAP program, blends of acceptable aerosol propellants are also acceptable and do not require separate approval.

Aeronautics and Space Administration (NASA)) specifications, or FDA approval (aside from MDIs); and products for smoke detector functionality testing.

- We are changing the status of the aerosol propellant HFC-134a from acceptable to acceptable, subject to use conditions as of [**insert date one year after publication in the Federal Register**], for the following specific uses: cleaning products for removal of grease, flux and other soils from electrical equipment or electronics; refrigerant flushes; products for sensitivity testing of smoke detectors; lubricants and freeze sprays for electrical equipment or electronics; sprays for aircraft maintenance; sprays containing corrosion preventive compounds used in the maintenance of aircraft, electrical equipment or electronics, or military equipment; pesticides for use near electrical wires, in aircraft, in total release insecticide foggers, or in certified organic use pesticides for which EPA has specifically disallowed all other lower-GWP propellants; mold release agents and mold cleaners; lubricants and cleaners for spinnerettes for synthetic fabrics; duster sprays specifically for use on removal of dust from photographic negatives, semiconductor chips, specimens under electron microscopes, and energized electrical equipment; adhesives and sealants in large canisters; document preservation sprays; MDIs approved by FDA for medical purposes[29]; wound care sprays; topical coolant sprays for pain relief; and products for removing bandage adhesives from skin.

The change of status determinations for aerosols are summarized in the following table:

Table 2. Change of Status Decisions for Aerosols

End-use	Substitutes	Decision	Uses that Are Acceptable, Subject to Use Conditions
Propellants	HFC-125	Unacceptable as of January 1, 2016	None

[29] Includes veterinary purposes.

Propellants	HFC-134a	Unacceptable as of [**insert date one year after publication in the Federal Register**] except for uses listed as acceptable, subject to use conditions	*From* [**insert date one year after publication in the Federal Register**] *to January 1, 2018*: products for smoke detector functionality testing; products for which new formulations require governmental review, including: EPA pesticide registration, military or space agency specifications, or FDA approval (other than MDIs)
			As of [**insert date one year after publication in the Federal Register**]: cleaning products for removal of grease, flux and other soils from electrical equipment; refrigerant flushes; products for sensitivity testing of smoke detectors; lubricants and freeze sprays for electrical equipment or electronics; sprays for aircraft maintenance; sprays containing corrosion preventive compounds used in the maintenance of aircraft, electrical equipment or electronics, or military equipment; pesticides for use near electrical wires, in aircraft, in total release insecticide foggers, or in certified organic use pesticides for which EPA has specifically disallowed all other lower-GWP propellants; mold release agents and mold cleaners; lubricants and cleaners for spinnerettes for synthetic fabrics; duster sprays specifically for removal of dust from photographic negatives, semiconductor chips, specimens under electron microscopes, and energized electrical equipment; adhesives and sealants in large canisters; document preservation sprays; FDA-approved MDIs for medical purposes; wound care sprays; topical coolant sprays for pain relief; and products for removing bandage adhesives from skin.
Propellants	HFC-227ea and blends of HFC-227ea and HFC-134a	Unacceptable as of [**insert date one year after publication in the Federal Register**] except for uses listed as acceptable, subject to use conditions	*As of*[**insert date one year after publication in the Federal Register**]: FDA-approved MDIs for medical purposes

a) What other alternatives are available?

EPA is changing the listing decisions for HFC-125, HFC-134a, HFC-227ea, and blends of HFC-134a and HFC-227ea, with some exceptions, because, as discussed in more detail in this section, for the uses for which we are listing these substitutes as unacceptable, alternatives (i.e., chemical compounds and technological options) are available or potentially available that reduce the overall risk to human health and the environment. Other substitutes listed as acceptable propellants include HFC-152a, HFO-1234ze(E), butane, propane, isobutane, CO_2 and other compressed gases, and dimethyl ether (DME). In addition, technological options include not-in-

kind alternatives such as finger/trigger pumps, powder formulations, sticks, rollers, brushes, and wipes. These alternatives have GWPs ranging from zero to 124 compared with HFC-134a's GWP of 1,430, HFC-227ea's GWP of 3,220 and HFC-125's GWP of 3,500.[30] All of these alternatives, both the ones remaining acceptable and those for which we are changing the listing, have an ODP of zero, are relatively low in toxicity, and are capable of remaining below their respective exposure limits when used as aerosol propellants. In addition to GWP, some of the other environmental and health attributes that the SNAP program considers that differ for these alternatives include impacts on local air quality and flammability. For example, butane, propane, isobutane, and DME are VOC as well as being flammable. Butane, propane, isobutane, and DME are not excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of state implementation plans (SIPs) to attain and maintain the national ambient air quality standards. Thus, these propellants are subject to federal, state, and local regulation that may prevent their use as a propellant in aerosols in some states and counties that have nonattainment areas for ground-level ozone and restrict their use under this action. HFC-125, HFC-134a, HFC-227ea, HFC-152a, HFO-1234ze(E), and the compressed gas CO_2 are exempted from the definition of VOC under these regulations and their use is expected to have negligible impact on ground-level ozone levels. As well as HFC-152a, HFO-1234ze(E), and CO_2, compressed N_2 and not-in-kind alternatives are not VOC.

The aerosols industry is generally familiar with how to address flammability risks. The aerosols industry has been using flammable compounds, including flammable propellants, for decades, consistent with OSHA requirements addressing flammability. There may be greater

[30] GWP values cited in this final rule are from the IPCC Fourth Assessment Report (AR4) unless stated otherwise. Where no GWP is listed in AR4, GWP values shall be determined consistent with the calculations and analysis presented in AR4 and referenced materials.

flammability risks for some specific uses of aerosol products because of their use in situations where there is a source of heat or electrical energy that could cause a fire (e.g., use on energized electrical equipment). Concerns with flammability occur more with industrial products, often referred to as "technical aerosols." For further discussion on consumer aerosols, technical aerosols, and medical aerosols, see the NPRM at 79 FR 46,136 through 46,138 (August 6, 2014).

There are a number of alternatives with GWPs lower than the GWPs for the substitutes that we are listing as unacceptable and that are not defined as VOC for purposes of SIPs, including: HFC-152a with a GWP of 124, HFO-1234ze(E) with a GWP of 6, and CO_2 with a GWP of 1. CO_2 and HFO-1234ze(E) are nonflammable under ambient temperature conditions, while HFC-152a is flammable, but less so than hydrocarbons or DME. All three have GWPs significantly lower than those of the HFCs for which we are changing the listing (range of GWPs from 1,430 to 3,500 for HFC-134a, HFC-227ea and HFC-125).

(1) Aerosols with flammability and vapor pressure constraints

Aerosols for industrial and commercial uses often require nonflammability and in some cases, specific vapor pressure criteria. For example, nonflammable aerosols are needed for use on energized electrical circuits, where sparking can create a fire or explosion hazard. Of the different alternatives that have previously been listed as acceptable, the nonflammable options at room temperature include HFC-125, HFC-134a, HFC-227ea, HFO-1234ze(E), compressed gases including CO_2 and N_2, and not-in-kind products. At slightly higher temperatures (30 °C or 85°F), HFO-1234ze(E) exhibits lower and higher flammability limits, and thus in theory could catch fire under specific conditions of concentration and applied energy. Some aerosol product formulators have expressed concern that the lower vapor pressure of HFO-1234ze(E) and the significantly higher vapor pressure of CO_2 and other compressed gases may not provide adequate

performance in propelling the contents of a can for technical aerosols or may exceed Department of Transportation pressure requirements under elevated temperatures (ITW Polymers Sealants, 2014). For comparison, the vapor pressures of HFO-1234ze(E), HFC-134a, and CO_2 at 20 °C are 422 kPa, 655 kPa, and 5,776 kPa, respectively.

Based on the information available today, EPA believes it cannot list HFC-134a as unacceptable for all aerosol uses. Thus, we are creating a use condition that would restrict use of HFC-134a to specific uses for which alternatives are not currently or potentially available.

Both HFC-227ea and HFC-125 have significantly higher GWPs than HFC-134a (HFC-227ea's GWP is 3220 and HFC-125's GWP is 3500) or other substitutes that could be potentially used where flammability is a concern, and there is not a significantly different level of risk based on the other factors that we consider. Thus, EPA has determined that HFC-227ea and HFC-125 pose significantly more risk than other available substitutes and EPA is changing their listing from acceptable to unacceptable in most uses where HFC-134a may be used to mitigate flammability risks. We note that we are not aware of any use of HFC-227ea or of HFC-125 in industrial aerosols to mitigate flammability risks.

(2) Aerosols for specific medical uses

For medical aerosols, there are special needs to address safety and toxicity. Furthermore, in order for a substitute to be available for use in medical devices, the device using the substitute must first be reviewed and approved by the FDA.

FDA has approved medications for use in MDIs using HFC-134a, HFC-227ea, and blends of these two HFCs as propellants. No medications have been approved for use in MDIs using other propellants. Although some dry powder inhalers that are not-in-kind substitutes are approved by FDA, these alternatives do not work for some situations. Thus, we cannot conclude

that there are other alternatives available for use in MDIs that pose lower risk than HFC-134a, HFC-227ea, or blends of these two. In addition, it is our understanding that because of differences in the solubility of water in HFC-134a and HFC-227ea, there are some medications that are sensitive to the presence of water for which only HFC-227ea may be used in an MDI.

For other medical uses, EPA is aware of medical aerosols that currently are using hydrocarbons or DME as the propellant, as well as not-in-kind alternatives for uses such as antifungals, calamine sprays, freeze sprays for wart removal, and liquid bandages (ICF, 2014a). However, EPA does not have information that alternatives other than HFC-134a are available and are approved by FDA as propellants in wound care sprays; topical coolant sprays for pain relief; and products for removing bandage adhesives from skin.

The available substitutes for medical devices are limited to those approved by FDA, and the available substitutes differ by the type of product and medical conditions treated. For these reasons, we are listing HFC-134a, HFC-227ea and blends of HFC-134a and HFC-227ea as acceptable, subject to use conditions, for specific uses for which other alternatives that pose lower overall risk to human health and the environment are not currently or potentially available. The use conditions limit use of HFC-227ea and blends of HFC-227ea and HFC-134a to MDIs approved by FDA and limit use of HFC-134a to MDIs approved by FDA and the other medical uses listed above.

HFC-125 has a GWP of 3,500, which is higher than the GWP of all other alternatives that are available for use as aerosol propellants (HFC-227ea has a GWP of 3,220; HFC-134a has a GWP of 1,430; HFO-1234ze(E) has a GWP of 6). Like HFC-134a, HFC-227ea, CO_2 and HFO-1234ze(E), it is VOC-exempt, nonflammable and low in toxicity. We are not aware of any medical or other aerosols currently using HFC-125, or of any FDA approval for aerosols using

HFC-125. For these reasons, we have determined that there are other available substitutes that pose lower overall risks to human health and the environment in this use and we are changing the listing of HFC-125 from acceptable to unacceptable.

For more information on the environmental and health properties of the different aerosol substitutes, please see the proposed rule at 79 FR 46,137-46,138 and a technical support document that provides the additional *Federal Register* citations (EPA, 2015d) in the docket.

b) When will the listings change?

On or after January 1, 2016, aerosol products may not be manufactured with HFC-125 and on or after [insert date one year after publication in the Federal Register], aerosol products may not be manufactured with HFC-134a or HFC-227ea, or blends thereof except for the specific uses allowed under the use conditions. In addition, as of January 1, 2018, HFC-134a will be unacceptable for certain uses, and aerosol products for those uses may not be manufactured with HFC-134a as of that date:

- products for which new formulations require U.S. federal government review, including: EPA pesticide registration, military or space agency specifications, and FDA approval (aside from MDIs); and
- products for functional testing of smoke detectors.

In the case of HFC-125, EPA is unaware of any products using HFC-125, and no public commenters mentioned the existence of such products or requested a date other than the proposed date of January 1, 2016.

We are setting **[insert date one year after publication in the Federal Register]**, as the date on which the status of HFC-134a, HFC-227ea, and blends thereof will change to unacceptable, or to acceptable, subject to use conditions, for certain specific uses. For those uses

that would no longer be allowed as of **[insert date one year after publication in the Federal Register]**, this timeframe will allow formulators and packagers of aerosols to make the necessary changes. (ICF, 2014a; Honeywell, 2014a). A number of formulators have already been testing, and in many cases introducing, new formulations with alternatives that remain listed acceptable. This timing will provide affected aerosol manufacturers and packagers sufficient time to change and test formulations and, to the extent necessary, to change the equipment in their factories.

For two aerosol uses, continued use of HFC-134a will be allowed under the use conditions until January 1, 2018. EPA is providing this longer transition time for these two uses because of additional safety precautions and approvals outside of the control of the aerosol formulator that must be addressed before transitioning. The first category is those that must undergo specific federal governmental reviews: EPA pesticide registration under the Federal Insecticide, Fungicide, and Rodenticide Act, military or space agency specifications, and FDA approval. The second category is aerosol products for functional testing of smoke detectors, which have National Fire Protection Association (NFPA) 72 requirements adopted in building codes. These types of aerosols must be tested not only for performance but also reviewed by third parties for compliance with regulatory or code requirements or military specifications. Given both the safety implications of insufficient testing and the additional time required for third-party testing and/or governmental approval that is not required for other aerosol formulations, we have determined that alternatives that reduce overall risk will not be available for these uses until January 1, 2018.

As of the change of status dates, products cannot be manufactured with HFC-134a or HFC-227ea or blends thereof except for the aerosol product types that are listed under the use conditions. Products manufactured prior to the change of status date may still be sold, imported,

exported, and used by the end-user after that date. As discussed below in the responses to comment, restricting use of aerosols by the end-user, as well as restricting the sale of previously manufactured aerosols, may disrupt the market and may not result in environmental benefits.

3. How is EPA responding to comments about this end-use?

a) Timeline

Comment: EPA received comments from a number of commenters on the status change date of HFC-134a, HFC-227ea, and HFC-125 as an aerosol propellant. Members of the aerosol industry proposed alternate years ranging from 2018 to 2021, always in reference to HFC-134a or to "technical" aerosols. Reasons provided for these dates included aligning with the European Union's (EU) timeline of January 1, 2018; a need for at least one to two more years to complete reformulation and all testing required; and additional time of two to five years to complete approval processes: e.g., Underwriters Laboratories (UL) approvals to meet NFPA requirements, EPA pesticide registration or testing for conformance with military specifications. Members of the aerosol industry also suggested that January 1, 2016, is too soon to transition away from HFC-134a because of the need for coordination with other regulatory requirements, because of business considerations including the timing of the need for budgeting for capital expenditures, developing and implementing worker education, negotiating contracts between aerosol formulators and retailers, and for technical reasons such as stability issues with HFO-1234ze(E), one of the alternatives that remains acceptable for use. NRDC and IGSD stated that EPA must maintain its 2016 timeline for transition to ensure that important climate reductions are realized.

Response: In determining when alternatives that reduce overall risk will be available for use, EPA considers technical constraints on the use of other alternatives, including when other alternatives may be used consistent with safety requirements. Unlike some end-uses, such as

some of the refrigeration end-uses, there are a much wider variety of uses with a much broader range of considerations under the aerosol propellant end-use. While there are exceptions, as we address in this action, for most of these wide-ranging uses, we do not anticipate significant hurdles to transitioning to alternatives. Based on information provided by the manufacturer of HFO-1234ze(E), a number of their customers have been able to develop and introduce aerosol products using HFO-1234ze(E) in a matter of months rather than years. Except in limited cases, as discussed below, commenters requesting a longer transition period did not provide concrete support for why more time for specific uses is needed, resting only on general statements that time is needed for "formulation" and "testing." Based on the information available showing that manufacturers have been able to transition relatively quickly, but also recognizing that there may be some variation in the time needed for specific uses, we are establishing a change of status date of **[insert date one year after publication in the Federal Register]**–roughly seven months later than the proposed date of January 1, 2016. This will allow approximately one year from the time this rule is issued in which manufacturers should be able to address their generalized testing and reformulation concerns. Also, HFC-134a remains acceptable, subject to use conditions, for many uses, reducing the number of products for which companies must reformulate, test, and transition to other alternatives.

For certain aerosol products using HFC-134a that must go through a federal government or other third-party approval process for new formulations, we are establishing a change of status date of January 1, 2018. These products include those needing EPA pesticide registration, testing to U.S. military or space agency specifications, and FDA approval (aside from MDIs). In addition, we are establishing a change of status date of January 1, 2018, for a product that requires extensive testing to NFPA standards, specifically for smoke detector functional testing.

Based on information received during the public comment period, we have determined that for these specific uses, alternatives that pose less risk are not available until these testing and registration processes are complete.

EPA disagrees that we should align the timelines in this rule with the EU timelines. The EU regulations rely upon different authority than the SNAP program, and reflect the European context. We believe it is appropriate for EPA decisions to base timelines upon when alternatives that reduce overall risk are available in the United States.

Comment: National Aerosol Association (NAA), Radiator Specialty Company (RSC), LPS Laboratories, Consumer Specialty Products Association (CSPA), and Aeropres commented that there is currently no industry consensus on the safe handling of HFO-1234ze(E) (and "any alternative products") in aerosol plants. CSPA states that the CSPA Aerosol Propellants Safety Manual will need to be updated to include new propellants like HFO-1234ze(E), and that the consensus guidelines will then be used to assure that fire and building codes are updated to properly cover new propellants. The commenter also states that while they seek consensus on updating their safety manual, companies are able to proceed using the guidance provided by the supplier, but many CSPA members prefer to await industry consensus standards. LPS Laboratories comments that applicable codes need to be updated before other alternatives can be used and suggests that a January 1, 2018, date for listing HFC-134a as unacceptable is more appropriate.

Response: In the absence of industry consensus guidance, a number of aerosol formulators are already manufacturing products safely using HFO-1234ze(E) relying upon safety guidelines developed by the chemical producer. No commenters raised, and we are unaware of, any specific safety concerns that are not addressed in this guidance issued by the chemical

producer. CSPA mentioned updating fire and building codes using the consensus guidelines, but did not state how these are related and also indicated that some companies have been able to move ahead without updates to fire and building codes based upon the guidance. For that reason, we do not believe there is a basis for determining that HFO-1234ze(E) is not available for safe use until January 1, 2018, as suggested by commenters.

b) Sell-through period

Comment: Honeywell stated that there should be a limited sell-through period to prevent stranded inventories for aerosol products, while avoiding delays in the transition to low-GWP substitutes. The commenter suggested that EPA prohibit the sale, import and export of aerosol products manufactured with unacceptable substitutes by no later than January 1, 2017. The commenter also suggested that the sell-through period should apply only to products that were manufactured prior to January 1, 2016, and that have entered the distribution channel.

Response: EPA disagrees with the commenter's suggestion that a limited sell-through period would be sufficient. Based on past experience with implementing a limited sell-through period for certain kinds of aerosols containing CFCs and with implementing an unlimited sell-through period for other aerosols, we found that a limited sell-through can result in market disruption and can strand inventory. Further, a limited sell-through period does not necessarily preclude emissions of HFCs to the environment because while manufacturers and distributors would need to dispose of stranded inventory, there is no current requirement prohibiting venting of the contents to the atmosphere (unlike for refrigeration or MVAC). In this rule, we allow new cars or new stand-alone refrigeration equipment manufactured with HFC-134a before the change of status date to be used and serviced after the change of status date to avoid market disruption, creation of stranded inventory, and perverse incentives for releasing refrigerant to the

environment; a closely analogous treatment for aerosols is to allow manufacturers and distributors to sell and end users to use aerosol products manufactured before the relevant change of status date. Finally, because of the relatively short period from issuance of EPA's final rule to the compliance date, we do not expect that there will be a large accumulation of inventory. Accordingly, this rule allows for an unlimited sell-through and use period for covered aerosol products manufactured before the change of status date.

c) Use conditions

Comment: Honeywell, the producer of HFO-1234ze(E), stated that there are either commercially available products or shelf-ready products that have not yet been commercialized that do not contain HFC-134a for some of the uses for which EPA proposed to change the status of HFC-134a, to acceptable, subject to use conditions, including cleaning products for electronics, sprays for aircraft maintenance, and dusters.

Response: EPA agrees, and we note that the uses identified in the use conditions encompass a variety of highly specific uses. While products without one of these substitutes or a blend of these substitutes might be used in one specific use, this does not hold true for the entire range of uses in the use category. In particular, this is the case for uses where flammability is of concern, such as for electronics cleaning and specialty dusters that are used on high-voltage equipment. In the future, additional testing may indicate that other alternatives, such as HFO-1234ze(E), can be used safely even under conditions where flammability is of concern, but the information available to date is not currently sufficient. Thus, we agree with other commenters from the aerosol industry, such as CSPA, that HFC-134a continues to be necessary in specific uses where other alternatives that pose less overall risk to human health and the environment are not available.

Comment: Arkema asked whether EPA is proposing that HFC-227ea continue to be acceptable for MDIs because of "the volumes or a record of unique suitability for a particular purpose," when HFC-134a might pose lower overall risk compared to HFC-227ea, since its GWP is less than half that of HFC-227ea.

Response: Arkema's comment seems to suggest that we should list HFC-227ea as unacceptable for use in MDIs, because it has a higher GWP than HFC-134a; we disagree. Although the GWP for HFC-227ea is significantly higher than that for HFC-134a, our understanding is that there are technical reasons why HFC-134a may not perform adequately as a propellant in MDIs using certain kinds of medications. For example, because some medications could react or degrade in the presence of moisture, and water is much more soluble in HFC-134a than in HFC-227ea, further technical work is needed to determine if HFC-134a is able to serve as a propellant in all MDIs. Currently, it is our understanding that for those types of medications, there are no alternatives to HFC-227ea that pose lower overall risk to human health and the environment.

Comment: The International Pharmaceutical Aerosol Consortium (IPAC) and Mexichem Fluor, Inc. (Mexichem) suggested using the same language for the listing for MDIs for HFC-227ea as for HFC-134a. IPAC, Mexichem, and King & Spaulding suggested revising the language to apply to a wider group of medical uses, including the treatment of conditions or diseases of other organs (for example diabetes) where aerosols can be used for systemic delivery through the lung or nose, or that HFC-134a and HFC-227ea should be allowed for any medical MDI that has been FDA-approved regardless of disease condition treated. One of the commenters also stated it should be made clear that blends of HFC-134a and HFC-227ea are also acceptable for such use.

Response: EPA agrees with the commenters that the lists of medical conditions treated with MDIs should be consistent for HFC-134a and HFC-227ea. Additionally, we agree that the language should more clearly specify our intent, which is to cover all MDI uses for which FDA has approved HFC-134a, HFC-227ea, or blends of these HFCs. This would include the wider group of medical uses suggested by King & Spaulding, including the treatment of conditions or diseases of other organs (for example diabetes) where aerosols can be used for systemic delivery through the lung or nose. It is our understanding that HFC-134a and HFC-227ea are the only available alternatives for MDIs approved by FDA, with dry powder inhalers as an additional possible not-in-kind alternative in limited cases. Thus, we believe that there are no other alternatives available or potentially available for all MDIs approved by FDA that pose less risk overall to human health and the environment. We have revised the wording of the regulatory listing decision to make clear that the use condition for HFC-134a, HFC-227ea, and blends of HFC-134a and HFC-227ea applies to all MDIs approved by FDA.

Comment: HSI (Fire & Safety Group, LLC), Honeywell, DuPont, and EIA commented that there are available alternatives and there is sufficient supply of these alternatives to support EPA's proposed change of status decisions for the aerosol propellants end-use.

Response: EPA agrees with the commenters that, for the most part, there is a sufficient supply of alternatives that will support a transition away from the substitutes that we have concluded provide a greater risk to human health and the environment. However, as discussed in more detail above and in response to other comments, in some specific cases we received information that demonstrates the existence of technological challenges that support a later date for the change in status. In those cases, we are providing a later date.

Comment: Commenters in the aerosol industry commented on situations where some

alternatives other than HFC-134a are not effective or feasible. NAA commented that if CO_2 were feasible, it would already be used. LPS Laboratories commented that formulators must consider chemical compatibility with formulations; for example, CO_2 cannot be used with water-based formulations due to the formation of carbonic acid. LPS Laboratories commented that nitrogen has very limited uses due to its lack of solubility and the substantial pressure drop that occurs as the product is used.

Response: EPA recognizes that not all alternative propellants work in every particular formulation. The commenters have described specific situations where CO_2 and nitrogen may not be appropriate propellants. However, other alternatives are also listed as acceptable. HFO-1234ze(E) and HFC-152a have some physical similarities with HFC-134a and the commenters do not claim that these other alternatives are not available.

Comment: NRDC and IGSD urged the Agency to deny any requests in the aerosols sector for additional exemptions.

Response: EPA has considered the comments and information submitted during the comment period and is adding a limited number of uses to the use conditions that would allow continued use of HFC-134a, HFC-227ea, or blends thereof for the reasons provided elsewhere in this preamble.

Comment: Honeywell, NAA, and CSPA commented on the nonflammability of HFO-1234ze(E). NAA indicated that HFO-1234ze(E) was found to be nonflammable by a number of standard tests (e.g., ASTM E-681) and aerosol flammability test methods (e.g., flame extension, enclosed space ignition), as well as by a non-standard test including a test that found no ignition up to temperatures greater than 900 °F. Honeywell commented that while it is accurate to say that HFO-1234ze(E) may exhibit vapor flame limits at elevated temperatures, that is only one of

many properties that must be taken into consideration when characterizing HFO-1234ze(E) and its usefulness in formulating nonflammable aerosol products. This commenter also provided additional information about other tests on the flammability of HFO-1234ze(E). CSPA said that there is still some concern about the potential for flammability at higher ambient temperatures, and that CSPA member product marketers, formulators and manufacturers are working to assure that specific products in various categories can be formulated, manufactured and used safely and effectively.

Response: Based on the information available to EPA at this time, we agree that HFO-1234ze(E) is nonflammable in most situations that aerosols will be used. However, we have not seen results of testing that cover all of the types of products for which there are concerns about the need for a nonflammable aerosol propellant, such as aerosol products used on energized circuits or other electrical equipment. For other uses, where we have evidence of product-specific testing on HFO-1234ze(E) showing nonflammability (e.g., tire inflators), we have concluded that the flammability risks of HFO-1234ze(E) are not a significant concern.

Comment: Several commenters discussed flammability concerns for tire inflators, with some suggesting that they should be added as a use for which HFC-134a is acceptable, subject to use conditions, others suggesting a later change of status date, and others supporting the proposal. NAA and RSC stated that due to past accidents traced to flammability of tire inflators, it is necessary to test all aspects of the inflators to ensure that there are no flammability issues with HFO-1234ze(E). RSC and Honeywell commented on the specific testing required to ensure that new tire inflators using HFO-1234ze(E) are nonflammable, because of the possibility of ignition sources such as application of a torch to the rim of the tire or sparking from metal tools contacting a steel belt during tire repair. ITW Global Tire Repair commented that previous

Aerosol Tire Inflators were flammable and there were several accidents in which tire repair professionals were injured when a spark ignited the product. This commenter also stated that EPA should not dismiss the need for a nonflammable product because other aspects of motor vehicles are flammable; tires and wheels have not been designed and engineered to contain flammable products, unlike many other flammable products in motor vehicles. CSPA referred to a March, 1999 recall from the National Highway Traffic Safety Administration (NHTSA) recall for 32 million units of an aerosol tire inflator due to injuries caused by the product's flammability. Mexichem comments HFO-1234ze(E) requires further evaluation before implementation for emergency tire inflators and sealers because of its flammability and uncertainty regarding its compatibility with sealants. Honeywell, the manufacturer of HFO-1234ze(E), commented that third-party testing of aerosol tire inflators using HFO-1234ze(E) found them to be nonflammable.

Response: We acknowledge that there have been reports of accidents associated with use of flammable tire inflators in the past, particularly affecting tire repair professionals. Not all manufacturers of tire inflators agree that a nonflammable propellant is necessary, given there are tire inflators using hydrocarbons already on the market. Although HFO-1234ze(E) can ignite under higher temperature conditions using the standard test ASTM E 681, a relevant question is whether data indicate that an aerosol tire inflator using HFO-1234ze(E) would be flammable under the pressure, temperature, and likely ignition sources specific to this use. This will ensure a relevant risk comparison and will not compare to other flammable substances used in other parts of a motor vehicle. One manufacturer of aerosol tire inflators has tested a formulation using HFO-1234ze(E) and has found it is nonflammable under the conditions that exist for use of a tire inflator (RSC, 2014). Therefore, other alternatives are available besides HFC-134a that

sufficiently mitigate flammability risks for this use. Concerning RSC's suggestion for a change of status date of January 1, 2018, to give sufficient time for additional testing, the commenter provided insufficient information on the types of testing or timeframes involved to warrant providing additional time. Further, in this final rule, we are providing roughly an additional seven months beyond the date in the proposal to meet commenters' general comments about requiring additional time for testing. Based on the information available, HFO-1234ze(E) is an option that other manufacturers of aerosol tire inflators are using to formulate products that are not flammable under the conditions expected for that use.

Comment: Commenters from the aerosol industry requested that EPA include additional uses for which HFC-134a is acceptable, subject to use conditions. These uses include certain aerosols used for testing smoke detector sensitivity and "emergency safety horns exclusively used for marine emergency situations and/or industrial emergencies and evacuations." Reasons cited include allowing time for developing and approving new smoke detector sensitivity testing equipment and the need for nonflammability because emergency safety horns function where flames or other ignition sources are present. An environmental group states that it disagrees with comments that request continued use of HFC-134a in freeze sprays, tissue freezes, portable safety horns and personal defense sprays, as these applications can use other lower-GWP alternatives such as dimethyl ether, HFO-1234ze(E), and CO_2.

Response: For aerosols used for smoke detector sensitivity testing, EPA received information from a manufacturer of such products that this use requires redesign of equipment for testing smoke detectors, and not just reformulation of the aerosol. This information indicates that the equipment for such testing is designed based on the vapor pressure of HFC-134a and would not work with another propellant. Therefore, we are adding aerosols for sensitivity testing

of smoke detectors to the list of use conditions.

For portable safety horns, personal defense sprays, and freeze sprays for wastes (as opposed to electronic freeze sprays), there are other alternatives that are available or potentially available that reduce overall risk to human health and the environment. Products using HFO-1234ze(E) already exist or are in development for these uses. EPA received no information indicating that alternatives other than HFC-125, HFC-134a or HFC-227ea, or blends thereof, cannot be safely used in tissue freeze sprays.

Comment: ITW Polymers Sealants requested that EPA either clarify that canister adhesives and sealants are not considered to be aerosols, or else that EPA add this use to the list of use conditions for HFC-134a. ITW Polymers Sealants provided information indicating that flammability of the propellant is of concern in the fabrication facilities with this use, and that use of hydrocarbon propellants would exceed VOC limits set for these products in many areas of the country. The commenter also indicated that HFO-1234ze(E), CO_2, and N_2, the only other propellants that would address flammability concerns for this use besides HFC-134a, have vapor pressures outside of the range that would provide sufficient performance. In the absence of sufficient vapor pressure, as with HFO-1234ze(E), the commenter claims that there will be performance problems such as lower bond strength or bumps and mounds in furniture surfaces; with the higher pressure propellants N_2 and CO_2, the commenter states that these will result in exceeding Department of Transportation internal pressure limits at elevated temperatures.

Response: We do consider canister adhesives and sealants to be aerosols because they are pressurized containers and they use a propellant, as opposed to solely mechanical means, to expel the other ingredients of the formulation from the container. The information provided by the commenter on vapor pressure concerns is plausible, based on the relative vapor pressures of

the different propellants. It is possible for fabrication facilities to use flammable adhesives and propellants safely, but it would require time to make the necessary upgrades to address these risks. It is also of concern that in VOC nonattainment areas, large amounts of hydrocarbons in these large canister adhesive containers would cause canister adhesives and sealants to exceed their VOC limits. Of the available propellant options that are not VOC or are exempted from the definition of VOC—HFC-134a, HFO-1234ze(E), CO_2, and N_2—to date, only HFC-134a has been shown to be in a pressure range that provides sufficient performance. Thus, it is likely that HFC-134a is the only available propellant for canister adhesives and sealants in many areas of the country. Therefore, this final rule adds adhesives and sealants in large canisters to the list of uses where HFC-134a is acceptable, subject to use conditions.

Comment: A number of members of the aerosol industry requested that EPA consider adding aerosols for use on energized electrical equipment as a use for which HFC-134a is acceptable, subject to use conditions. Specific products mentioned include dusters for use on live electric circuits, contact cleaners for energized circuits, mold cleaners, and electronic freeze sprays.

Response: EPA agrees that, given the high temperatures and high electrical energy present on energized electrical equipment, it is necessary to retain the option of a propellant that remains nonflammable at high temperatures. As described elsewhere in the preamble, compressed gases such as CO_2 and N_2 may be nonflammable but are not appropriate in some situations, due to pressure drop-off and reactions with other formulation ingredients. HFO-1234ze(E) is nonflammable in many situations, but it is not yet clear if it remains nonflammable in the presence of the high temperatures and high electrical energy in the specific uses mentioned by the commenters. If additional information becomes available showing that HFO-1234ze(E)

remains nonflammable in such situations, we may revisit this decision in the future. In this final rule, we are adding mold cleaners, electronic freeze sprays, and dusters for use on energized electrical circuits to the list of aerosol products that may continue to use HFC-134a under the use conditions. We consider electrical contact cleaners for energized electrical equipment to be part of the use "cleaning products for removal of grease, flux and other soils from electrical equipment or electronics" and therefore covered by the use condition.

Comment: MicroCare, a company specializing in cleaning, and Traulsen, a manufacturer of commercial refrigeration equipment, request that refrigeration system flushes be added to the use condition specifying which end-uses may still use HFC-134a. They explain that after removing refrigerant and flushing any oils or particulates left, the lines are brazed, soldered or welded back together at high temperatures well above the level at which HFO-1234ze(E) becomes flammable (e.g., above 1,995 °C).

CSPA stated that it should be clarified that "Cleaning products for removal of grease, flux, and other soils from electrical equipment or electronics" includes cleaners for refrigeration coils because of similar requirements for nonflammability. NAA stated that its members did not reach consensus on whether refrigerant flushes should be added to the acceptable list. This commenter states that it is common practice in the industry to remove flushing agents from lines and blowing them dry with nitrogen or compressed air after flushing, which eliminates risks posed by welding lines after flushing.

Response: Because of the extremely high temperatures cited by MicroCare and Traulsen that may be present in a refrigerant line after flushing, EPA agrees that it is necessary to have a nonflammable propellant available for refrigerant flushes. The term "refrigerant flushes" also refers to cleaners for refrigerant coils. Although nitrogen can be used to purge refrigerant lines to

remove refrigerant flushes prior to brazing or welding, it is not clear that this is a universal practice in the industry. Therefore, we are adding refrigerant flushes to the use condition specifying uses that may continue to use HFC-134a.

Comment: SAE International and Alliance of Automobile Manufacturers (AAM) commented that there are aerosol products available for servicing MVAC systems which contain additives in a can propelled by HFC-134a which the commenters believe should be acceptable, subject to use conditions. The commenters stated that the use of propellants other than HFC-134a could cause technical problems, could contaminate refrigerant so that EPA-approved Recovery, Recycling and Recharging (RRR) equipment cannot be used, or could be incompatible with SAE standards if the propellant goes into the MVAC systems.

Response: EPA considers an aerosol can containing HFC-134a used to recharge an MVAC system to fall under the MVAC end-use and not the aerosol propellant end-use. Under the SNAP lists for the MVAC end-use, HFC-134a remains an acceptable substitute for servicing existing systems. An aerosol can containing HFC-134a refrigerant and oil or leak sealant, which is used to inject oil or repair leaks and to then recharge MVAC systems, would also fit in the MVAC end-use and remains acceptable for use on existing systems. These cans must have the unique fittings required by SNAP for HFC-134a as a motor vehicle air conditioner refrigerant. However, an aerosol can primarily intended to inject additives, e.g., dye, rather than to add HFC-134a as a refrigerant would be considered an aerosol, and use of HFC-134a as the propellant would not be allowed as of [**insert date one year after publication in the Federal Register**], under this final rule. We do not consider this type of product to fit under the commenter's request for products for servicing. Further, we disagree with the commenter that it is necessary to have a propellant that is the same as the refrigerant used in MVAC. We note that in the future, HFO-

1234yf or other refrigerant substitutes will be used as a refrigerant in many vehicles; thus, in the future, automotive products will need to be formulated to include propellants other than HFC-134a, as well as formulated with propellants that are different from the refrigerant used in the MVAC system.

Comment: DuPont recommended that EPA establish use conditions rather than narrowed use limits in implementing any changes of status for HFCs used in aerosols. The commenter stated that acceptable conditions of use are a relatively straightforward, self-implementing regulatory approach that would limit the burden on aerosol companies, most of which are small businesses, in complying with the changed status. DuPont commented that narrowed use limits are a much more administratively intensive approach for both the Agency and the regulated community, and would impose significant burdens on these small businesses, as well as on EPA.

Response: We agree with the commenter that narrowed use limits are more administratively burdensome. We are establishing use conditions in the final rule.

d) HFC consumption and climate impact of aerosols

Comment: DuPont, Mexichem and the Consumer Specialty Products Association (CSPA) commented on the relatively small contribution of non-medical aerosols to HFC consumption, stating that it represents between 1 and 2% of all HFC consumption. A producer of tire inflators noted that tire inflators make up less than 0.2% of the current use of HFC-134a. Mexichem stated that the continued availability of HFC-134a for the small businesses and consumers that produce/rely on aerosol products, will make no appreciable difference to EPA's goal of reducing GHG emissions, because aerosol products account for only five percent of total HFC consumption, and of that portion, only 24% serve non-medical purposes. This commenter suggested that EPA should accommodate these uses through exemptions or a delay in the "de-

listing" of HFC-134a. In contrast, Honeywell mentions that its new technologies in the aerosol sector could reduce GHG emissions by more than 6 $MMTCO_2eq$ per year in 2016.

Response: EPA agrees that the aerosol sector comprises a small portion of the total consumption of HFCs. However, we disagree that we should not change the status of HFCs for the aerosol propellant end-use because GHG emissions from that end-use are small. We note that any given end-use within the 50-some SNAP end-uses may be relatively small compared to the whole. Section 612(c) of the CAA directs EPA to publish lists of substitutes prohibited for specific uses and safe alternatives for specific uses. Thus, we make our decision by considering the overall risk to human health and the environment posed by the available or potentially available substitutes within each end-use, rather than comparing risks in different end-uses to each other. We disagree with the commenter's suggestion that EPA provide a later change of status date for aerosol uses because of their relatively low GHG emissions. Instead, EPA considers the time in which alternatives are available for use, which involves the feasibility of implementing alternatives with lower overall impacts on human health and the environment. EPA appreciates the information provided by one commenter that indicates that for the aerosol sector, the change in status for HFC-134a, HFC-227ea, and HFC-125 could reduce GHG emissions by more than 6 $MMTCO_2eq$ per year.

e) Small business impacts

Comment: Falcon Safety Products comments that they transitioned from HCFCs to HFCs in 1993, after which it began transitioning from HFC-134a (with a GWP of 1,430) to HFC-152a (with a GWP of 124) in compressed gas dusters, at a significant cost to its company, in terms of retooling and installing new gas tanks and filing lines. Falcon Safety Products supports the EPA's high-GWP emissions reduction efforts, but believes that they should not negatively

impact small businesses or have a detrimental impact on the safety, affordability, or efficacy of its product categories. Falcon Safety Products comments that transitioning to HFO-1234ze(E) is very expensive for small businesses like itself, in terms of changing tanks, filling lines, and revising labels and marketing materials.

Response: EPA did not propose and is not finalizing a change in status for HFC-152a in aerosols. See preamble section V.A.3 for EPA's status changes for HFCs in the aerosols sector, and supporting document Economic Impact Screening Analysis for Regulatory Options to Change Listing Status of High-GWP Alternatives (ICF, 2014f; ICF, 2015b).

f) Imports

Comment: CSPA expressed concern about noncomplying products from offshore, which they state has been a large problem in the past. CSPA stated that for retail products, more time is needed to adjust contracts and to work with EPA to ensure that CSPA member complying products are not displaced by non-complying products from offshore.

Response: For aerosol products, the rule applies to imported products as well as to manufacture of products in the United States. By providing a full year after finalization of the rule before a change of status is required for the HFCs covered by this action known to be in current use for aerosol product manufacture, there is now additional time to adjust contracts and work with retailers. EPA welcomes the suggestion that we should work together with the aerosol industry and retailers to avoid sale of non-complying products that might be imported.

B. MVAC systems for newly manufactured light-duty motor vehicles

1. Background

MVAC systems cool passenger cars, light-duty trucks, buses, and rail vehicles. CFC-12 was the refrigerant historically used in the manufacture of MVAC systems. HFC-134a, along

with a number of other substitutes, was found acceptable for use in light-duty vehicles in 1994 and at the same time, CFC-12 was being phased out of production. By the mid-1990s, use of CFC-12 in manufacturing new light-duty vehicles ceased in the United States and manufacturers of light-duty vehicles uniformly decided to adopt HFC-134a for use in MVAC. Today, while MVAC systems in some older vehicles may still be using CFC-12, HFC-134a remains the dominant refrigerant used in light-duty vehicles worldwide. More recently, additional alternatives for MVAC have been listed as acceptable, subject to use conditions,[31] including HFO-1234yf, HFC-152a, and carbon dioxide (CO_2 or R-744). Manufacturers are currently manufacturing or are actively developing light-duty models using HFO-1234yf, HFC-152a, and CO_2. The development of MVAC systems using lower-GWP refrigerants has been encouraged by MVAC refrigerant requirements in Europe, where the European Union Directive on Mobile Air Conditioning (MAC Directive) mandates transition to a refrigerant with a GWP below 150 by January 1, 2017,[32] and in the United States by the availability of credits under the Light-Duty Greenhouse Gas (LD GHG) Rule, described in further detail below.

Neither HFC-134a nor any of the refrigerants listed more recently is ozone-depleting. HFO-1234yf, HFC-152a, and CO_2 have much lower GWPs than HFC-134a. HFO-1234yf has a GWP of 4, HFC-152a has a GWP of 124, and CO_2 (by definition) has a GWP of 1 while HFC-134a has a GWP of 1,430. HFC-134a and CO_2 are nonflammable; HFO-1234yf and HFC-152a are flammable. All of the gaseous refrigerants can cause asphyxiation at high concentrations. CO_2 concentrations that could potentially result from refrigerant leaks into the passenger compartment without mitigation measures could reduce a driver's attentiveness and

[31] Listed at 40 CFR part 82, subpart G.
[32] Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 (EU MAC Directive). This document is accessible at: *eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0040:EN:HTML*.

performance. HFC-134a and the three lower-GWP alternatives are exempt from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the national ambient air quality standards. As discussed in the NPRM, EPA has created use conditions for HFC-134a, HFO-1234yf, HFC-152a, and CO_2 that establish unique fittings and labeling requirements, and where appropriate, mitigate flammability and toxicity risks.

HFO-1234yf is being used in cars on the road today in the United States. At the time of the proposal for this rule, EPA was aware that HFO-1234yf was in use in MVAC systems in approximately nine[33] models in the United States produced by several manufacturers of light-duty vehicles. EPA expects, and several commenters indicated that, additional models have or will be introduced using HFO-1234yf systems over the next several years. The results of a 2014 industry survey submitted by AAM and the Association of Global Automakers (Global Automakers) as a public comment to this rule found that automobile manufacturers who responded to the survey had plans in place to transition 90% of light-duty models sold in the United States by or before MY 2021.[34] According to comments submitted by Honeywell, there are approximately 28 different automobile brands selling around 60 different models designed to use HFO-1234yf globally.[35] DuPont stated that more than 7 million vehicles using HFO-1234yf are estimated to be on the road by the end of 2015 globally, and in addition to infrastructure being in place at vehicle assembly plants, equipment suppliers are already producing the under

[33] Nelson, 2013. Gabe Nelson. Automakers' switch to new refrigerant will accelerate with EPA credits, European mandate. Automotive News. Available online at *www.autonews.com/article/20131230/OEM01/312309996/warming-to-the-idea.*
[34] EPA-HQ-OAR-2014-0198-0207 and EPA-HQ-OAR-2014-0198-0113
[35] EPA-HQ-OAR-2014-0198-0170

hood, in factory, and service equipment.[36]

While EPA was aware in the 1990s that CO_2 might be a feasible alternative in this application, the state of research and development indicated that it was not yet available because a design had not yet been developed that would allow safe use in MVAC systems in light-duty vehicles. More than 20 years later, EPA is still not aware of current commercial use of CO_2 in MVAC systems. However, significant research and development are occurring in order to design a system that will ensure CO_2 can be used safely as an MVAC refrigerant. At least one global manufacturer of light-duty vehicles has announced its intention to commercialize vehicles that use CO_2 as the MVAC refrigerant in the next five years, and perhaps as early as 2016.[37]

In 2008, EPA found HFC-152a acceptable subject to use conditions. MVAC systems using HFC-152a have not been commercialized to date; however, EPA is aware of a demonstration project in India with a major Indian motor vehicle manufacturer considering HFC-152a in secondary loop MVAC systems. [38]

In addition to the use and development of HFO-1234yf, HFC-152a, and CO_2 MVAC systems, EPA is aware of ongoing research and development which could ultimately result in future listings of additional alternatives for light-duty MVAC systems. For example, since the publication of the proposed rule, the SNAP program received a new submission for another low-GWP alternative that is a blend with a GWP below 150.

There are also several blend refrigerants that have been listed as acceptable or acceptable,

[36] EPA-HQ-OAR-2014-0198-0077
[37] Daimler, 2014.
[38] Andersen et al., 2015. "Secondary Loop Motor Vehicle Air Conditioning Systems (SL---MACs). Using Low-Global Warming Potential (GWP) Refrigerants in Leak-Tight Systems In Climates with High Fuel Prices and Long, Hot and Humid Cooling Seasons. Building on the Previous Success of Delphi, Fiat, General Motors, Volvo, Red Dot, SAE Cooperative Research Projects, And Other Engineering Groups." MACS Briefing, 2015.

subject to use conditions, since 1994, but that have never been developed for use in MVAC or used in manufacture of new vehicles. Today's action will change the status of these refrigerant blends to unacceptable as of MY 2017 for use in newly manufactured light-duty vehicles. These substitutes include HFC blends SP34E and R-426A (also known as RS-24) with GWPs of 1,380 and 1,508, respectively, and the HCFC blends, R-416A (also known as HCFC Blend Beta or FRIGC FR12), R-406A, R-414A (also known as HCFC Blend Xi or GHG-X4), R-414B (also known as HCFC Blend Omicron), HCFC Blend Delta (also known as Free Zone), Freeze 12, GHG-X5, and HCFC Blend Lambda (also known as GHG-HP), with GWPs ranging from 1,480 to 2,340 and ODPs ranging from 0.012 to 0.056. For simplicity, we refer to these substitutes as "the refrigerant blends" in the following discussion.

As noted above, none of these are currently used by the original equipment manufacturers (OEMs) nor are we aware that any models are being developed for use with these substitutes. All of these refrigerant blends have GWPs that are significantly higher than the GWPs for HFO-1234yf, HFC-152a, and CO_2 and the blends containing HCFCs have ODPs ranging from 0.012 to 0.056. As discussed, there are alternatives with lower overall risk to human health and the environment that are available for this use.

2. What is EPA finalizing regarding MVAC systems for newly manufactured light-duty motor vehicles?

The change of status determinations for MVAC are summarized in the following table:

Table 3. Change of Status Decisions for MVAC

End-use	Substitutes	Decision

Motor vehicle air conditioning (new equipment in passenger cars and light-duty trucks only)	HFC-134a	Unacceptable as of Model Year (MY) 2021, except where allowed under a narrowed use limit through MY 2025. Acceptable, subject to narrowed use limits, for vehicles exported to countries with insufficient servicing infrastructure to support other alternatives, for MY 2021 through MY 2025; Unacceptable for all newly manufactured vehicles as of MY 2026.
Motor vehicle air conditioning (new equipment in passenger cars and light-duty trucks only)	R-406A, R-414A (HCFC Blend Xi, GHG-X4), R-414B (HCFC Blend Omicron), HCFC Blend Delta (Free Zone), Freeze 12, GHG-X5, HCFC Blend Lambda (GHG-HP), R-416A (FRIGC FR-12, HCFC Blend Beta), SP34E, R-426A (RS-24, new formulation)	Unacceptable as of MY 2017

a) HFC-134a

In the August 6, 2014, proposal, EPA proposed to change the listing status of HFC-134a from acceptable to unacceptable for use in air conditioning systems in newly manufactured passenger cars and light-duty trucks beginning in MY 2021.[39] This final action adopts the proposed approach, but with one exception. Specifically, we are including a narrowed use limit for HFC-134a in MVAC systems of newly manufactured passenger cars and light-duty trucks destined for use in countries that do not have infrastructure in place for servicing with other acceptable refrigerants. This narrowed use limit will be in place through MY 2025.

This change of status applies to MVAC systems for passenger cars and light-duty trucks as defined at 40 CFR 86.1803-01, referred to jointly in this FRM as light-duty vehicles. As discussed in the NPRM and above, three alternatives currently on the SNAP list of substitutes

[39]Because the MVAC system used is so closely related to vehicle design, we are using model years and not calendar years.

that are acceptable, subject to use conditions—HFC-152a, CO_2, and HFO-1234yf—are in use or under various stages of development and have significantly lower GWPs than HFC-134a. Use conditions for these substitutes mitigate flammability and toxicity risks, as relevant, and thus for the other factors EPA evaluates, there was not an appreciable difference in risk. Because HFC-134a has a significantly higher GWP than HFC-152a, CO_2, and HFO-1234yf, and because the use conditions for these three refrigerants ensure that other risks are not appreciably higher than for HFC-134a, we are listing HFC-134a as unacceptable for use in MVAC systems in new light-duty vehicles in MY 2021.

Without the use conditions these other substitutes do not pose overall lower risk than HFC-134a. Thus, in deciding when the unacceptability determination should apply, we considered when it would be feasible for manufacturers to develop systems meeting the use conditions. We proposed MY 2021 while also requesting comment on MY 2017, MY 2019 and MYs later than 2021. As explained in the NPRM, EPA considers MY 2021 the date by which automobile manufacturers will be able to redesign all vehicle models (including design of the MVAC systems) for use with a lower-GWP alternative, consistent with the use conditions.

EPA previously considered the model year by which manufacturers of light-duty vehicles would be able to transition away from use of HFC-134a in support of the greenhouse gas and fuel economy standards for MY 2017-2025 light-duty vehicles issued jointly by EPA and NHTSA on August 28, 2012.[40] As part of that rulemaking, EPA established the availability of credits for the use of alternative refrigerants with lower GWPs than that of HFC-134a towards meeting the LD GHG standards. For today's action, EPA relied on the analysis conducted in

[40] 77 FR 62,624, 62,807-810 (October 15, 2012); see also 75 FR 25,325, 25,431-32 (May 7, 2010) (discussing the same issue for MY 2012-2016 light-duty vehicles)

support of the LD GHG standards for MYs 2017-2025. The analysis considered the practices used by the automobile manufacturing industry in introducing new technologies into their vehicles through manufacturing redesign changes and refresh cycles. For each vehicle model, manufacturers establish a product development cycle over which they plan any significant technological changes or "redesigns" to that vehicle. Between the major redesign model years, they may make only minor "refresh" changes.[41] At any point in time, a manufacturer may have some vehicles at or approaching a major redesign point and others that are earlier in their product cycle.

In developing the LD GHG standards, EPA assumed that the transition to alternative refrigerants would generally need to occur during manufacturer model redesigns because of changes to the system design that are needed to allow the safe use of these alternatives consistent with the regulatory use conditions.[42] EPA used the overall typical industry redesign cycle of five model years to estimate how the expected industry-wide transition to new refrigerants might occur. Thus, EPA projected that the industry, in order to safely make use of the credits offered for use of lower-GWP refrigerants, would fully transition to these refrigerants over the time between MY 2017 and MY 2021, beginning with 20 percent transition in MY 2017, to be followed by a 20 percent increase in substitution in each subsequent model year, completing transition in MY 2021.[43] EPA continues to rely on the projections made in support of the LD GHG Rule as well as all other information currently available to the Agency to support the

[41] See 77 FR 62,712 and 75 FR 25,407, 25,451 for a more detailed discussion of this practice.[42] As previously noted, HFO-1234yf, CO_2 and HFC-152a are all listed as acceptable subject to use conditions and many of the use conditions address the design of systems to account for flammability or exposure.
[42] As previously noted, HFO-1234yf, CO_2 and HFC-152a are all listed as acceptable subject to use conditions and many of the use conditions address the design of systems to account for flammability or exposure.
[43] 77 FR 62,720

decision in this action that MY 2021 is the MY by which it will be feasible for manufacturers to safely, but expeditiously, transition MVAC systems for all light-duty vehicle models.

EPA proposed to modify the listing of HFC-134a to unacceptable as of MY 2021 for light-duty vehicles, and sought comment on MYs 2017, 2019, and MYs later than 2021. Some commenters argued that full transition cannot occur until after MY 2021 because a limited number of models do not currently have plans in place to transition by MY 2021. For these models, commenters claimed that two full design cycles, which could take 10 years, will be necessary in order to transition. Commenters also provided information that the vehicle redesign is not "locked-in" until two years before the model year. EPA understands that because MY 2016 vehicles are being produced in the 2015 calendar year, this means most manufacturers have "locked-in" their planned product designs for MY 2016 and MY 2017, or potentially even out to MY 2018.[44] EPA did not receive information on why manufacturers cannot redesign models that are not yet locked-in or why MVAC system redesign cannot occur during a product refresh for those models that are locked-in. According to the 2014 survey of the automobile industry, manufacturers who participated in the study indicated that they already expect to have transitioned 90% of the fleet by MY 2021. We did not receive any information indicating it was not technically feasible to also transition the remaining 10% of models by MY 2021.

EPA expressly requested specific information supporting claims that a transition by MY 2021 would not be technically feasible because specific model vehicles cannot be redesigned to safely use alternative refrigerants by MY 2021. No such information was forthcoming. Although

[44] Global Automakers, in their comments on the NPRM, stated, "These major model re-designs typically occur every five or six model years, and are staggered year-by-year so that the manufacturer's full product line is refreshed over time rather than all at once. Because of the need to lock in suppliers to support production well in advance, vehicle designs are usually locked in about two years before the model year." EPA-HQ-OAR-2014-0198-0207

one manufacturer did provide information on the increase in cost to transition for a particular type of vehicle that was originally not planned for a refrigerant change by MY 2021,[45] commenters did not submit specific information, confidential or otherwise, that showed it would not be technically feasible for any specific model vehicles to adjust their redesign cycle, switch refrigerants mid-cycle, or switch during a refresh. After thoroughly reviewing all of the information in the possession of the Agency, EPA did not find a technical basis for extending the change of status date beyond MY 2021. We believe the information in the record supports a conclusion that it is feasible for vehicles and the associated MVAC systems to be redesigned to safely use alternative refrigerants by MY 2021.

EPA also received comments on this rule requesting an earlier change of status date based on the availability of alternative refrigerants and the fact that transition is already occurring in the United States and globally. The available information indicated that many of the models that have already transitioned are being sold in Europe rather than in the United States. There is no information showing that it is technically feasible for all or most models to transition to alternatives safely by MY 2017 or MY 2019, which begin in 2016 and 2018 respectively. As discussed below in the responses to comments, MY 2021 is the earliest year that we find provides sufficient time to transition refrigerant during vehicle redesign cycles or to plan a mid-cycle transition to alternatives that ensures safety through compliance with SNAP use conditions.

We also considered the supply of the alternative refrigerants in determining when alternatives would be available. At the time the light-duty GHG rule was promulgated, there was a concern about the potential supply of HFO-1234yf. Some commenters indicated that supply is

[45] As explained in more detail in the responses to comments, under the SNAP criteria for review in 40 CFR 82.180(a)(7), the only cost information that EPA considers as part of its SNAP review is the "cost and availability of the substitute."

still a concern, while others, including two producers of HFO-1234yf, commented that there will be sufficient supply. Moreover, some automotive manufacturers are developing systems that can safely use other substitutes, including CO_2, for which there is not a supply concern for the refrigerant. If some global light-duty motor vehicle manufacturers use CO_2 or another acceptable alternative, additional volumes of HFO-1234yf that would have been used by those manufacturers will then become available. Based on all of the information before the Agency, EPA believes production plans for the refrigerants are in place to make available sufficient supply no later than MY 2021 to meet current and projected demand domestically as well as abroad, including, but not limited to, the EU.

Based on information the Agency possessed at the time of the proposal and additional information submitted during the comment period regarding the technical feasibility of transitioning the fleet of light-duty vehicles and refrigerant supply, we conclude that MY 2021 represents the time by which other alternative refrigerants that pose less overall risk than HFC-134a can be used in all light-duty vehicle models consistent with the use conditions. Thus, MY 2021 is the time at which those alternative refrigerants will be "available" within the meaning of CAA section 612(c)(2).

b) Refrigerant blends

In today's action, EPA is also finalizing changes to the listing status of SP34E, R-426A, R-416A, R-406A, R-414A (also known as HCFC Blend Xi or GHG-X4), R-414B (also known as HCFC Blend Omicron), HCFC Blend Delta (also known as Free Zone), Freeze 12, GHG-X5, and HCFC Blend Lambda (also known as GHG-HP) from acceptable to unacceptable for use in newly manufactured light-duty motor vehicles beginning in MY 2017, as proposed. The GWPs of HFC-152a, HFO-1234yf, and CO_2 are significantly lower than those of the refrigerant blends

and all but two of these blends have ODPs, whereas HFC-152a, HFO-1234yf, and CO_2 do not. Moreover, if used consistent with the established use conditions, the three lower-GWP refrigerants do not pose greater overall risk than any of the refrigerant blends. At the time of the proposal, EPA was not aware of current or projected future use of these refrigerant blends in any MVAC systems in newly manufactured light-duty vehicles. We did not receive any comments providing information suggesting current or projected use of these refrigerant blends in any newly-manufactured light-duty MVAC systems and received several comments supporting this aspect of the proposal. EPA is changing the listing status for the refrigerant blends to unacceptable for use in new light-duty vehicles as of MY 2017, the next model year in production after this rule is issued.

3. MVAC servicing

EPA did not propose and is not making any changes that would alter the ability to service existing motor vehicles designed to use HFC-134a or a refrigerant blend.[46]

MVAC systems designed to use lower-GWP substitutes and installed in vehicles will need to be serviced. Some stakeholders and commenters have expressed a concern that the price differential between HFO-1234yf and HFC-134a provides an economic incentive to replace HFO-1234yf with HFC-134a during servicing.[47] HFC-134a is listed, and will remain listed, as an acceptable refrigerant for retrofit of existing systems designed to use CFC-12, but because of the use restrictions for refrigerants listed as acceptable, it cannot be used as a retrofit for MVAC systems using other alternatives. Specifically, the SNAP listings for all MVAC refrigerants require the use of unique fittings for each alternative refrigerant. These fittings are found at

[46] EPA is also clarifying that thermostatic expansion valves (TXVs) are not impacted by today's action.
[47] See also 77 FR 62,807.

attachment points on the car itself, on all recovery and recycling equipment, on can taps and other charging equipment, and on all refrigerant containers. The purpose of these fittings is to prevent cross-contamination. Using an adapter or deliberately modifying a fitting to use a different refrigerant is a violation of these use conditions. If used properly, the unique fittings will not allow for the introduction of HFC-134a refrigerant to an HFO-1234yf system. Furthermore, the SNAP regulations prohibit using a substitute refrigerant to 'top-off' a system that uses another refrigerant and the SNAP use conditions for refrigerants in this end-use require that the original refrigerant be recovered, in accordance with regulations issued under section 609 of the CAA, prior to charging with a substitute (40 CFR 82.34). Thus, the SNAP use conditions prohibit adding a new refrigerant to the system without first recovering the refrigerant already in the system.

For vehicles for which the manufacturer counts air conditioning credits toward its LD GHG compliance, the MVAC systems (or elements of those systems) are considered emission-related components as defined in 40 CFR 86.1803. This designation includes provisions for emission-related warranty, requirements that they operate properly for the specified useful life, as well as tampering restrictions. For example, if a manufacturer claims air conditioning credits for an MVAC system that uses a lower-GWP refrigerant on a particular vehicle as part of the LD GHG program, removing and replacing that refrigerant with any other refrigerant that has a higher GWP, including HFC-134a, would be considered tampering with an emission-related component under Title II of the CAA.

4. Would this action affect EPA's LD GHG Rule?

In their comments, AAM stated that "EPA should state clearly and unequivocally in the final rule that EPA is committed to continuing the A/C credits through MY 2025 and beyond."

Global Automakers made a similar request. EPA in fact stated in the NPRM, and reiterates here, that nothing in this final rule changes the regulations establishing the availability of air conditioning refrigerant credits under the GHG standards for MY 2017-2025, found at 40 CFR 86.1865-12 and 1867-12. Those standards and credits are established by rule and EPA did not reopen that rule in this proceeding. Thus, manufacturers can generate credits from use of lower-GWP alternative refrigerants through MY 2025, and the ability to generate and use those credits towards compliance with the LD GHG standards will not change under this final rule. [48] We do note further, however, that the LD GHG standards do not require any specific means of compliance, so that manufacturers have the flexibility to either switch refrigerants or to comply with the standards by other means. If a manufacturer chooses to comply with the LD GHG standard by a strategy not involving refrigerant substitution, for MY 2021 and later vehicles, this final rule would still require the manufacturer to use refrigerant other than HFC-134a.

5. How will the change of status apply to exports of MVAC systems?

a) SNAP interpretation

Under 40 CFR 82.174, no person may introduce a refrigerant substitute into interstate commerce without notifying EPA 90 days in advance. Our longstanding interpretation of this regulatory provision is that the notification requirement applies to products manufactured in the United States and exported. EPA has defined interstate commerce in our labeling regulations at 40 CFR 82.104(n) as: "The distribution or transportation of any product between one state, territory, possession or the District of Columbia, and another state, territory, possession or the District of Columbia, or the sale, use or manufacture of any product in more than one state, territory, possession or the District of Columbia. The entry points for which the product is

[48] See 77 FR 62,804-809.

introduced into interstate commerce are the release of a product from the facility in which the product was manufactured, the entry into a warehouse from which the domestic manufacturer releases the product for sale or distribution, and at the site of United States Customs clearance." While this definition appears in EPA's labeling regulations, EPA's practice is to use it for purposes of the SNAP program as well. See e.g., 76 FR 78,846, December 20, 2011 ("This definition applies to any appliances produced in the United States, including appliances that will be exported.")

In addition, under the SNAP regulations EPA regulates "use" in the United States and "use" is defined at 40 CFR 82.172 to include "use in a manufacturing process or product, in consumption by the end user, or in intermediate uses, such as formulation or packaging for other subsequent uses." Charging a MVAC system with refrigerant during the manufacturing of a vehicle in the United States is considered a "use" under the SNAP program. This is consistent with our statement in the initial SNAP rule that "Substitutes manufactured within the U.S. exclusively for export are subject to SNAP since the definition of use in the rule includes use in the manufacturing process, which occurs within the United States." (59 FR 13,052; March 18, 1994)

b) Narrowed use limit for MVAC

Based on comments received, we understand that certain countries to which vehicles are exported do not, and may not for some period of time, have in place the infrastructure for servicing MVAC systems with flammable refrigerants. Because this raises concerns with the safe usage of HFC-152a and HFO-1234yf, we have determined that there may be circumstances in which alternatives that pose lower overall risk to human health and the environment will not be available for MVAC systems in those vehicles by MY 2021. Therefore, EPA is providing a

narrowed use limit for MVAC systems that applies to vehicles being exported to countries that do not have infrastructure to service vehicles containing the alternatives found to pose less overall risk.

Under a narrowed use limit, the manufacturer needs to ascertain that these other alternatives are not technically feasible because of the lack of infrastructure for servicing with the alternative refrigerants and document the results of their analysis. See 40 CFR 82.180(b)(3). Users are not required to report the results of their investigations to EPA, but must retain the documentation in their files for the purpose of demonstrating compliance.

Documentation should include descriptions of:

- Products in which the substitute is needed;
- Substitutes examined and rejected for the destined country;
- Reason for rejection of other alternatives; and
- Anticipated date other substitutes will be available and projected time for switching.

Based on the comments received, EPA does not anticipate that a significant number of countries will lack the necessary infrastructure needed to service MVAC systems with the alternatives for which the equipment is designed by MY 2021. Also, based on the comments received, we do not believe that an extensive additional amount of time will be needed before the necessary infrastructure is in place. Therefore, under this final rule, the narrowed use limit will no longer be available beginning with MY 2026 vehicles.

6. How is EPA responding to comments concerning this end-use?

a) Timeline

Comment: EPA received several comments on the current and projected pace of adoption of alternative refrigerants. Several commenters stated that transition to HFO-1234yf is already

occurring. Honeywell commented that there are approximately 28 different automobile brands selling around 60 different models designed to use HFO-1234yf globally and that more than a dozen models are being manufactured by U.S. manufacturers. Other commenters provided similar statistics. One of these commenters, DuPont, estimated that globally, more than 7 million vehicles using alternatives other than HFC-134a will be on the road by the end of 2015. They also commented that in addition to infrastructure being in place at vehicle assembly plants, equipment suppliers are already producing the under-hood, in-factory, and service equipment necessary for the transition.

AAM and Global Automakers "conducted an industry survey to create a 'non-confidential' blinded summary of individual manufacturer refrigerant changeover plans."[49] Ten automobile manufacturers, representing 85% of light-duty vehicles sold in the United States in MY 2013, submitted information. The survey found that out of 139 vehicle platforms, manufacturers currently plan to transition 90% of the models by MY 2021.

Response: EPA recognizes some manufacturers have already transitioned to use of HFO-1234yf in a limited number of models. In the United States the transition began in a small number of MY 2013 vehicles, and increased in MY 2014[50] and MY 2015. As of the beginning of 2015, the U.S. fleet was continuing on a trajectory that we expect to achieve 20% adoption by MY 2017, which aligns with EPA's projection in the supporting documents for the light-duty GHG rule.[51] While adoption is occurring in the United States, most of the estimated 7 million vehicles mentioned by DuPont are in Europe where the EU MAC Directive mandates transition to refrigerant with a GWP below 150 by January 1, 2017.

[49] EPA-HQ-OAR-2014-0198-0207 and EPA-HQ-OAR-2014-0198-0113
[50] Nelson, 2013
[51] 77 FR 62,720

The Agency recognizes and appreciates the factual information supplied by the commenters, including the information shared as a result of the 2014 industry-led survey conducted by AAM and Global Automakers. EPA's responses to the comments submitted by AAM and Global Automakers within the context of the survey are provided below. EPA relied on all of the information in our possession as we made our decision on the change of status for HFC-134a.

Comment: Several commenters noted that the transition from CFC-12 to HFC-134a was achieved in about three to four model years and claimed that the transition from HFC-134a to lower-GWP alternatives could also happen in the same timeframe.

Response: Regarding the comments suggesting that the current transition could occur in a similar period of time to the transition from CFC-12 to HFC-134a for MVAC, EPA disagrees because the system changes required for this transition are more extensive than those required for the transition from CFC-12 to HFC-134a. It is EPA's understanding, as confirmed by comments, such as those from the automobile associations, that many models will need to transition during a redesign cycle.

EPA understands that many model types will require hardware changes that normally occur during a redesign, unlike the transition from CFC-12 to HFC-134a. HFO-1234yf has a slightly lower cooling efficiency than that of HFC-134a; offsetting this efficiency difference usually requires hardware changes, specifically the incorporation of an internal heat exchanger and potentially other system adjustments, which in some cases could result in changes to overall air conditioning system design and layout. CO_2 MVAC systems will require significantly more hardware changes, which in many cases is expected to result in changes to the system design and layout. This transition contrasts with the case of the transition in the 1990s from CFC-12 to

HFC-134a, where the systems did not require changes to the components of the MVAC system, besides the fittings, allowing manufacturers to switch many vehicles mid-cycle. Some models were already being manufactured using HFC-134a as early as 1992, with a significant proportion already being manufactured with HFC-134a by the time that EPA listed it as acceptable in the initial SNAP rule (59 FR 13,044; March 18, 1994).

Comment: EPA received several comments related to the proposed time for changing the listing status of HFC-134a in MVAC. Several commenters support accelerating the proposed transition to earlier than MY 2021, and recommended implementation dates of MYs 2017, 2018, and 2019. Many cited the progression of transition in the EU, as well as the transition already seen in the United States as a result of EPA's LD GHG Rule in support of an earlier transition timeframe. Honeywell, a producer of HFO-1234yf, commented "that given manufacturers' experience in the EU and United States there is already an understanding and capability to transition vehicles for U.S. car production" and they recommended a transition date of MY 2018. DuPont, another producer of HFO-1234yf, stated "there are no technology, supply or engineering barriers to rapid transition" and recommended a transition date of MY 2019. EIA commented that there is no reason to delay the change in status and recommended MY 2017 as the implementation date. Two commenters, NRDC and IGSD, jointly commented that EPA should adopt MY 2017, a deadline that would be set based on the leaders in the industry that are already using safer chemicals, rather than the laggards. Effective Altruism at the University of Maryland commented that HFC-134a should be listed as unacceptable as of January 2017, and the California Air Resource Board (CARB) commented that MY 2018 is a reasonable timeframe for the unacceptable listing to apply.

Some commenters stated that aligning with the EU transition by January 1, 2017, will

signal to the international community that the United States is taking steps to "promote the rapid deployment of climate-friendly and safe alternatives in motor vehicle air conditioning" as agreed to in the Leaders' statement at the G-7 Summit in June 2014. Some commenters suggested an accelerated transition date is needed to achieve the President's environmental goals, and would have a significant trickle-down effect in other markets around the world, specifically commenting that selecting MY 2017 would encourage Japan to "set the same global motor vehicle air-conditioning phaseout schedule for HFC-134a." Also, NRDC and IGSD commented that "matching the MY 2017 European schedule is protecting against American automakers finding themselves unprepared when other markets close their doors to automobiles made with HFC-134a." Some commenters stated that the transition can be achieved by an earlier date and that greater environmental benefits would be achieved with an earlier transition. These commenters stated that MY 2021 would not provide benefits beyond those achieved under "business as usual."

Response: EPA agrees with the commenters that suggested that an earlier transition year would result in greater environmental benefits to the extent that it would result in earlier reduction of use of HFC-134a in MVAC. However, in considering whether other listed alternatives are available that pose lower overall risk, EPA needs to consider whether there are any technical challenges that would prevent use of those alternatives consistent with the use conditions which are necessary to ensure that they pose lower risk than HFC-134a. EPA does not agree that a safe, smooth transition in compliance with the use conditions required for the lower-GWP alternatives can be made for all vehicles prior to MY 2021 in the United States. This is based on the need to transition most vehicles during redesign cycles, which in many cases requires hardware changes, as discussed above. EPA has also considered the potential benefits to

aligning our domestic transition to the EU's, in light of the fact that the transition to MVAC systems using one of the three alternatives began earlier than we predicted, and in light of the adequate supply of alternatives. Based on our current understanding and the information provided by commenters, especially the automobile manufacturers, the Agency has concluded that MY 2021 is the earliest date by which all model vehicles can be safely transitioned to lower-GWP alternatives in accordance with the use conditions.

We note that even though we are establishing MY 2021 as the date by which HFC-134a will be unacceptable,[52] EPA expects health and safety benefits will be realized sooner, as manufacturers will be designing new models each year using lower-GWP refrigerants for MVAC. The benefits analysis provided with the NPRM (EPA, 2014) and the analysis associated with this final action (EPA, 2015b) use a "business as usual" scenario that assumes a transition in refrigerant for MVAC will occur for vehicles manufactured and sold in the United States, in order to be consistent with the LD GHG Rule, and that assumes no regulatory action, and thus no benefits, under SNAP. However, our analysis of the effects of a change of status for MVAC as of MY 2021 shows some benefits beyond the "business as usual" scenario, reflecting the use of lower-GWP refrigerants in exported vehicles.

While not relevant to EPA's decision regarding the appropriate date for changing the status of HFC-134a for use in MVAC, EPA also agrees its action to change the status of HFC-134a will send a valuable signal to the international community regarding the continued use of high-GWP alternatives.

[52] As noted elsewhere, we are creating a narrowed use limit for vehicles exported to countries without adequate facilities for servicing vehicles with the other acceptable alternatives.

Comment: NRDC and IGSD suggested that EPA set a status change date as of MY 2017, and address any sub-sectors that have problems meeting a transition date earlier than MY 2021 through a narrowed use limit. EIA recommended transition in MY 2017 and suggested EPA grant a limited exemption until MY 2021 for companies who publicly pledge to convert to CO_2 systems.

Response: EPA is not finalizing today's rule with a change of status for HFC-134a as of MY 2017, as recommended by these commenters. As discussed above, it is our understanding that because of the necessary changes to hardware, manufacturers will need to transition most vehicles during a redesign cycle. Although in some cases where less extensive hardware changes are required, it will be possible to transition mid-cycle, it is not reasonable to expect that most manufacturers will be able to do so. Achieving a transition by MY 2017, approximately one year from now, would not be feasible for any manufacturers that had not already started transition planning before issuance of the NPRM, and in such a circumstance, we do not consider it reasonable to require compliance based on actions that would have been necessary before issuance of the NPRM. Rather than setting a change of status date that we expect manufacturers may have difficulty meeting, we are setting the change of status date at the earliest model year by which the best information indicates that all model vehicles can be safely transitioned to lower-GWP alternatives in accordance with the use conditions.

Concerning EIA's suggestion for a limited exemption until MY 2021 for companies who publicly pledge to convert to CO_2 systems, because we have set MY 2021 as the status change date for all vehicles, there is no need for an exemption related to adoption of CO_2 MVAC systems.

Comment: A private citizen commented in support of a MY 2021 change of status.

Response: EPA is finalizing a MY 2021 transition date for the reasons previously stated.

Comment: Several commenters supported transition in MY 2025 or later, including AAM, Global Automakers, NADA and Mexichem. The majority of these commenters stated that reengineering and system design requirements for alternative refrigerants require significant lead time and necessitate transition during a vehicle redesign cycle. Commenters stated that two full design cycles lasting beyond MY 2021 may be necessary in order to complete the transition due to timing of publication of the proposed status change rule, and the relationship of that to where manufacturers are in the redesign cycle for each model. Global Automakers commented that the vehicle redesign cycle is usually locked in about two years before the model year. Commenters supporting a transition date of MY 2025 or later also commented that a later date would align with the existing LD GHG Rule with no measurable environmental impact at stake, and address supply concerns. With regard to the 10% of vehicle platforms identified in the 2014 industry survey as planning to transition after MY 2021, AAM, and Global Automakers commented that those are not all small volume platforms and the production will account for a small, but not insignificant percentage of production after MY 2021.

Response: Regarding comments by AAM, Global Automakers, and Mexichem suggesting that two full design cycles, extending past MY 2021, would be needed to transition all vehicle models to alternative refrigerants, the commenters failed to provide any specific, technical support for such a claim. EPA appreciates the submission of 2014 survey data indicating that automobile manufacturers have plans in place to transition 90% of vehicle models to alternative refrigerants by MY 2021. However, the commenters did not provide support or an explanation of why it will not be technically feasible to transition each of the remaining individual models by MY 2021. According to commenters, the vehicle redesign is locked in two

years before the model year; therefore, time still exists to make the necessary alterations to MY 2017, MY 2018 and later vehicles. While we believe it would be possible for the majority of models to transition by MY 2021 during a redesign cycle, EPA is aware that sometimes it is technically feasible to transition between redesign cycles during a mid-cycle redesign, or refresh. A manufacturer shared with EPA information claimed as confidential that more than one vehicle model in the United States has been transitioned to HFO-1234yf, in compliance with the SNAP use conditions, between scheduled redesign cycles. Although it would not be feasible to expect most models to transition mid-redesign cycle, for such a small number of models, this is likely to be feasible. EPA did not receive any information that provides specific and sufficient information to show that transition by MY 2021 is not technically feasible for any specific model vehicle. One automobile manufacturer provided information claimed as confidential concerning vehicles used for a specific purpose but did not provide sufficient justification that transition by MY 2021 was not feasible for technical reasons. EPA is aware of two automobile manufacturers that will have the majority of their U.S. fleet transitioned by MY 2016. EPA is also aware of several automobile manufacturers intending to transition all of their vehicle models by MY 2021.

While the AAM and Global Automakers survey does not indicate the impetus for the transition plans for the various manufacturers and models, EPA assumes the plans were adopted in response to the credits offered under EPA's LD GHG Rule. EPA further assumes these transition plans were based on strategic utilization of credits available under the rule as a flexibility measure, rather than technical feasibility of transition, and EPA did not receive any information to the contrary.

Comment: AAM stated that a MY 2025 transition date would accommodate "run-out" models. "Run-out" models are defined as models that, for a variety of reasons, will continue to

be produced and marketed without any updates to major vehicle sub-systems, including AC systems. Commenters indicated that to require an early end of production for such run-out models would increase the levels of stranded investment associated with ending the production of such models prematurely.

Response: Commenters did not indicate what portion of the vehicle models with current plans to transition in MYs after 2021 is made up of "run-out" models, if any, as compared to other models captured in the results of the industry survey. In the proposed rule, EPA requested comment on changing the status of HFC-134a in a MY later than 2021, "including specific information supporting claims that a transition by MY 2021 would not be technically feasible because specific model vehicles cannot be redesigned to safely use alternative refrigerants by MY 2021." EPA did not receive this type of information. EPA is not aware of any technical barriers that preclude transition of "run-out" models by MY 2021 given the time available between now and MY 2021 to implement a transition for these models.

Comment: Commenters indicated the challenges associated with designing MVAC systems to use alternative refrigerants, especially CO_2. AAM provided information on the hardware changes and component supply, as well as industry standards needed for MVAC systems to use CO_2. AAM commented that "a MY 2025 date would allow extra time for commercialization of CO_2 MVACs."

Response: EPA is aware that CO_2 systems require significantly more complex redesign and hardware development than HFO-1234yf systems, primarily because the operating pressures of these systems will be significantly higher than that of a HFC-134a system. Therefore, EPA understands that incorporation of CO_2 MVAC systems would most likely need to occur during product redesign, not product refresh. At least one manufacturer has stated that it plans on using

CO_2 systems. These systems are currently in prototype phase, and we understand that there may be significant technical hurdles yet to overcome. However, those pursuing this option have announced plans to introduce cars in Europe with CO_2 MVAC systems as early as MY 2017. This timing allows for several years after initial deployment of these systems for automobile manufacturers to redesign models prior to the MY 2021 date in the United States.

Given the transition plans in place, EPA disagrees that other alternatives, including CO_2, cannot be used consistent with the use conditions by MY 2021. However, even if a particular alternative could not be used in some or any vehicles consistent with the use conditions by MY 2021, for the reasons already provided, we have determined that other alternatives can be safely used consistent with the use conditions by MY 2021. Because alternatives that pose lower risk than HFC-134a will be available by MY 2021, we do not believe there is a basis for selecting a later date for changing the status of HFC-134a.

Comment: AAM raised concerns about the transition of manufacturing facilities and the need to modify or upgrade refrigerant storage facilities and charging stations on assembly lines. Also, the commenters stated that because many manufacturing facilities produce multiple vehicle models, some plants may not have the space necessary to accommodate infrastructure for both refrigerants.

Response: EPA understands that there are challenges associated with transitioning refrigerants. EPA is also aware that prior to issuance of the NPRM, manufacturers were planning a gradual, model-by-model transition, in which some models would be filled with HFC-134a while others are filled with HFO-1234yf or another alternative refrigerant at the same plant.

Comment: In the proposed rule EPA requested specific information supporting claims that a transition by MY 2021 would not be technically feasible because specific model vehicles

cannot be redesigned to safely use alternative refrigerants by MY 2021. AAM commented stating that "EPA did not properly consider confidentially submitted information that alternatives will not be available until after MY 2021."

Response: EPA has considered information provided to the Agency and claimed as confidential as support for this and other decisions that are part of this action. As described elsewhere in this section, EPA did not receive sufficient information, whether claimed confidential or not, to conclude that other alternatives cannot be used consistent with their use conditions by MY 2021.

Comment: Many commenters provided comments about the impact the supply of acceptable alternatives could have on the timeline for transition. Several commenters believe there is enough supply of alternatives to transition prior to MY 2021.

The comments submitted by Honeywell and DuPont, current suppliers of HFO-1234yf, indicate that both companies are confident in their ability to supply enough HFO-1234yf to support a full transition by MY 2018 and MY 2019, respectively. According to comments submitted by Honeywell "there is one commercial scale HFO-1234yf production plant operating today in China, a second one is expected to be commissioned in the first half of 2015 in Japan via a strategic supply relationship between Honeywell and Asahi Glass Company Ltd, and a third world-scale plant will be commissioned by Honeywell by the end of 2016 in Geismar, Louisiana." DuPont submitted similar comments on announced or planned production capacity in Asia, the United States and Europe by multiple producers, including DuPont, Honeywell, and Asahi Glass Co. (AGC), indicating that production will begin in 2015-2017 at most of these facilities.

CARB commented that they understand that chemical manufacturers expect to be capable of providing a sufficient supply of HFO-1234yf for complete U.S. transition away from HFC-134a starting with MY 2018. In support of a MY 2017 transition date, NRDC and IGSD commented that the supply of alternatives (HFO-1234yf and others) is not a constraint; they believe EPA correctly recognizes that "production plans for the refrigerant appear to be in place to make it available in volumes that meet current and projected domestic auto industry demand."

Response: EPA appreciates information provided by commenters supporting EPA's understanding at the time of the proposal that sufficient supply will be available to support a transition in MY 2021. The companies producing HFO-1234yf commented that sufficient supplies should be available for MY 2018 or 2019, indicating that there will be sufficient supplies prior to MY 2021. In addition, the commenter submitted additional information to the Agency that they claimed as confidential and that further supports that adequate supply will be available by MY 2021.

Comment: Several commenters supported MY 2025 or later, expressing concerns about ongoing uncertainty in sufficient supply of HFO-1234yf for a full U.S. transition by MY 2021 due to limited production, as well as lack of competition, artificial constraints, and other factors. Arkema commented that they estimate the global demand for HFO-1234yf in 2021 will be around 45,000 metric tons and they believe Honeywell and DuPont will only be able to supply half that amount. Arkema commented that the supply shortage would cause a serious dislocation in supply and demand (i.e., willing buyers would be unable to find willing sellers of HFO-1234yf) and having only two suppliers would create highly restricted competitive conditions. Arkema also commented that the manufacturer has not publicly announced production capacities for the coming years and EPA has not provided reliable evidence, and none exists, that adequate

volumes of HFO-1234yf are or will be available to "meet current and projected domestic auto industry demand." Global Automakers commented that it is too soon to conclude that there will be adequate supplies of alternative refrigerants to meet U.S. demand as well as other possible demands for alternative refrigerants worldwide by MY 2021.

*Respons*e: Based on EPA's understanding of refrigerant supply at the time of the proposed rule, the information received from commenters in response to the proposed rule, and information claimed as confidential and provided during meetings, EPA remains confident that sufficient supply of alternatives will exist to transition MVAC systems in all new light-duty vehicles manufactured in the United States by MY 2021. EPA is fully aware of delays with the launch of some production facilities prior to the implementation of the European Union regulations. However, EPA notes that those facilities are now online and are producing supplies well in excess of what is needed to meet EU demand. They are not currently operating at full capacity. Moreover, Honeywell and DuPont, two producers of HFO-1234yf, provided information regarding plans to launch additional facilities, one of which will be a joint effort between Honeywell and a third chemical manufacturer, AGC.[53] For these reasons, EPA does not agree with commenters that there will be an insufficient supply of alternatives by MY 2021. Further, EPA is also aware of public announcements by Arkema indicating planned production in 2017 of HFO-1234yf.[54]

[53] AGC, 2014. "AGC to Supply Honeywell with HFO-1234yf—New-generation Automobile Refrigerant," 23 January 2014. This document is accessible at: *https://www.agc.com/english/news/2014/0123e.pdf.*
[54] Arkema, 2013. "Arkema is announcing the construction of production capacities for new refrigerant fluorinated gas 1234yf," September 4, 2013. This document is accessible at: *www.arkema.com/en/media/news/news-details/Arkema-is-announcing-the-construction-of-production-capacities-for-new-refrigerant-fluorinated-gas-1234yf/?back=true*.

Comment: Commenters indicated concern because available supply of HFO-1234yf will need to go to Europe for the January 1, 2017, transition before automobile manufacturers will have access to supply to transition in the United States. These commenters believe a MY 2025 or later transition date would allow sufficient time to alleviate supply concerns.

Response: EPA does not agree that the January 1, 2017, transition in the EU will limit supply in the United States. The SNAP transition date is several years after the transition in the EU will be complete and, as noted above, the manufacturers of HFO-1234yf have provided information supporting that supply will be adequate by MY 2021. EPA does acknowledge that supply in the United States would likely not be adequate by MY 2017. The main suppliers of HFO-1234yf stated as much in their comments.

Comment: Mexichem commented that the "pending re-examination proceedings involving sham patents registered by Honeywell, continue to be a barrier to the effective development of HFO-1234yf." Arkema commented that EPA overlooks the considerable efforts that Honeywell has undertaken to maintain its exclusive control over the manufacture of HFO-1234yf. Arkema commented that "Although legal proceedings and investigations regarding Honeywell and DuPont's exclusive control of HFO-1234yf are underway at the European Commission, the Federal Trade Commission, the U.S. Patent & Trademark Office, and elsewhere, those proceedings and investigations are not yet resolved." Arkema stated that "until those investigations are resolved, Honeywell and DuPont will control the manufacture of HFO-1234yf and will impose restrictive supply conditions, all with the apparent *de facto* endorsement of the EPA in violation of the Sixth Principle to "not endorse products manufactured by specific companies". Arkema adds that this will slow the transition to HFO-1234yf and add to its cost.

Response: EPA is aware that proceedings and investigations are occurring related to the

patents on HFO-1234yf; however, EPA is not involved and cannot comment on these proceedings. EPA believes that based on the information available today, sufficient supply will be available of HFO-1234yf for a full transition in MY 2021 for new light-duty MVAC systems even if all manufacturers choose to use HFO-1234yf. Regarding the comment that this action is in violation of the "Sixth Principle," we disagree that EPA endorsed HFO-1234yf or the companies producing it by its inclusion on the list of acceptable substitutes for the MVAC end-use at issue in this action. HFO-1234yf is one of three acceptable lower-GWP alternatives and EPA does not believe it is appropriate to assume manufacturers will use only HFO-1234yf. In addition to HFO-1234yf, CO_2 and HFC-152a are listed as acceptable and the manufacturers can choose which substitute they wish to use in their product. EPA does not recommend or require the use of a specific refrigerant and does not endorse products manufactured by specific companies. At least one global motor vehicle manufacturer has announced plans to have cars with MVAC systems using CO_2 on the road in Europe by MY 2017; we are not aware of any reason why such models would not be introduced into the United States by MY 2021. EPA is also aware of a demonstration project planned by a major Indian motor vehicle manufacturer considering HFC-152a and HFO-1234yf in MVAC systems using secondary loops (Andersen et al., 2015). As noted elsewhere in this final action, EPA is aware of ongoing research and development which could ultimately result in future listings of additional alternatives and notes that since the issuance of the proposal the Agency received a submission for one additional MVAC alternative.

b) Interaction with EPA's LD GHG Rule

Comment: EPA received several comments related to the interaction of this rulemaking with EPA's LD GHG Standards. Commenters requesting a MY 2025 or later transition,

including AAM, Global Automakers, the National Automobile Dealers Association (NADA), and Mexichem, commented that the later date would preserve the integrity and commitments made under the GHG program, preserve the compliance flexibilities granted to automakers and provide the same environmental benefits. Commenters stated that a MY 2025 transition allows for full compliance flexibility, in addition to credits, allotted to manufacturers in the vehicle GHG rulemakings throughout MYs 2012-2025. AAM requested that EPA "state clearly and unequivocally that EPA is committed to continuing the A/C credits through MY 2025 and beyond" and asked EPA to include this certainty in the regulatory text of the final SNAP rule and not just in the preamble.

Response: Nothing in this final rule changes the regulations establishing the availability of air conditioning refrigerant credits under the GHG standards for MY 2017-2025, found at 40 CFR 86.1865-12 and 1867-12. The stringency of the standards remains unchanged. As stated above, manufacturers may still generate and utilize credits for substitution of HFC-134a through the 2025 model year. Further, this final rule is also not in conflict with the Supplemental Notice of Intent (76 FR 48,758, August 9, 2011) that described plans for EPA and NHTSA's joint proposal for model years 2017-2025, since EPA's GHG program continues to provide the level of air conditioning credits available to manufacturers as specified in that Notice. Specifically, the Supplemental Notice of Intent states that "(m)anufacturers will be able to earn credits for improvements in air conditioning … systems, both for efficiency improvements…and for leakage or alternative, lower-GWP refrigerants used (reduces [HFC] emissions)." 76 FR at 487,613. These credits remain available under the light-duty program at the level specified in the Supplemental Notice of Intent, and using the same demonstration mechanisms set forth in that Notice. Moreover, the supporting assessment for this rulemaking is consistent with the

assumptions set forth in the 2017-2025 LD GHG Rule that automakers would switch to lower-GWP refrigerants by MY 2021. Indeed, the standards' stringency was predicated on 100% substitution beginning in MY 2021.[55]

We are not adding a statement to the regulatory text in the final SNAP rule. As noted in the preamble to the proposed rule, and reiterated here: "The light duty standards do provide that manufacturers can generate credits from use of alternative refrigerants with lower GWPs than that of HFC-134a through MY 2025, and the ability to generate and use those credits towards compliance with the light duty standards will not change if this action is finalized as proposed." (79 FR 46,142)

c) Environmental impacts

Comment: Several commenters addressed the climate impacts of the proposed HFC-134a unacceptability determination for MVAC. The vast majority of commenters on this section of the rule support a transition to climate-friendly alternatives in MVAC due to HFC-134a's high global warming potential. Several commenters supporting transition prior to MY 2021 related these impacts to the proposed timeline for the transition and we addressed those comments above (e.g., that if an earlier change of status date were adopted, there would be additional environmental benefits). Commenters requesting a transition date of MY 2025 or later commented that the environmental benefits of a delayed change of status date will be substantially the same as a MY 2021 transition because the majority of vehicles will transition by MY 2021 as a result of the LD GHG Rule. These commenters stated that any benefits of a MY 2021 or earlier transition may be averaged out against tailpipe emissions, and could result in automobile manufacturers slowing other fleet GHG reductions. DuPont commented that it is

[55] See *id.* at 62,779/2; see also *id.* at 62,778/2 and 62,805/3.

unlikely that any additional credits achieved under the LD GHG regulations from a MY 2019 transition date would be fully offset and instead there would likely be net additional CO_2 reductions over those achieved by current regulations. Arkema commented that there is no significant climate risk reduction to be had from any SNAP action on HFC-134a in the MVAC sector, and that no further control, beyond that imposed by the LD GHG Rule, is necessary.

Response: EPA anticipates that if a change of status date earlier than MY 2021 were shown to be feasible and thus were adopted, additional environmental benefits would be gained beyond those accounted for under EPA's analysis to support the LD GHG Rule.[56] In EPA's analysis of the environmental benefits associated with the proposed and final change of status rule, EPA assumed no environmental benefits from domestic transition of MVAC systems in light-duty vehicles given that the environmental benefits resulting from a full transition by MY 2021 were accounted for in the LD GHG Rule. The LD GHG Rule anticipated that transition for MVAC systems manufactured for use in the United States, while continuing to provide flexibility to manufacturers until MY 2025. This rule, however, ensures a complete transition away from HFC-134a by MY 2021 to a refrigerant that reduces the overall risks to human health and the environment for all MVAC systems manufactured in the United States, including those exported to other countries,[57] and those imported into the United States. The benefits analysis includes these benefits. Also, the analysis was updated to reflect the potential impact of the narrowed use limits in this final rule that allow continued use of HFC-134a for vehicles exported to countries with inadequate infrastructure to support safer alternatives. For additional

[56] See Chapter 7 of the Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, EPA-420-R-12-016, August 2012.
[57] Except those vehicles subject to the narrowed use limit.

information on environmental benefits analysis conducted for this rule, see the supporting document "Climate Benefits of the SNAP Program Status Change Rule" (EPA, 2014; EPA, 2015b).

Comment: Arkema commented that the NPRM deprives U.S. plants of existing global business in HFC-134a without yielding any environmental benefit. Arkema also noted that EPA said, as part of its regulations for HCFCs, that production of HCFC-22 for export from the U.S. might displace production in other countries that do not control their emissions as stringently as U.S. chemical producers. Arkema stated, "if U.S. production of HCFCs reduces overall environmental risks, then so does U.S. production of HFC-134a, and EPA should not be using the risk-based SNAP program to restrict auto exports."

Response: This rule does not directly regulate production of HFC-134a, unlike the rulemaking on the phaseout of HCFCs that Arkema cited; rather, we are regulating use of HFC-134a as a substitute in specific uses. Further, we disagree with Arkema's assertion that U.S. production of HFC-134a would potentially reduce overall environmental risks if U.S. production of HCFCs reduces environmental risks. EPA's HCFC allocation rule specifically mentioned that HCFC-22 production (and not production of HCFCs in general) results in byproduct emissions of HFC-23, a gas with a very high GWP of 14,800. The commenter has not provided any information indicating that emissions from production of HFC-134a, with a GWP of 1,430, or its byproducts would have a similar high environmental impact. We disagree with the commenter's assumptions as well as the conclusion that the SNAP program should not regulate exports of vehicles.

Comment: AAM stated that the MVAC-related climate benefits of this rulemaking have been incorrectly calculated and that "the environmental benefits of a MY 2025 change of listing

status date are substantially the same as in MY 2021 date." AAM also commented that the cessation of exports of vehicles containing HFC-134a to EU countries should not be included in the benefits calculation because the EU already prohibits the use of HFC-134a and that subtracting exports to EU countries and to Canada would reduce the climate benefit due to exports by half to 1 $MMTCO_2eq$.

Response: EPA directs commenters to the benefits analysis associated with the final rule and in particular to the anticipated long term change in the trajectory for high-GWP HFCs and alternatives. The benefits analysis is available in the docket and reflects the final decisions in this action. It has been updated since the issuance of the NPRM to reflect changes between the NPRM and the final rule. The benefits analysis for the final rule does not include vehicles sold into the EU or Canada, given the EU's existing F-gas regulations and MAC Directive, and for Canada, the relationship between their market and ours.

d) Cost impacts of rule

Comment: EPA received several comments concerning the cost impact of this rulemaking for the MVAC end-use. AAM, Global Automakers, and Mexichem commented that delaying transition to MY 2025 or later would avoid costs and engineering burdens on manufacturers resulting from making adjustments to their refrigerant change-over plans for both vehicles and manufacturing plants. NRDC and IGSD commented that a transition date of MY 2017 would align the U.S. and EU markets and erase these competitive disadvantages with minimal impact to industry. The Automotive Refrigeration Products Institute (ARPI) and Auto Care Association commented that a change from HFC-134a to lower-GWP refrigerants should not cause any substantial economic hardship to car owners. Additional comments relating to EPA's economic analysis are included in section VII.B of the preamble, "Cost and economic impacts of proposed

status changes."

Response: EPA understands that there are challenges associated with transitioning refrigerants, including costs to manufacturers in redesigning equipment and making changes to manufacturing facilities. However, as explained in more detail in the response to comments later in this preamble, under the SNAP criteria for review in 40 CFR 82.180(a)(7), consideration of cost is limited to cost of the substitute under review, and that consideration does not include the cost of transition when a substitute is found unacceptable. Moreover, we note that during model redesigns, many other engineering changes are being made and that changing the MVAC system during a planned redesign cycle could reduce costs when compared to MVAC system changes mid-redesign cycle. We anticipate that a change of status in MY 2021 will allow manufacturers to make changes to the MVAC systems for most vehicle models as part of the model redesign process.

Comment: A few commenters noted the high price of HFO-1234yf relative to HFC-134a. One commenter, referring to the NPRM, stated that EPA continues to believe that HFO-1234yf is unlikely to ever be as inexpensive as HFC-134a is currently. Commenters stated that the high price of HFO-1234yf is likely to slow the transition away from HFC-134a in the United States.

Response: As explained in more detail in the response to comments later in this preamble, under the SNAP criteria for review in 40 CFR 82.180(a)(7), the only cost information that EPA considers as part of its SNAP review is the cost of the substitute under review. As part of EPA's cost analysis conducted in support of this rulemaking, the potential costs to manufacturers were estimated based on per-system costs of alternative systems, as identified in EPA's report on *Global Mitigation of Non-CO_2 Greenhouse Gases: 2010-2030* (EPA, 2013a), and converted to 2013 dollars. The incremental per-system cost of an alternative MVAC system compared to an

HFC-134a system is estimated to be about $62/unit. EPA previously analyzed these costs in documents supporting the LD GHG Rule and in that analysis accounted for the cost of 100% of domestic vehicles to transition to use of HFO-1234yf by MY 2021. These incremental costs are less than 1% relative to the total direct manufacturing cost for a light-duty vehicle.[58] EPA does not believe an incremental cost of less than 1% of the total direct manufacturing cost will slow the transition away from HFC-134a. EPA understands that often new alternatives have higher initial costs, but this is not always true. In addition, over time the cost of the alternative often drops as demand and supply increase.

Comment: Global Automakers and AAM commented that if EPA includes exports in this regulation, EPA would be placing U.S.-based manufacturers of export vehicles at a competitive disadvantage compared to automakers producing vehicles outside of the United States. Global Automakers stated in their comment that "this rulemaking will unnecessarily cause substantial economic harm to the U.S. economy, U.S. jobs, and balance of payments if exports are included in the regulatory provisions." Arkema, Mexichem, and BMW also commented on the potential economic impacts of regulating exports.

Response: An inability to export vehicles manufactured with HFC-134a could be a competitive disadvantage in any countries where vehicles manufactured with other alternatives cannot be supported. However, as discussed above, the additional cost of a vehicle manufactured using an alternative (e.g., HFO-1234yf) is anticipated to be approximately $62 more per vehicle; this is not sufficient to create a competitive disadvantage in countries where both HFC-134a and

[58] Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA). 2012. Joint Technical Support Document: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards. August 2012. Available online at: http://www.epa.gov/otaq/climate/documents/420r12901.pdf.

other alternatives are supported. Further, EPA is providing a narrowed use limit in this final action that would allow vehicles destined for export to a country with insufficient infrastructure to be manufactured with HFC-134a through MY 2025. Thus, U.S. manufacturers should not experience a competitive disadvantage.

e) Servicing and retrofits

Comment: EPA received comments related to the continued servicing of MVAC systems manufactured to use HFC-134a. Two commenters support the continued acceptability of HFC-134a for servicing, and one commenter requests assurance that continued servicing will be permitted. ARPI and the Auto Care Association, representing the automotive aftermarket industry, jointly commented that they support the change of status of HFC-134a in MVAC provided that systems using replacement refrigerants are available at the time at a reasonable price and that the "phase out" does not adversely affect the use of HFC-134a in the millions of vehicles which will then still have MVAC systems designed for that refrigerant.

Response: EPA did not propose and is not finalizing a change of status for HFC-134a used for servicing MVAC systems designed to use HFC-134a. Thus, vehicles manufactured to use HFC-134a may, consistent with this rule, continue to be serviced with HFC-134a.

Comment: EPA received a comment requesting clarification on the ability to retrofit or service an HFO-1234yf system with HFC-134a.

Response: As discussed elsewhere in the preamble, the SNAP regulations include use conditions and other requirements that limit the ability to service an MVAC system designed to use an alternative with a refrigerant other than the one the system was designed to use. See section V.B.3 for a detailed description.

Also, as discussed in more detail in section V.B.3, for vehicles for which the

manufacturer counts air conditioning credits toward its LD GHG compliance, the MVAC systems (or elements of those systems) are considered emission-related components as defined in 40 CFR 86.1803. This designation includes provisions for emission-related warranty, requirements that they operate properly for the specified useful life, and tampering restrictions.

f. Refrigerant blends for retrofits of MVAC systems

Comment: Two commenters requested that EPA also list the refrigerant blends as unacceptable for use in retrofits in the final rule as well as in new equipment. SAE Interior Climate Control Committee (SAE ICCC), the leading standards writing body in the United States for MVAC, commented that they support the extension of the unacceptability finding to retrofits because they have never written any standards for these refrigerants. The other commenter, DuPont, recommended that because the refrigerants are not currently in use and it would be undesirable to have them used, EPA should also change the SNAP status for the blend refrigerants to unacceptable for retrofit (in addition to new) MVAC uses.

Response: EPA has not undertaken the full analysis necessary to determine whether to list these refrigerant blends as unacceptable for retrofits. Accordingly, EPA did not propose to find the refrigerant blends unacceptable for retrofits. Additional information, as well as an opportunity for public comment, would be necessary before we would be able to potentially find the refrigerant blends unacceptable for use in retrofits (e.g., information on the extent of use of the refrigerant blends). EPA appreciates the comments submitted on this topic and will take them into consideration when preparing additional status change rules.

g) Use conditions for HFC-134a

Comment: Arkema commented that it is “arbitrary and capricious” for EPA to find acceptable substances that could compete with HFC-134a in MVAC only because those other

substances are subject to use conditions, and then to find HFC-134a unacceptable based on comparisons to those other substances without considering any comparable use restriction on HFC-134a. The commenter referred to a discussion in the proposed rule concerning establishing charge limits through use conditions for a number of high GWP refrigerant blends for use in supermarket systems and condensing units as an example.

Response: EPA has not proposed additional use conditions for HFC-134a comparable to those for HFO-1234yf, HFC-152a, and CO_2 because the ways of addressing risks for these substitutes are not comparable. The use conditions unique to HFO-1234yf and HFC-152a address flammability risks through engineering strategies that will keep refrigerant concentrations below the lower flammability limit in each vehicle and by requiring labels providing information on the flammability risk. The use conditions unique to CO_2 address toxicity and consumer exposure risks through requiring engineering strategies that will keep refrigerant concentrations at safe levels in the passenger compartment of the vehicle. In contrast, the environmental risks from HFC-134a are due to the collective global impact of refrigerant emissions released over time from the entire automotive industry.

In past cases where the SNAP program has regulated other substitutes that posed high environmental risk due to collective global emissions, we have taken three different approaches. One approach has been to restrict the substitute to a niche use through a narrowed use limit, where it was particularly difficult to find any feasible substitute and the niche use was unlikely to result in significant total emissions (e.g., narrowed use limit on high-GWP fire suppressant SF_6 for use only as a discharge agent in military applications and in civilian aircraft at appendix B to 40 CFR part 82, subpart G). A similar approach has been to restrict the substitute through a narrowed use limit to use only "where other alternatives are not technically feasible due to

performance or safety requirements" (e.g., narrowed use limits on perfluorocarbon solvents for precision cleaning and C_6F_{14} as a total flooding agent for fire suppression at appendix A to 40 CFR part 82, subpart G). The third approach EPA has used to address environmental risks from global emissions of a substitute, and the only approach we have taken to date for such a substitute that is already widespread in industry, is to find the substitute unacceptable (e.g., HCFC-141b in solvent cleaning at appendix A to 40 CFR part 82, subpart G and HCFC-141b in foam blowing at appendix M to 40 CFR part 82, subpart G). MVAC is not a niche use, and there are clearly other technically feasible substitutes that will be available by the status change date specified in this final rule for use in vehicles that will be sold domestically, so it is not reasonable to provide a narrowed use limit for HFC-134a beyond that established in this final rule for export to nations with insufficient infrastructure for other alternatives.

Concerning Arkema's reference to a discussion on use conditions for charge size limits, we note that in the proposed rule we also stated, "However, given the high GWP of these refrigerants compared to other refrigerants that are available in these end-uses, we do not believe that use with a small charge size adequately addresses the greater risk they pose." This is even more so in MVAC than in commercial refrigeration products, due to the more widespread use of MVAC in hundreds of millions of vehicles and the greater difference in GWP between the unacceptable substitute and other, lower-GWP alternative, compared to supermarket systems and remote condensing units.

h) Flexibility for exports

Comment: NRDC, IGSD, and DuPont suggested that if EPA finalizes MY 2017 or MY 2019, respectively, EPA could consider narrowed use limits to address any sub-sectors that have problems meeting a transition date earlier than MY 2021, if, for example, the Agency believed

there was a basis to claims of country-specific performance barriers (e.g., due to high ambient temperatures) or lack of infrastructure for safer alternatives.

Response: As discussed further in this section, EPA has finalized a narrowed use limit for certain vehicles to be exported to countries that have not yet developed sufficient infrastructure for using safer alternatives. EPA has received no documentation supporting a narrowed use limit related to ambient temperature conditions, and therefore, has not included such a narrowed use limit in this final action.

Comment: EPA received comments from several commenters related to the servicing infrastructure for lower-GWP alternatives outside the United States. Some details are provided below and the remaining details can be found in the Response to Comments document. Arkema, Mexichem, BMW, AAM, and Global Automakers raised concerns including whether destinations for exported vehicles will have sufficient service sector support and refrigerant distribution networks for HFO-1234yf; and the ability to conform to SNAP use conditions, given the large proportion of automobiles manufactured in the U.S. for export (up to one-fourth). Commenters question whether the alternatives are truly "available" for use in export markets if there is a lack of service sector support and comment that this regulation could lead to manufacturers having to limit export production at U.S. assembly plants. Commenters are also concerned about the time needed to overcome regulatory and legislative barriers. AAM suggested that EPA designate certain export markets that can still receive U.S. exports of HFC-134a vehicles, which they believe currently should be all export markets except Canada and Europe.

In contrast, DuPont and Honeywell, manufacturers of HFO-1234yf, asserted that service supply follows demand and the equipment for low GWP refrigerant service is readily available.

These commenters stated that dealers and service shops can be expected to acquire the necessary equipment and materials to serve the market demand and that it is the responsibility of the vehicle manufacturer to ensure that their authorized dealers in those countries are able to provide all the necessary service to these exported cars under warranty. Honeywell and DuPont both stated that they have already developed an extensive network of distributors that are capable of supplying HFO-1234yf globally. DuPont stated that based on demand from the motor vehicle aftermarket, they have distribution covering more than 40 countries, 11 more than the combined EU member states and the United States, and including Saudi Arabia, Turkey, Israel and the United Arab Emirates.

Response: EPA is aware that many countries, in addition to Canada and those in the EU, already have servicing infrastructure in place, and anticipates that the number will grow by MY 2021. However, EPA also recognizes that there may be some markets where additional time may be needed to ensure servicing infrastructure is available. EPA is providing a narrowed use limit for HFC-134a in new MVAC systems destined for use in countries that do not have infrastructure in place for servicing with other acceptable refrigerants. This narrowed use limit will remain in place through MY 2025. The remaining information in this response explains why EPA believes it is not necessary to have a narrowed use limit in place indefinitely. EPA is particularly encouraged to learn that there is currently distribution for HFO-1234yf in 40 countries, 11 more than the combined EU member states and the United States and, that these countries include Saudi Arabia, Turkey, Israel and the United Arab Emirates, which indicates that infrastructure is already being put in place in a significant number of countries.

EPA does not agree that every country in the world would need as much time as was needed in North America and Europe to resolve barriers to transition. Many countries look to the

SNAP program and the EU's REACH program as a source of information to inform their domestic programs and, thus transition for those countries should proceed more quickly. EPA notes the widespread use of flammable refrigerants for various end-uses in other countries (more so than in the United States) as well as the inclusion of such refrigerants for projects considered by the Executive Committee of the Montreal Protocol's Multilateral Fund. We anticipate that many countries that do not have adequate infrastructure in place in 2015 will have it in place in time to service MY 2021 vehicles.

In many cases international agencies, such as the United Nations Environment Programme (UNEP), have been working with developing countries to facilitate changes in domestic regulations to allow for the use of lower-GWP solutions. This has been particularly true since 2007 when the Parties to the Montreal Protocol adopted a more aggressive phaseout schedule for HCFCs, for end-uses using HCFCs such as stand-alone commercial refrigeration appliances. Thus there are systems in place for communicating information on new refrigerants and for sharing experience. Further, the experiences of the United States and Europe are being shared widely. We have provided information to the Montreal Protocol's Secretariat and to UNEP. We already are also seeing information shared through a range of mechanisms by the Secretariat and UNEP as well as included in reports of the Montreal Protocol's Technical and Economic Assessment Panel (TEAP), SAE, and other bodies.

In addition, EPA notes that the G-7 leaders committed in June 2014 to promote the rapid deployment of climate-friendly and safe alternatives to HFCs in motor vehicle air-conditioning and to promote public procurement of climate-friendly HFC alternatives. EPA notes that many countries already are committed to take action to promote public procurement of climate-friendly lower-GWP alternatives whenever feasible and would likely consider MVAC as a potentially

feasible end-use. For the reasons above, we believe that sufficient progress is being made and will continue to be made such that the narrowed use limit need not apply beyond MY 2025.

Comment: Global Automakers commented that it is imperative to have trained technicians and shops equipped with the necessary equipment to service and repair MVAC systems using flammable refrigerants, and special equipment is needed to recover, recycle, and re-charge flammable refrigerants before vehicles using such refrigerants can be marketed in a specific country. AAM commented that on average, every vehicle gets completely recharged with new refrigerant at least once during its lifetime, and therefore, the unique need for such widespread service support for MVAC differentiates this situation from past SNAP considerations of export markets for other appliances.

Response: EPA agrees with the value of providing information and training to technicians. In the United States, we are currently working with technician certification programs to include information on HFC-152a, R-744, and HFO-1234yf. EPA agrees with commenters that there is value in technician training and education on a global basis. International agencies such as UNEP could potentially be a source of such training in developing countries. EPA does not agree that it is necessary to ensure such training is in place in all markets worldwide in order to fully accommodate U.S. exports with the new refrigerants. EPA has already developed information on the newer alternative refrigerants acceptable in the United States that is available on our website and could be a resource for others. In addition, the use conditions requiring labeling and unique fittings for refrigerants for MVAC for service equipment and vehicle service ports serves as a means for informing technicians as to what refrigerant is being used.

EPA understands that the commenters are suggesting that there still may be markets that do not have infrastructure in place by MY 2025. Based on the speed of transition that we are

seeing, EPA does not agree. However, the Agency could consider proposing a change in the future if needed.

C. Retail food refrigeration and vending machines

1. Background

a) Overview of SNAP end-uses, end-use categories and commonly-used refrigerants

EPA refers readers to section V.C.1 of the preamble to the proposed rule for a detailed discussion of the end-uses within the refrigeration sector covered by this rule as well as information on some of the refrigerants used within those end-uses.

In the proposed rule, EPA proposed to change the listing for certain refrigerants for two end-uses within the "commercial refrigeration" sector – retail food refrigeration and vending machines. Retail food refrigeration, as affected by today's rule, is composed of three main categories of equipment: stand-alone equipment; remote condensing units; and supermarket systems. Stand-alone equipment consists of refrigerators, freezers, and reach-in coolers (either open or with doors) where all refrigeration components are integrated and, for the smallest types, the refrigeration circuit is entirely brazed or welded. These systems are termed "stand-alone" within the SNAP program because they are fully charged with refrigerant at the factory and typically require only an electricity supply to begin operation.

Condensing units, called remote condensing units in this final action as discussed below, exhibit refrigerating capacities that typically range from 1 kW to 20 kW (0.3 to 5.7 refrigeration tons) and are composed of one (and sometimes two) compressor(s), one condenser, and one receiver assembled into a single unit, which is normally located external to the sales area. The modifier "remote" indicates that the condenser (and often other parts of the system) are not

located in the space or area cooled by the evaporator but are instead located outside the room, typically ejecting heat to the outdoor ambient environment. Remote condensing units are commonly installed in convenience stores and specialty shops such as bakeries and butcher shops, as well as in supermarkets, restaurants and other locations where food is stored, served or sold.

Typical supermarket systems are known as multiplex or centralized systems. They operate with racks of compressors installed in a machinery room. Two main design classifications are used: direct and indirect systems. At least 70% of supermarkets in the United States use centralized direct expansion (DX) systems to cool their display cases.[59] In these systems, the refrigerant circulates from the machinery room to the sales area, where it evaporates in display-case heat exchangers, and then returns in vapor phase to the suction headers of the compressor racks. Another direct supermarket design, often referred to as a distributed refrigeration system, uses an array of separate compressor racks located near the display cases rather than having a central compressor rack system. Indirect supermarket designs include secondary loop systems and cascade refrigeration. Indirect systems use a chiller or other refrigeration system to cool a secondary fluid that is then circulated throughout the store to the cases.

Refrigerant choices depend on the refrigerant charge (i.e., the amount of refrigerant a system is designed to contain under normal operating conditions), the product temperature required, energy efficiency, system performance, ambient temperatures, operating conditions, potential impact on community safety, potential risk to personal safety, cost, and minimization of

[59] *www2.epa.gov/greenchill/advanced-refrigeration*

direct and indirect environmental impacts, among other things. In addition, federal or local regulations may also affect refrigerant choice. For instance, regulations from the OSHA may restrict or place requirements on the use of some refrigerants, such as ammonia (R-717). Building codes from local and State agencies may also incorporate limits on the amount of particular refrigerants used. There are and will continue to be a number of factors that retailers must consider when selecting the refrigerant and operating system design. While a number of approaches exist, there is no uniformly accepted holistic analysis of the multiple factors listed above. EPA recognizes that there must be a range of options, and that the decision as to which option to select must remain with the owner and operator of the system.

b) Terms and coverage

During a meeting with EPA just prior to publication of the proposed rule, an industry trade organization representing manufacturers of refrigeration equipment, Air-Conditioning, Heating, and Refrigeration Institute (AHRI), raised concerns that in some situations the definitions and categories used in the SNAP program differ from those used by the U.S. Department of Energy (DOE) and/or the industry and they submitted a document identifying those definitions and categories (see *EPA Meeting on Commercial Refrigeration Equipment - June 10, 2014* under Docket ID# EPA-HQ-OAR-2014-0198-0005). They indicated that the term "commercial refrigeration" is often first divided by the type and location of the condensing unit, using two broad terms. "Remote condensing" is used to indicate systems where the condensing unit and compressors are located remotely from where food is stored or displayed and instead the refrigerant or secondary-fluid is piped to the cases or rooms where the food is located. "Self-contained" is used to indicate that the condensing unit (along with the compressor and evaporator) is integrated into the case in which the food is stored and displayed. These units are

generally initially charged by the case manufacturer at the manufacturing plant.

EPA notes that the term "self-contained" is synonymous with the SNAP end-use category "stand-alone" and we are retaining use of the term stand-alone for this rulemaking action. The term "remote condensing" applies to the SNAP end-use categories of "supermarket systems" and "condensing units." For the latter end-use category, in this final rule we are revising the term "condensing units" to be "remote condensing units." EPA draws a distinction between "supermarket systems" and "remote condensing units" based on the number of compressors in the remote condensing system. Supermarket systems generally have more than two compressors arranged in a "rack" whereas remote condensing units typically have only one or two compressors linked to a single condenser. For purposes of this rule, we are keeping these two categories separate.

The AHRI document (Docket ID# EPA-HQ-OAR-2014-0198-0005) also attempts to draw an additional distinction regarding commercial walk-in coolers and freezers. We note that we do not treat such units separate from the categories described above. Rather such units would fall within the end-use category "supermarket system" if the refrigerant is supplied on the same multi-compressor circuit used to cool food elsewhere in the store or within the end-use category "remote condensing unit" if only a one- or two-compressor system is used (generally dedicated to just the individual walk-in cooler or freezer).

AHRI further notes that both supermarket systems and remote condensing units can be connected to various types of display cases designed to maintain products at various temperatures, often subdivided as "medium-temperature"—roughly between 32°F (0°C) and 41°F (5°C)—and "low-temperature"—roughly between -40°F (-40°C) and 32°F (0°C). EPA notes that within the SNAP end-uses and categories described above, no distinction is currently

made based on application temperature (medium or low) and so the decisions finalized in today's rule apply to all equipment fitting within the supermarket and remote condensing units end-use categories as described; however, based on comments received, within the stand-alone equipment end-use category a distinction is made between equipment designed for "low" temperatures and other equipment.

During the comment period on the proposed rule, we received additional questions and comments about whether certain types of equipment were included in the end-uses addressed in this action. We are clarifying here that specific types of equipment used in the food industry do not fall within the end-uses and end-use categories affected by this rule: blast chillers, ice making machines not connected to a supermarket system, very low temperature refrigeration, and certain food and beverage dispensing systems.

A "blast chiller" or "blast freezer" is a type of equipment in which cold air is supplied and circulated rapidly to a food product, generally to quickly cool or freeze a product before damage or spoilage can occur. Such units are typically used in industrial settings (e.g., at a factory or on a large fish-catching vessel) and fall under the SNAP end-use "Industrial Process Refrigeration" and hence are not subject to this rule.

"Ice makers" are machines designed for the sole purpose of producing ice, in various sizes and shapes, and with different retrieval mechanisms (e.g., dispensers or self-retrieval from bins). Under SNAP, "commercial ice machines" are identified as a separate end-use not part of the retail food refrigeration end-use (e.g., not a "stand-alone" unit). See e.g., 59 FR 13,070 (March 18, 1994) where EPA clearly designated "commercial ice machines" as a separate end-use than "retail food refrigeration." Thus, both self-contained ice makers, as well as ice-making units solely connected via piping to a dedicated remote condenser, do not fall under the retail

food refrigeration end-use and hence are not subject to this rule. In contrast, ice-making units that are connected to a supermarket system are subject to this rule. For instance, if a supermarket rack system supplies refrigerant to a unit to make ice, such as for use in meat and seafood storage, display and sales, and that refrigerant and compressor rack are part of a larger circuit that also provides cooling for other products in the store, the entire system would be classified as a "supermarket system" and hence would be subject to today's rule. EPA would like to clarify that since remote condensing ice makers designed solely to be connected to a supermarket remote rack are not sold or manufactured with a condensing unit, they do not meet the definition of automatic commercial ice maker used by DOE in the automatic commercial ice maker energy conservation standards.

Several commenters, including Master Bilt Products and Thermo Fisher, identified products they manufacture to reach temperatures of -50°F (-46°C) or even lower. These products fit under the end-use "very low temperature refrigeration" and hence are not covered by this rule. EPA also notes that it recently found R-170 (ethane) as acceptable, subject to use conditions, in the very low temperature refrigeration end-use. (April 10, 2015; 80 FR 19,453)

Other commenters, such as Emerson, HC Duke/Electro-Freeze, and United Technologies, mentioned equipment designed to make or process cold food and beverages that are dispensed via a nozzle, including soft-serve ice cream machines, "slushy" iced beverage dispensers, and soft-drink dispensers. Such equipment can be self-contained or can be connected via piping to a dedicated condensing unit located elsewhere. EPA does not consider this equipment to fall under either the "stand-alone" or "remote condensing unit" categories of retail food refrigeration. While our definition of retail food refrigeration includes "cold storage cases designed to chill food for commercial sale," these units generally do more than just store food or beverages. For

instance, United Technologies states such equipment "transform[s] a liquid product into a frozen beverage or confection with the incorporation of air to provide uniformity and specific customer requirements. These products are transformed and manufactured within the equipment, held in a frozen state and ultimately dispensed into a serving vessel that is provided to an end customer." Hence, these types of products are in a category separate from the three "retail food refrigeration" end-use categories addressed in today's rule.

We also received several comments and questions regarding energy conservation standards established by DOE and how the equipment subject to this rule is also subject to the DOE standards. While EPA is not making any decisions on the applicability of the DOE standards to specific equipment, we see that at least three such standards and perhaps more apply to types of equipment that are also subject to this rule. These three standards are titled Energy Conservation Standards for Commercial Refrigeration Equipment (79 FR 17,725; March 28, 2014), Energy Conservation Standards for Walk-In Coolers and Freezers (79 FR 32,049; June 3, 2014) and Energy Conservation Standards for Refrigerated Bottled or Canned Beverage Vending Machines (74 FR 44,914; August 31, 2009). These are referred to in this rule using shortened names or a generic name such as "DOE Standards."

The Commercial Refrigeration Equipment Standards have an effective date of May 27, 2014 and a compliance date of March 27, 2017. The Walk-In Coolers and Freezers Standards have an effective date of August 4, 2014 and a compliance date of June 5, 2017. The Beverage Vending Machines Standards have effective dates of October 30, 2009 and August 31, 2011 and a compliance date of August 31, 2012. DOE posted a notice of a public meeting and availability of the Framework document for an expected proposed rule to amend the standards for refrigerated bottled or canned beverage vending machines (78 FR 33,262; June 4, 2013).

Material in the docket for that action indicate DOE's plans for a final rule with a compliance date three years later (see EERE-2013-BT-STD-0022).

EPA's review indicates that equipment designated in the Commercial Refrigeration Equipment Standards may fall under the supermarket systems, remote condensing units, and stand-alone equipment end-use categories. Specifically, equipment classes designated in the DOE Standard as *XXXX*.RC.*T*, where *XXXX* is the equipment class, RC specifies a remote condensing operating mode code, and *T* indicates a rating temperature (e.g., M and L for medium and low temperature, respectively), may fall under either the supermarket system or remote condensing unit end-use category, depending on how that equipment is applied. In addition, equipment classes designated as *XXXX*.SC.*T*, where SC specifies a self-contained operating mode code, may fall under the stand-alone equipment end-use category.

EPA's review indicates that equipment designated in the Walk-In Cooler and Freezers Standards may fall under the supermarket systems, remote condensing units, and stand-alone equipment end-use categories. Specifically, equipment within the class descriptor Multiplex Condensing (either Medium or Low Temperature) may fall under the supermarket systems end-use category, i.e., if such a walk-in cooler or freezer utilizes refrigerant from a larger, multi-compressor (rack) system. In addition, equipment within the class descriptor Dedicated System, Outdoor System (regardless of temperature and capacity) may fall under the remote condensing units end-use category, i.e., if connected to a remote condensing unit and not integrated into a larger, multi-compressor (rack) system. Furthermore, equipment falling in the class descriptor Dedicated System, Indoor System (regardless of temperature and capacity) may fall in the stand-alone equipment end-use category, i.e., if the equipment is manufactured and fully charged with refrigerant at the factory.

EPA's review indicates that equipment covered by the Beverage Vending Machine Standards (including Class A, Class B and Combination vending machines) falls under the vending machines end-use.

In all cases, the DOE Standards apply to new equipment, not retrofitted equipment. Also, any foam used in such systems or components that are also covered (e.g. various panels and doors within the Walk-In Coolers and Freezers Standard), may fall under the rigid PU commercial refrigeration and sandwich panel end-use and be affected by the changes of status discussed in section V.D below.

c) The terms "new" and "retrofit" and how they apply to servicing

Several commenters, including the Food Marketing Institute (FMI), Supermarket Company ABC, and Hussmann sought clarification of the terms "new" and "retrofit" and how these terms might affect store remodels and the use of cases or other equipment that in the future are added to or replaced for existing cases or equipment.

For the refrigeration and air-conditioning sector, the SNAP program has, since the inception of the program, made a distinction between new equipment and retrofitted equipment. In some cases, a particular refrigerant is acceptable or acceptable subject to use conditions only in new equipment, not in retrofits. In other cases, a particular refrigerant is only acceptable in retrofits, not new equipment. In the NPRM, EPA evaluated whether to change the status of refrigerant substitutes for retrofits separate from its evaluation of whether to change the status of refrigerant substitutes for new equipment in each of the four end-uses and categories—supermarket systems, remote condensing units, stand-alone equipment, and vending machines—addressed. Since the inception of the SNAP program, EPA has made separate determinations for refrigerants used in "new" equipment and as a "retrofit" to existing equipment. We are likewise

today making separate decisions for new and retrofit equipment within the retail food refrigeration and vending machines end-uses.

EPA uses the term "retrofit" to indicate the use of a refrigerant in an appliance (such as a supermarket system) that was designed for and originally operated using a different refrigerant[60] and does not use the term to apply to upgrades to existing equipment where the refrigerant is not changed. For instance, we drew this distinction when we found R-290 acceptable for use in retail food refrigerators and freezers (stand-alone units) subject to use conditions (76 FR 78,832; December 20, 2011) stating "none of these substitutes may be used as a conversion or 'retrofit' refrigerant for existing equipment designed for other refrigerants" (40 CFR part 82, subpart G, appendix R). Some alternative refrigerant providers describe their retrofit products as "drop-ins" but EPA does not use that term interchangeably with retrofit (see 79 FR 64,270). We recognize that some changes typically would be required for equipment to use a refrigerant other than the one for which it was designed. In many cases, lubricants need to be changed (for instance, changing from a mineral oil to a polyolester lubricant when retrofitting from a CFC to an HFC). Due to different performance characteristics, other changes may need to occur when retrofitting, such as adjustments to or replacement of thermostatic expansion valves (TXVs) and filter-driers. In addition, gaskets and other materials may need to be replaced due to different compatibility properties of the different refrigerants. Such changes could occur as part of maintenance as well as during a retrofit.

In addition to drawing a distinction between new and retrofit for the SNAP program, EPA also included a distinction between new and existing equipment in its regulations

[60] A chemical or mixture that is not the same as that used before the retrofit, typically denoted by different "R" numbers under ASHRAE Standard 34.

implementing the HCFC phaseout and use restrictions in section 605 of the CAA. As of January 1, 2010, use of HCFC-22 and HCFC-142b was largely restricted to use as a refrigerant in equipment manufactured before that date (40 CFR 82.15(g)(2); 74 FR 66,412). Similarly, as of January 1, 2015, use of other HCFCs not previously controlled was largely restricted to use as a refrigerant in equipment manufactured before January 1, 2020 (40 CFR 82.15(g)(4); 74 FR 66,412). In that context, EPA defined "manufactured," for an appliance, as "the date upon which the appliance's refrigerant circuit is complete, the appliance can function, the appliance holds a full refrigerant charge, and the appliance is ready for use for its intended purposes" (40 CFR 82.3, 82.302). We provided further explanations and example scenarios of how the HCFC phaseout and use restrictions apply to supermarkets in the fact sheet *Supermarket Industry Q & A on R-22 Use* (*www.epa.gov/ozone/title6/phaseout/Supermarket_Q&A_for_R-22.html*).

Under today's rule, existing systems may continue to be serviced and maintained for the useful life of that equipment using the original refrigerant, whereas new systems (including new supermarket systems) manufactured after the change of status date will not be allowed to use refrigerants for which the status has changed to unacceptable. Consistent with the definition in subparts A and I of part 82, quoted above, EPA will consider a system to be new for purposes of these SNAP determinations as of the date upon which the refrigerant circuit is complete, the system can function, the system holds a full refrigerant charge, and the system is ready for use for its intended purposes. As explained in the fact sheet referenced above, a supermarket may undergo an expansion and continue to use the existing refrigerant "if there is sufficient cooling capacity within the system to support the expansion" as EPA would consider that in such a situation "the store is not changing the intended purpose of the system." As pointed out by FMI, the replacement of existing display cases with ones that operate at a higher evaporator

temperature, but still provide the same purpose of maintaining products at required temperatures, is one way in which a system may be remodeled without changing the intended purpose of the system. On the other hand, if a supermarket remodel or expansion changes the intended purpose of the original equipment, for instance by adding additional cases, compressors, and refrigerant that were not supported by the original compressor system, EPA would consider the expanded system a "new" system. In that situation, a supermarket would not be allowed to use a refrigerant that was listed as unacceptable as of the date that new system was expanded or remodeled, even if the system had been using that refrigerant before the expansion or remodel.

2. What is EPA finalizing for retail food refrigeration (supermarket systems)?

The change of status determinations for retail food refrigeration (supermarket systems) are summarized in the following table:

Table 4. Change of Status Decisions for Retail Food Refrigeration (Supermarkets Systems)

End-use	Substitutes	Decision
Retail food refrigeration (supermarket systems)(new)	HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of January 1, 2017
Retail food refrigeration (supermarket systems)(retrofit)	R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of **[insert date one year after publication in the Federal Register]**

a) New supermarket systems

For new supermarket systems, EPA had proposed to change the status, as of January 1, 2016, for nine HFC blends and HFC-227ea to unacceptable: the HFC blends are R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A. In today's final rule, we are changing the status of these ten refrigerants to unacceptable in new supermarkets as of January 1, 2017 (i.e., one year later than proposed), based on information the Agency received

concerning timelines for planning new stores; this information implied that contractual arrangements for specific equipment purchases could have already been in place at the time the proposal was issued but that new systems will not be completed by January 1, 2016. A January 1, 2017, status change date will address this concern. We note that systems not ready for use by January 1, 2017 would not be able to use a substitute listed as unacceptable as of that date.

(1) **What other alternatives does EPA find pose lower overall risk to human health and the environment?**

A number of other refrigerants are listed as acceptable for new supermarket systems: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-407A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-422B, R-424A, R-426A, R-437A, R-438A, R-448A, R-449A, R-450A, R-513A, R-744, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-02, and THR-03.[61] In addition, R-717 is listed as acceptable in new supermarkets when used as the primary refrigerant in a secondary loop system.

Several of these alternatives, such as R-407A, R-407F, and R-744, are in widespread use today in supermarket systems in the United States. EPA considers this widespread use as indicative of the availability of these acceptable alternatives. HFC/HFO blends are also entering the market. For instance, R-448A and R-449A are being used in supermarkets in the United States and R-450A is in use in a supermarket in Spain.[62] The producer of R-450A, Honeywell, indicated in their comments that supply of this acceptable alternative was "soon to become

[61] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production.
[62] Cooling Post, 2014. Spanish store first to test new R404A "drop-in." October 5, 2014. Available online at *www.coolingpost.com/world-news/spanish-store-first-to-test-new-r404a-drop-in*/

available." They indicated that they have invested in their U.S. facility "to ensure high-volume manufacturing capability for HFO-1234ze(E)," one component of R-450A. The other component, HFC-134a, is widely available from multiple producers and refrigerant suppliers. Honeywell noted that "commercial quantities of HFO-1234yf and HFO-1234ze [are] available today." Likewise, DuPont indicated an increasing supply of HFO-1234yf, a component in a number of acceptable refrigerants for new supermarket systems, specifically R-448A, R-449A and R-513A, amongst other applications discussed below.

In the preamble to the NPRM, 79 FR at 46,144, EPA provided information on the risk to human health and the environment presented by the alternatives that are being found unacceptable as compared with other available alternatives. In addition, EPA listed as acceptable R-450A on October 21, 2014 (79 FR 62,863) and included information on its risk to human health and the environment. Concurrently with this rule, EPA is also listing R-448A, R-449A and R-513A as acceptable in this end-use category and is including information on their risk to human health and the environment. A technical support document that provides the additional *Federal Register* citations concerning data on the SNAP criteria (e.g., ODP, GWP, VOC, toxicity, flammability) for these alternatives may be found in the docket for this rulemaking (EPA, 2015d). In summary, the other available substitutes all have zero ODP and have GWPs ranging from 0 to 2,630. The refrigerants we are finding unacceptable through this action also have zero ODP, but they have GWPs ranging from 2,730 to 3,985. With the exception of R-717, the other available refrigerants have toxicity lower than or comparable to the refrigerants whose listing status is changing from acceptable to unacceptable. Also, with the exception of R-717, the other available refrigerants, as well as those that we are finding unacceptable, are not flammable. R-717 is classified as B2L (higher toxicity, lower flammability, low flame speed) under the

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 34-2013. However, since it is acceptable only for use as the primary refrigerant (i.e., the one housed in the machine room and limited-access condensers) in secondary loops systems, potential exposure is limited to technicians and operators who are expected to have had training on its safe use. Because of this limited access, the fact that R-717 has been used successfully as a refrigerant for over 100 years, and because building codes and OSHA regulations often apply specifically to the use of R-717, EPA previously determined that in this end-use the risk posed with regard to toxicity and flammability is not significantly greater than for other available refrigerants or for the refrigerants we are listing as unacceptable. Some of the refrigerant blends listed as acceptable, as well as some of the substitutes that we are finding unacceptable include small amounts (up to 3.4% by mass) of VOC such as R-600 (butane) and R-600a (isobutane). These amounts are small, and EPA's analysis of hydrocarbon refrigerants show that even when used neat (i.e., as the sole refrigerant, not as a component within a blend) they are not expected to contribute significantly to ground level ozone formation (ICF, 2014e). In the original actions listing these refrigerants as acceptable or acceptable subject to use conditions, EPA concluded none of these refrigerants pose significantly greater risk than for the refrigerants that are not or do not contain VOC. Because the risks other than GWP are not significantly different for the other available alternatives than for those we proposed to list as unacceptable and because the GWP for the refrigerants we proposed to list as unacceptable is significantly higher and thus poses significantly greater risk, we are listing the following refrigerants as unacceptable: HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A.

(2) **When will the status change?**

As explained here and in our responses to comments, EPA is finalizing a change of status

date for new supermarket systems of January 1, 2017.

EPA noted in the NPRM, and multiple commenters echoed, that supermarket equipment using some of the acceptable alternatives, notably HFC-134a, R-407A, R-407C, R-407F and R-744, is available today and has been used in supermarkets for several years. While some, but not all, manufacturers argued more time was warranted to develop additional equipment and address performance issues, they did not provide adequate justification or specificity on when such equipment would be available or when such issues would be addressed.

A supermarket system manufacturer believed time was needed to develop contractor training materials. While EPA agrees that training is valuable, we note below that such training is already available and, given that acceptable alternatives have already been implemented in new supermarkets, we do not see the need to delay our proposed status change date for new equipment in this end-use category more than one year.

However, one system manufacturer noted that supermarket plans are developed in time frames that could hinder the proposed status change date of January 1, 2016. EPA understands that such planning is necessary and we are establishing a status change date of January 1, 2017, to accommodate those end users who have already planned changes to their systems or may have plans to manufacture a new system (e.g., for a new store) but that may not have such systems operational in the period between the time this rule is issued and January 1, 2016. As noted earlier, this change in the proposed status change date will affect those end users who are currently in the midst of planning for a new system or a change to their existing system. A new system not ready for use by January 1, 2017, would not be able to use a refrigerant listed as unacceptable as of that date.

b) Retrofit supermarket systems

For retrofit supermarket systems, EPA proposed to list, as of January 1, 2016, nine HFC blends as unacceptable: R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A. In today's final rule we are finding these refrigerants unacceptable in retrofit supermarkets as of **[insert date one year after publication in the Federal Register]**.

Consistent with the proposal, this action does not apply to servicing equipment designed to use these nine refrigerants or servicing equipment that was retrofitted to use those refrigerants before the **[insert date one year after publication in the Federal Register]**, status change date. For example, supermarket systems designed for use with or retrofitted to R-404A or R-507A prior to **[insert date one year after publication in the Federal Register]**, may continue to operate and to be serviced using those refrigerants.

(1) What other alternatives does EPA find pose lower overall risk to human health and the environment?

A number of other refrigerants are listed as acceptable for retrofit supermarket systems: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-407A, R-407C, R-407F, R-417A, R-417C, R-421A, R-422B, R-424A, R-426A, R-427A, R-437A, R-438A, R-448A, R-449A, R-450A, R-513A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-02, and THR-03.[63] A technical support document that provides the additional *Federal Register* citations concerning data on the SNAP criteria (e.g., ODP, GWP, VOC, toxicity, flammability) for these alternatives may be found in the docket for this rulemaking (EPA, 2015d).

[63] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production.

Several of the alternatives that remain acceptable are in use today in the United States for supermarket system retrofits. While blends such as R-407A and R-407F have become the norm, GreenChill partners also report use of other refrigerants as retrofits in supermarket systems.[64] Also, as noted earlier, R-450A was used to retrofit a supermarket system in Spain (Cooling Post, 2014).

In the preamble to the NPRM, EPA provided information on the risk to human health and the environment presented by the alternatives that are being found unacceptable and those that remain acceptable. In addition, EPA listed R-450A as acceptable on October 21, 2014 (79 FR 62,863) and included information on its risk to human health and the environment. Concurrently with this rule, EPA is also listing as acceptable R-448A, R-449A and R-513A and including information on their risk to human health and the environment. As discussed above, the producers of the substitutes that will remain acceptable do not expect supply problems. In summary, the refrigerants listed above that remain acceptable have zero ODP as do those that we are finding unacceptable. The refrigerants remaining acceptable have GWPs ranging from below 100 to 2,630, lower than the GWPs of the nine blends we are finding unacceptable, which have GWPs ranging from 2,730 to 3,985. All of the refrigerants remaining acceptable have toxicity lower than or comparable to the refrigerants whose listing status is changing from acceptable to unacceptable. None of the refrigerants that remain acceptable or those that are being listed as unacceptable are flammable. Some of the refrigerant blends that remain acceptable and some of those that we are finding unacceptable include small amounts (up to 3.4% by mass) of VOCs such as R-600 (butane) and R-600a (isobutane). Because these amounts are small, and EPA's

[64] The GreenChill Advanced Refrigeration Partnership is a voluntary program with food retailers to reduce refrigerant emissions and decrease their impact on the ozone layer and climate change. See

analysis of hydrocarbon refrigerants shows that even when used neat (100% by mass), they are not expected to contribute significantly to ground level ozone formation (ICF, 2014e), these blends would also not contribute significantly to ground level ozone formation. Because the risks other than GWP are not significantly different for the other available alternatives than for those we proposed to list as unacceptable, and because the GWP for the refrigerants we proposed to list as unacceptable is significantly higher and thus poses significantly greater risk, we are listing the following refrigerants as unacceptable: R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A.

EPA regulations have eliminated or will eliminate by 2020 the production and import of HCFC-22. These and other regulations also affect end users who are using CFC-12, R-502, and several HCFC-containing blends such as R-401A, R-402A and R-408A. Therefore, we believe that the impact of this action addressing retrofits will primarily affect those owners who are faced with the choice of continuing to operate systems with a refrigerant that has been phased out of production and import or to switch to a refrigerant listed as acceptable for retrofit at the time the retrofit occurs.

Many retail chains maintain their own stockpile of HCFC-22, for instance by recovering from stores that are decommissioned or retrofitted and using such supplies to service stores that continue to operate with HCFC-22. In addition, over four millions pounds of HCFC-22 has been reclaimed every year since at least 2000 and over seven million pounds every year since 2006.[65] Equipment operating with ODS refrigerants may continue to do so given the supply of such materials in stockpiles and through the reclaim market. Thus, owners have the option to continue

[65] EPA, 2012a. The latest data on refrigerant reclamation can be found on EPA's website at: *www.epa.gov/spdpublc/title6/608/reclamation/recsum_merged.pdf*

to operate this equipment through its useful life with the refrigerant they are using, such as HCFC-22. Regardless of the continued supply of HCFC-22 and other ODS refrigerants, we believe that the majority of retrofits are planned for reasons other than the supply of the refrigerant currently in use; for instance, owners may decide to retrofit when upgrading to more energy efficient equipment or during planned maintenance overhauls of their stores.

We see that many retrofits are already directed towards lower-GWP blends such as R-407A and R-407F, which are widely available and remain acceptable for such use under today's rule, and not those of the refrigerants whose status will change to unacceptable under today's rule. These two refrigerants (R-407A and R-407F), other available HFC blends, the additional HFC/HFO options that EPA recently listed as acceptable, and other HFC/HFO blends that are being evaluated by chemical producers and equipment manufacturers, as well as the option of continuing to operate with HCFC-22, are sufficient to meet the various features—such as capacity, efficiency, materials compatibility, cost and supply—that affect the choice of a retrofit refrigerant.[66]

(2) When will the status change?

As explained here and in our responses to comments, EPA is establishing a change of status date for retrofit supermarkets of **[insert date one year after publication in the Federal Register]**.

In the NPRM and above, EPA pointed out that retrofits of supermarkets using acceptable alternatives are already occurring. Supermarket Company ABC indicated that their experience with the use of R-407A in retrofits indicates the availability and viability of it and other

[66] For example, see CCAC, 2012.

alternatives. FMI similarly indicated that many of its members have already stopped performing retrofits with refrigerants we are finding unacceptable. EPA considers these comments directly from the supermarket retailer to indicate that adequate performance can be achieved using refrigerants that will remain listed as acceptable.

As indicated in section V.C.1.c above, retrofits may require various changes to the existing equipment, such as different lubricants, new materials such as gaskets and filter driers, and adjustments to expansion valves. These changes include readily available materials and common refrigeration practices. Such retrofits to acceptable alternatives are already occurring, and the option to continue to operate and service existing systems remains; however, EPA received comment that users may plan a "new store layout" in advance. While not specifically referencing retrofits, a new layout of an existing store may include the retrofitting of the existing supermarket system. Therefore, EPA is modifying the change of status date to provide a full year from publication of the final rule to ensure that any supermarkets that may have retrofits underway using a refrigerant that will no longer be acceptable will be able to complete those retrofits ahead of the change of status date. While EPA did not receive specific comments on the time to complete retrofits that are underway, it is our understanding that any ongoing retrofits can be completed within this timeframe .

c) How is EPA responding to comments on retail food refrigeration (supermarket systems)?

Comment: Several commenters commented on the proposed January 1, 2016 change of status date for new supermarket systems. One supermarket owner, Supermarket Company ABC, specifically supported the proposed 2016 date for both new and retrofit systems. An industry organization representing supermarkets, FMI, stated that "a majority of our members have

already voluntarily and proactively discontinued the use of R-404A, R-507 and R-422D for new systems and as a retrofit refrigerant." Two environmental organizations, NRDC and IGSD, supported the proposed 2016 date for both new and retrofitted supermarket systems. One manufacturer of supermarket systems, Hillphoenix, supported the change of status date of January 1, 2016, for HFC-227ea, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A and R-434A in new and retrofit supermarket systems.[67]

Several other manufacturers of supermarket equipment, including Hussmann, Master-Bilt, Lennox, and Zero Zone, and an association representing such manufacturers—AHRI—suggested later dates for the change of status. Hussmann suggested a change of status date of 2018 for new equipment as store layouts of their customers are planned "up to three years in advance." Another manufacturer, Lennox, requested three years from the date of any final rule, a position supported by AHRI, which also noted "alternatives are available and manufacturers have started re-designing products to minimize or eliminate the use of high GWP refrigerants." Master-Bilt indicated that under the proposed January 1, 2016, change of status date for new supermarket systems, they would convert to HFC-134a and R-407A, but would have to address issues of energy efficiency and reliability. They believed "these HFCs will also be banned as soon as lower GWP alternatives are available" and therefore did not offer a long-term solution. Instead, they stated blends with even lower GWPs than the ones remaining acceptable would be available in 1-3 years and requested a minimum of 3 years from then to develop products. Zero Zone indicated that it has products available for R-407A and R-407C, but needs time to address performance issues.

[67] They addressed the change of status date for R-404A and R-507A with regard to stand-alone units but not supermarket systems.

Response: Several commenters indicated that many stores were already using alternatives other than the ones we proposed to list as unacceptable. While two manufacturers of equipment, Zero Zone and Lennox, and AHRI advocated for a later change of status date, they also indicated that products using refrigerants that will remain acceptable are already in use. Hillphoenix and Hussmann, both of whom offer supermarket systems with such refrigerants, and Supermarket Company ABC and FMI, who have used such products, did not indicate that there were performance, efficiency or reliability issues when using R-407A, R-407C or R-407F in supermarket systems.

We recognize the concern raised by Hussmann regarding store layout plans for new systems. Store design plans are generally developed well in advance of the physical change-over or construction, because of several different factors related to construction and installation as well as the need to address any commissioning, performance optimization or start-up procedures. Hussmann suggested a change of status date of 2018 to allow up to three years for design. Hussmann did not indicate if the "up to three years in advance" for planning a new design was a typical planning cycle or a rare maximum, nor did they indicate that any particular customer currently is in the planning stage but will not have equipment designed to use a refrigerant we are listing as unacceptable operational until 2018. We further note that the NPRM was proposed on August 6, 2014, and thus supermarkets were on notice at that time that the refrigerants currently listed as acceptable would possibly be unacceptable for use as of January 2016. In order to address concerns about those end users who began planning prior to the proposal, we are establishing a change of status date one year later than proposed for new supermarket systems and **[Insert one year after publication in the Federal Register]** for retrofits. This will provide those end users who were in the planning stage prior to the time of the proposal over two years

after issuance of the proposal to ensure new supermarket systems are in place and operational and likewise approximately two years to complete any retrofits.

Comment: Lennox noted that supermarket system designs exist for R-407 series refrigerants, but stated that manufacturers "need at least 3 years to develop complete product lines, technical literature and contractor training materials." Lennox did not indicate specifically how much time was needed to complete their equipment development. Zero Zone Inc. comments that the industry needs at least six years to make a smooth complete transition away from R-404A, R-507A, and HFC-134a; they indicated this time was needed "to eliminate the performance issues and design product that uses these refrigerants in the most energy efficiency manner." In its comments regarding supermarket systems, AHRI indicated low-GWP alternatives are available and stated research on other, lower-GWP refrigerants was underway but requested "a minimum of 3 years" to transition. AHRI contended that "manufacturers have started re-designing products to minimize or eliminate the use of high GWP refrigerants" but that "manufactures need more time" on "the re-design effort that started [a] few years ago." In general comments not specific to the three retail food refrigeration end-use categories addressed in the proposal, AHRI also indicated that "a typical design cycle takes an average 7 years from start to finish" for non-flammable alternatives. Supermarket Company ABC referenced the NPRM discussion of new supermarket systems (79 FR 46,144) and stated that their "own experience and testing with R134a, CO_2 and the R-407 series of refrigerants have demonstrated to our satisfaction that implementable alternatives to R-404A and R-507A are available to meet that time frame" of January 1, 2016.

Response: The commenters have not provided sufficient information to support that alternatives will not be available for several years because of technical constraints. As indicated

in the comments from AHRI, Lennox, and Zero Zone, manufacturers have been working for the past several years to design systems using low GWP alternatives and as FMI noted many supermarkets are already choosing to use them. EPA noted in the proposal that R-407A systems have already become a norm for supermarkets and Supermarket Company ABC indicated it was using R-407A in its comments. In fact, EPA notes that the amount of R-404A in use from partners participating in EPA's GreenChill partnership program reporting in 2012 and 2013 increased only 1.3%, while the amount of R-407A in use increased 24%. Hence, we do not agree that a several year delay in the change of status date is needed to accommodate design of systems.

With respect to contractor training, EPA agrees proper education and training is important, and we note that there are already many manufacturers and suppliers who have been conducting such training. For example, Hillphoenix, a manufacturer of supermarket systems and other equipment affected by this rule, operates a learning center with courses available including several on R-744 equipment.[68] Learning material is also available from EPA's GreenChill program, including for instance the GreenChill retrofit guidelines[69], which contain material on refrigerants R-407A, R-407F and R-427A, all of which remain acceptable in retrofit supermarket systems . For supermarket systems, we note that alternatives such as R-407A have been in the market and have been used successfully for many years. Other alternatives, such as R-448A, R-449A, R-450A and R-513A, are nonflammable and operate with similar characteristics to HFC-134a or R-404A, and hence should require only minimal extra training. EPA believes the January

[68] See *www.hillphoenixlc.com/course-curriculum/refrigeration-systems/*.

[69] EPA, 2011b. GreenChill Best Practices Guidelines, Commercial Refrigeration Retrofits. August 2011. This document is accessible at *http://www2.epa.gov/sites/production/files/documents/retrofit_guideline_august_2011.pdf*.

1, 2017, change of status date for new supermarket systems, will allow technicians that focus on particular end-uses or end-use categories to obtain the training they need and likewise for those that cover all end-uses and end-use categories to build their skills across those end-uses over time. We disagree that a need to develop complete technical lines and technical literature are technical challenges that limit the availability of refrigerants for new supermarket systems beyond January 2017.

3. What is EPA finalizing for retail food refrigeration (remote condensing units)?

The change of status determinations for retail food refrigeration (remote condensing units) is summarized in the following table:

Table 5. Change of Status Decisions for Retail Food Refrigeration (Remote Condensing Units)

End-use	Substitutes	Decision
Retail food refrigeration (remote condensing units)(new)	HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of January 1, 2018
Retail food refrigeration (remote condensing units)(retrofit)	R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of **[insert date one year after publication in the Federal Register]**

a) New remote condensing units

For new remote condensing units, EPA proposed to list, as of January 1, 2016, nine HFC blends and HFC-227ea as unacceptable. The HFC blends are R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A. In today's final rule, we are finding that same list of nine HFC blends and HFC-227ea as unacceptable as of January 1, 2018. The change from the proposal is in response to information provided by commenters concerning technical challenges with meeting the January 1, 2016, proposed date.

(1) What other alternatives does EPA find pose lower overall risk

to human health and the environment?

A number of other refrigerants are listed as acceptable for new remote condensing units: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-407A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-422B, R-424A, R-426A, R-437A, R-438A, R-448A, R-449A, R-450A, R-513A, R-744, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-02, and THR-03.[70] R-717 is acceptable in remote condensing units when used as the primary refrigerant in a secondary loop system.

Some of these acceptable alternatives are currently in use in remote condensing unit systems in the United States, such as R-407C and R-407F. Others, such as R-744 and hydrocarbons, while not indicated as in use in the United States, are being used in limited demonstration trials in Europe and elsewhere. In addition, commenters have pointed out that testing of low-GWP HFC/HFO blends is underway; several of these HFC/HFO blends have been submitted to EPA for SNAP review in this end-use category and four are listed as acceptable.

See section V.C.2.a.1 above for a summary of our comparative assessment of the SNAP criteria (ODP, GWP, VOC, toxicity, flammability) for the refrigerants we are listing as unacceptable with the other available refrigerants. The refrigerants we are listing as unacceptable for new remote condensing units are the same as those we are listing unacceptable for new supermarket systems. Likewise, the other available refrigerants are the same for new remote condensing units as for new supermarket systems. For the same reasons as presented in section 2, EPA concludes that there are other refrigerants for use in new remote condensing units that pose

[70] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production.

lower overall risk to human health and the environment than the alternatives we are listing as unacceptable.

(2) When will the status change?

As explained here and in our responses to comments, EPA is establishing a change of status date for new remote condensing units of January 1, 2018.

Blends such as R-407A, R-407C and R-407F are technically viable options. We did not receive any comments suggesting that these or other alternatives that will remain acceptable could not be used in these systems. In fact, information in the docket to this rule supports the feasibility of these alternatives. For example, information in the Agency's possession from a manufacturer of remote condensing units provides an energy efficiency analysis for R-407A as compared with R-404A in remote condensing units, with results ranging from 10% lower to 1% higher in low-temperature equipment and 0% to 6% higher in medium-temperature equipment (EPA-HQ-OAR-2014-0198-0184). For unit coolers, this information showed improved results of 4.3% to 13.3% in medium-temperature applications. While the low-temperature applications showed 3.6% to 6.7% decreases, it was noted this came "as the capacity increased;" hence, we expect adjustments to the equipment could improve the efficiency while still meeting the original capacity requirements. In addition, Honeywell indicated that R-448A and R-449A, which have been submitted to SNAP for review in this end-use, are undergoing extensive field trials and that R-448A is "close to being qualified with numerous manufacturers," indicating that manufacturers are developing equipment to use this alternative. DuPont indicates that R-449A (also referred to as DR-33 and XP40), which has been submitted to SNAP for review in this end-use, works well in their tests of a display case connected to a remote condensing unit. DuPont found that the energy consumption for this refrigerant in a remote condensing unit originally

designed for R-404A was 3% to 4% less than R-404A in low-temperature tests and 8% to 12% less in medium-temperature tests.

Although there are technically viable alternatives, we recognize the testing and certification needs for this equipment. Compliance with DOE energy conservation standards will be required on March 27, 2017 for commercial refrigeration equipment and on June 5, 2017 for walk-in coolers and freezers (see also section V.C.1.b above and V.C.7 below). Commenters noted the challenges with timing for designing products with acceptable alternatives and testing these products to meet the 2017 DOE energy conservation standards for commercial refrigeration equipment and for walk-in coolers and freezers. EPA agrees with the commenters that the challenge of meeting both this status change rule and the DOE standards creates a significant technical hurdle that would be difficult to overcome by a January 2016 change of status date. A January 1, 2018, change of status date for remote condensing units recognizes the time needed for redesign and testing to meet both regulatory obligations.

b) Retrofit remote condensing units

For retrofit remote condensing units, EPA proposed to list, as of January 1, 2016, nine HFC blends as unacceptable: R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, and R-507A. In today's final rule, we are establishing a change of status date for these refrigerants of [**insert date one year after publication in the Federal Register**].

Consistent with the proposal, this action does not apply to servicing equipment designed to use these nine refrigerants or servicing equipment that was retrofitted to use those refrigerants before the January 1, 2018 status change date. For example, remote condensing units designed for use with or retrofitted to R-404A or R-507A prior to **[insert date one year after publication**

in the Federal Register], are allowed to continue to operate and to be serviced using those refrigerants.

(1) What other alternatives does EPA find pose lower overall risk to human health and the environment?

A number of other refrigerants are listed as acceptable for retrofitting remote condensing units: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-407A, R-407C, R-407F, R-417A, R-417C, R-421A, R-422B, R-424A, R-426A, R-427A, R-437A, R-438A, R-448A, R-449A, R-450A, R-513A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-02, and THR-03.[71]

Unlike retrofits of supermarket systems, which are common, retrofits of remote condensing units are unusual. However, given that the operating conditions and requirements between supermarket systems and remote condensing units are generally similar, EPA believes blends such as R-407A, R-407C and R-407F are available options.

See section V.C.2.b.1 above for a summary of our comparative assessment of the SNAP criteria (ODP, GWP, VOC, toxicity, flammability) for the refrigerants we are listing as unacceptable with the other available refrigerants. The refrigerants we are listing as unacceptable for retrofit remote condensing units are the same as those we are listing as unacceptable for retrofit supermarket systems. Likewise, the available alternatives for retrofit remote condensing units are the same as those for retrofit supermarket systems. For the same reasons as presented in section V.C.2.b.1, EPA concludes that there are other refrigerants for use in retrofit remote

[71] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production.

condensing units that pose lower overall risk to human health and the environment than the alternatives we are listing as unacceptable.

EPA regulations have eliminated or will eliminate by 2020 the production and import of HCFC-22. These and other regulations also affect end users who are using CFC-12, R-502, and several HCFC-containing blends such as R-401A, R-402A and R-408A. Therefore, we believe that the impact of this action addressing retrofits will primarily affect those owners who are faced with the choice of continuing to operate systems with a refrigerant that has been phased out of production and import or to switch to a refrigerant listed as acceptable for retrofit at the time the retrofit occurs.

As noted in section V.2.b.1, millions of pounds of HCFC-22 are reclaimed every year, and this supply is available to remote condensing unit owners, operators and technicians, just as it is available for supermarket owners, operators and technicians. We also noted that many retail chains have maintained their own stockpile of HCFC-22, for instance by recovering from stores that are decommissioned or retrofitted and using such supplies to service stores that continue to operate with HCFC-22. This same strategy is possible for those who own or operate multiple facilities using remote condensing units. By establishing a change of status date of **[insert date one year after publication in the Federal Register]**, we are providing owners and operators of remote condensing units the opportunity to begin to address any HCFC-22 supply concerns they may have. Thus, owners have the option to continue to operate this equipment through its useful life with the refrigerant they are using, such as HCFC-22.

Supermarket Company ABC indicated that they have used R-407A to retrofit HCFC-22 systems and that their experience indicates the availability and viability of this and other alternatives. The success of R-407A as a retrofit refrigerant, the other available HFC blends, the

additional HFC/HFO options that EPA recently listed as acceptable, and the other HFC/HFO blends that are being evaluated by chemical producers and equipment manufacturers, as well as the option of continuing to operate with HCFC-22, are sufficient to meet the various features—such as capacity, efficiency, materials compatibility, cost and supply—that affect the choice of a retrofit refrigerant.

(2) When will the status change?

As explained here and in our response to comments, EPA is establishing a change of status date for retrofit remote condensing units of **[insert date one year after publication in the Federal Register]**.

We did not receive any comments suggesting that alternatives that remain acceptable could not be used in these systems. As noted above, Supermarket Company ABC indicated that they have had success using R-407A to retrofit HCFC-22 systems. Results from testing of remote condensing units with R-407A and R-449A are presented above in section V.C.3.a.2. Those results showed increased energy efficiency and/or increased capacity with those refrigerants, indicating that they are viable for both new and retrofit equipment. As indicated in section V.C.1.c above, retrofits may require various changes to the existing equipment, such as different lubricants, new materials such as gaskets and filter driers, and adjustments to expansion valves. These changes include readily available materials and common refrigeration practices. Such retrofits to acceptable alternatives are already occurring, and the option to continue to operate and service existing systems remains. However, as discussed in Section V.C.2.b.2 above, comments indicate that a “new store layout” could be planned or otherwise underway, and that such layout may include the retrofitting of existing remote condensing units to a refrigerant that will no longer be acceptable. Therefore, by providing one full year from the final rule’s

publication, EPA is providing sufficient time for any such retrofits in this end-use category to occur as planned.

c) How is EPA responding to comments on retail food refrigeration (remote condensing units)?

Comment: Two environmental organizations, NRDC and IGSD, urged EPA to maintain the proposed status change date of January 1, 2016, for new remote condensing units. Supermarket Company ABC stated that they did not oppose the January 1, 2016, change of status date for new remote condensing units. FMI, an industry organization representing supermarkets, a market segment that also utilizes remote condensing units, pointed out that "a majority of our members have already voluntarily and proactively discontinued the use of R-404A, R-507, and R-422D for new systems and as a retrofit refrigerant."

Many equipment manufacturers including: Hussmann; Continental Refrigerator; Nor-Lake; Master-Bilt Products; International Cold Storage, Crown Tonka, and ThermalRite Walk-Ins; Lennox; and Manitowoc requested later dates for the status change ranging from 2018 to 2025. In some cases the date requested applied to new equipment in other end-use categories as well as new remote condensing units. AHRI suggested a minimum of six years to transition. The North American Association of Food Equipment Manufacturers (NAFEM) and Howe Corporation submitted comments that were general rather than specific to any particular refrigeration end-use. Based on NAFEM's membership and the products Howe discussed, EPA believes these comments apply to remote condensing units and stand-alone equipment. Howe proposed that the status of R-404A and R-507A change "no sooner than year 2024" while NAFEM suggested a ten-year delay for all of the refrigeration end-uses addressed in the proposed rule and enumerated 14 tasks that they indicate are "necessary to safely introduce

different/flammable refrigerants into the manufacturing process." A separate comment from NAFEM listed five phases, totaling 10 to 12 years, to adopt hydrocarbon refrigerants but also stated that "in no case should any manufacturer be expected to transition prior to 2022." These manufacturers and industry associations cited concerns over the availability of alternatives, the need to design and test products using those alternatives, as well as other concerns that we summarize and address in the Response to Comments Document that has been placed in the docket. Several manufacturers indicated that a January 1, 2016, change of status date would create significant difficulties in designing products with refrigerants that remain acceptable while also meeting the DOE energy conservation standards for commercial refrigeration equipment and for walk-in coolers and freezers that are scheduled to become effective in 2017 (see also section V.C.1.b above and V.C.7 below). In particular, the commenters claimed that additional development of low-temperature products may be necessary to match current efficiency levels.

Hussmann was concerned with the lead time of its customers in planning store layouts with "remote systems," which could include remote condensing units as well as supermarket systems, and indicated that a date of 2018 would allow its customers to better determine what types of systems and refrigerants to use. Lennox proposed a "phased in implementation timing by refrigerant equipment end-use category," suggesting five years from publication of the final for remote condensing units compared to three years for supermarkets and seven years for stand-alone units. AHRI similarly suggested that the change of status date for remote condensing units occur after that of supermarkets.

Regarding HFC/HFO blend alternatives, Honeywell, indicates that supply of R-450A, an alternative listed as acceptable, will be available soon and that R-448A and R-449A, which are currently under SNAP review, are undergoing extensive field trials. Honeywell further stated that

R-448A is "close to being qualified with numerous manufacturers," indicating that manufacturers are developing equipment to use this refrigerant. DuPont indicated that R-449A works well in their tests of a display case connected to a remote condensing unit.

Response: Supermarket Company ABC and FMI as well as environmental organizations supported or did not oppose the proposed status change date of January 1, 2016. A number of other commenters supported a later date ranging from 2017 to as late as 12 years after this action is finalized. The comments requesting later status change dates either did not address retrofits or did not provide adequate information indicating why a date earlier than that for new remote condensing units would be infeasible for retrofit equipment.

Although some use of alternatives is already occurring, we agree with the commenters that certain technical challenges still exist that support a change of status date later than we proposed for new and retrofit equipment. However, we do not agree that significant additional time is needed before alternatives listed as acceptable will be available for new equipment.

There are alternatives that are not subject to a status change that are used already in new and retrofit remote condensing units and others are being developed and deployed. As supported by the comments from FMI, many supermarkets have already transitioned away from the refrigerants we are listing as unacceptable and are using refrigerants that will remain acceptable after this final action. Supermarket Company ABC stated that alternatives were available, pointing towards their experience with R-407A in retrofits and HFC-134a, R-744 and the R-407 series in new equipment. Information in the Agency's possession from a manufacturer of such equipment, explained above, is indicative that R-407A, among other available alternatives, can be readily implemented now in new remote condensing units at medium-temperature applications both during and after meeting DOE energy conservation standards for commercial

refrigeration equipment and for walk-in coolers and freezers. However, the information showed efficiency losses for this refrigerant in low-temperature applications. Although DuPont points to positive results using R-449A in a display case connected to a remote condensing unit, this refrigerant too showed lower energy efficiency in low-temperature than medium-temperature conditions. Both comments indicate that there is a more significant challenge for low-temperature applications.

Thus, while there has been significant progress in transitioning to alternatives that will remain acceptable in medium-temperature applications, there has been less progress in doing so for low-temperature applications. However, the information provided by Honeywell and DuPont indicates that significant additional time will not be needed before equipment is available. In recognition that new remote-condensing unit equipment will need to meet DOE and National Sanitation Foundation (NSF) standards, and some efficiency challenges exist particularly with low-temperature equipment, we are establishing a status change date of January 1, 2018, for new remote condensing units and **[insert one year from publication in the Federal Register]** for retrofits .

Given that the low-temperature results with R-407A showed only 3.6% to 6.7% efficiency declines along with capacity increases, and those from DuPont with R-449A showed a slight improvement in efficiency, we consider a status change date of January 1, 2018, to be adequate to adopt these or other acceptable alternatives into new equipment and perform any testing and certification necessary. A January 1, 2018, change of status date for new remote condensing units will allow time for manufacturers to redesign any products that require additional engineering to meet both this rule and the DOE standards. In situations where these refrigerants do not show energy efficiency improvements, other design changes as described in

the DOE rulemakings and in the literature can be utilized to achieve required efficiencies. In addition, as indicated above, current research and testing on some HFC/HFO blends show similar or better energy efficiency for these products.

While we agree than a short additional amount of time is needed to address these technical challenges and the testing and certification requirements for new equipment, we disagree with commenters who suggest that a lengthy period is needed prior to the change of status. NAFEM estimated 10 to 12 years to adopt hydrocarbon refrigerants; however, as hydrocarbons are not listed as acceptable for remote condensing units, and no schedule was provided for nonflammable refrigerants, EPA views this comment as pertaining to stand-alone equipment. (See section V.C.4 below). All of the refrigerant blends that remain acceptable are nonflammable and some were designed to mimic HFC-134a and R-404A. EPA believes that these can be adopted into manufacturers' products with minor changes while still meeting the DOE requirements. The commenters failed to identify specific technical challenges that would support a more lengthy delay in the change of status date.

4. What is EPA finalizing for retail food refrigeration (stand-alone equipment)?

The change of status determination for retail food refrigeration (stand-alone equipment) is summarized in the following table:

Table 6. Change of Status Decisions for Stand-Alone Equipment

End-use	Substitutes	Decision

Retail food refrigeration (stand-alone medium-temperature units[72] with a compressor capacity below 2,200 Btu/hr and not containing a flooded evaporator) (new)	FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03.	Unacceptable as of January 1, 2019
Retail food refrigeration (stand-alone medium-temperature units with a compressor capacity equal to or greater than 2,200 Btu/hr and stand-alone medium-temperature units containing a flooded evaporator) (new)	FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03.	Unacceptable as of January 1, 2020
Retail food refrigeration (stand-alone low-temperature units[73]) (new)	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, RS-44 (2003 formulation).	Unacceptable as of January 1, 2020
Retail food refrigeration (stand-alone units only) (retrofit)	R-404A and R-507A.	Unacceptable as of **[Insert one year from publication in the Federal Register]**

a) New stand-alone equipment

For new stand-alone equipment, EPA proposed to list HFC-134a and 31 other refrigerants for new stand-alone retail food refrigeration equipment unacceptable, as of January 1, 2016. In today's final rule, EPA is subdividing the new retail food refrigeration (stand-alone equipment) end-use category. For new stand-alone medium-temperature units with a compressor capacity below 2,200 Btu/hr and not containing a flooded evaporator, EPA is changing the listing for HFC-134a and 30 other refrigerants from acceptable to unacceptable as of January 1, 2019.

[72] "Medium-temperature" refers to equipment that maintains food or beverages at temperatures above 32°F (0 °C).
[73] "Low-temperature" refers to equipment that maintains food or beverages at temperatures at or below 32°F (0 °C).

These30 other refrigerants are FOR12A, FOR12B, R-426A, RS-24 (2002 formulation), SP34E, THR-03 and 24 additional refrigerants, listed below, for which EPA is changing the status in all types of stand-alone equipment. For new stand-alone medium-temperature units with a compressor capacity equal to or greater than 2,200 Btu/hr and all stand-alone medium-temperature units containing a flooded evaporator, EPA is changing the listing of HFC-134a and the same 30 other refrigerants from acceptable to unacceptable as of January 1, 2020. For new stand-alone low-temperature units, EPA is changing the status from acceptable to unacceptable of 24 refrigerants as of January 1, 2020. The 24 refrigerants are: 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). While EPA proposed to change the status from acceptable to unacceptable for FOR12A, FOR12B, HFC-134a, R-426A, RS-24 (2002 formulation), SP34E, and THR-03 in all new stand-alone equipment, EPA is not changing the status for these refrigerants in this final rule in stand-alone low-temperature equipment, or for IKON B for any stand-alone equipment, for the reasons provided below. EPA clarifies below how the compressor capacity is to be determined as well as how to distinguish medium-temperature and low-temperature stand-alone equipment.

(1) What other alternatives does EPA find pose lower overall risk to human health and the environment?

EPA has listed R-290, R-600a and R-441A acceptable subject to use conditions in new stand-alone equipment. R-290 is already in use globally, including in the United States, and R-600a is in use outside of the United States as well as in test market trials in the United States. For instance, at a recent exposition, stand-alone equipment using R-290 was displayed by multiple

companies and component suppliers exhibited compressors, filter driers, controls and expansion valves that are designed to use R-290 or R-600a.[74]

R-450A, R-513A, R-744, IKON A, IKON B and THR-02 are listed as acceptable substitutes in new stand-alone equipment without use conditions. [75] In addition, HFC-134a, FOR12A, FOR12B, R-426A, RS-24 (2002 formulation), SP34E and THR-03 remain acceptable without use conditions and are not subject to a change of status date in new stand-alone low-temperature equipment. Also, concurrently with this rule, EPA is listing R-448A and R-449A acceptable without use conditions for new stand-alone low-temperature equipment. EPA is aware of equipment deployment using R-744 and HFC-134a. We are not aware of such deployment with respect to any other of these substitutes, although we are aware that several are undergoing research and testing. The producer of R-450A, Honeywell, stated that the supply of R-450A is "soon to be available." Although we did not see evidence that products were produced with the HFC/HFO blends that are listed as acceptable, publicly-available literature indicates that R-448A, R-449A, R-450A, R-513A and others are under investigation. For example, R-513A (trade name XP10) was tested in commercial bottle cooler/freezer under test 008 of AHRI's Low-GWP Alternative Refrigerants Evaluation Program research.[76] The Refrigeration and Air Conditioning Magazine quoted Emerson, a major supplier of compressors for this industry, as saying it is "prepared to support customers and devote more resources to qualifying lower-GWP

[74] See "New regulations inspire hydrocarbon displays at U.S. NAFEM Show," *www.hydrocarbons21.com/news/view/6143*.

[75] Shecco, 2015. "New Regulations Inspire Hydrocarbon Displays at U.S. NAFEM Show, February 24, 2015. This document is accessible at http://www.hydrocarbons21.com/news/viewprintable/6143.".

[76] Shapiro, Doron. "System Drop-In Tests of R-134a, R-1234yf, Opteon™ XP10, R-1234ze(E), and N13a in a Commercial Bottle Cooler/Freezer", January 25, 2013. This document is accessible at *http://www.ahrinet.org/App_Content/ahri/files/RESEARCH/AREP_Final_Reports/AHRI%20Low-GWP%20AREP-Rpt-008.pdf.*

A1 refrigerant alternatives such as R448A, R449A, R-450A and R513A."[77] EPA addressed the supply of these HFC/HFO blends, and specifically the production of HFO-1234yf and HFO-1234ze(E), which are components of these blends, above in section V.C.2.a.1.

In the preamble to the NPRM, EPA provided information on the risk to human health and the environment presented by the alternatives that are being found unacceptable compared with other alternatives, including several refrigerants listed as acceptable (October 21, 2014, 79 FR 62,863) or acceptable, subject to use conditions (April 10, 2015; 80 FR 19,453) after the NPRM was issued. A technical support document that provides the additional *Federal Register* citations concerning data on the environmental and health properties (e.g., ODP, GWP, VOC, toxicity, flammability) for the acceptable alternatives as well as those we are finding unacceptable may be found in the docket for this rulemaking (EPA, 2015d).

In summary, for stand-alone medium-temperature refrigeration equipment, the substitutes listed above that remain acceptable have zero ODP and GWPs ranging from 1 to about 630. In contrast, the alternatives that we are listing as unacceptable for stand-alone medium-temperature equipment also have zero ODP and they have GWPs ranging from approximately 900 to 3,985. Three of the substitutes that remain acceptable, R-290, R-600a, and R-441A, are or are composed primarily of VOC. EPA's analysis indicates that their use as refrigerants in this end-use are not expected to contribute significantly to ground level ozone formation (ICF, 2014e). These three substitutes are also flammable; however, the use conditions specified ensure that they do not pose greater overall risk than any of the substitutes currently listed as acceptable in

[77] Gaved, 2015. "Emerson Climate Technologies offers to help supply chain move to lower-GWP refrigerants," *www.racplus.com/news/-emerson-climate-technologies-offers-to-help-supply-chain-move-to-lower-gwp-refrigerants/8677708.article*

new stand-alone medium-temperature equipment.[78] None of the refrigerants currently listed as acceptable present significant human health toxicity concerns or other ecosystem impacts. In comparison, the refrigerants we are finding unacceptable are similar in ODP (zero ODP), flammability (low risks of flammability), toxicity (low toxicity), and VOC (non-VOC or not expected to contribute significantly to ground level ozone formation). Because the risks other than GWP are not significantly different for the other available alternatives than for those we are listing as unacceptable and because the GWP for the refrigerants we are listing as unacceptable is significantly higher and thus poses significantly greater risk, we are listing the following refrigerants as unacceptable for new stand-alone medium-temperature refrigeration equipment: FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03.

For stand-alone low-temperature refrigeration equipment, the substitutes that remain acceptable have zero-ODP and GWPs ranging from 1 to about 1,500. The alternatives we are listing as unacceptable have GWPs ranging from approximately 1,800 to 3,985. For the other risk criteria we review, the analysis provided above for stand-alone medium-temperature refrigeration equipment applies also to for the alternatives that remain acceptable and those we are listing as unacceptable. Because the risks other than GWP are not significantly different for the other available alternatives than for those we proposed to list as unacceptable and because the GWP for the refrigerants we proposed to list as unacceptable is significantly higher and thus

[78] The risks due to the flammability of these refrigerants in this end-use were analyzed in the SNAP rules finding them acceptable subject to use conditions (December 20, 2011; 76 FR 78,832 and April 10, 2015; 80 FR 19,453). Refer to Docket ID No. EPA–HQ–OAR–2009–0286 and EPA-HQ-OAR-2013-0748.

poses significantly greater risk, we are listing the following refrigerants as unacceptable for new stand-alone low-temperature refrigeration equipment: 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).

(2) When will the status change?

We are establishing a status change date of January 1, 2019, for new stand-alone medium-temperature equipment with a compressor capacity below 2,200 Btu/hr and not containing a flooded evaporator, and a status change date of January 1, 2020, for all other types of new stand-alone equipment. For this equipment, there are several alternatives that can meet the technological needs of the market. EIA states that "R-744, R-290, R-441A, and isobutene ('R-600a') can satisfy the vast majority of the current market for refrigerants in stand-alone equipment." We are aware of products using R-290, R-600a and R-744 that are already on the market. According to Shecco, based on its October 2014 survey, the manufacturers of stand-alone equipment they surveyed "are already today able to produce sufficient amount of such [R-290, R-600a and R-744] equipment to cover the needs of the entire market. All of the interviewed manufacturers confirmed that they plan to covert [sic] their whole manufacturing facilities to hydrocarbons and/or CO2 by 2018/2019 latest." While the alternatives that remain acceptable will be able to meet the technical constraints for this equipment, time will be needed for the transition to occur. On the aspect of timing, Shecco, Supermarket Company ABC, Hatco, and H&K International suggested a 2018 change of status date, while DuPont and Honeywell suggested 2017. NRDC and IGSD believed EPA should maintain the proposed January 1, 2016, change of status date. In contrast, numerous other manufacturers of stand-alone equipment

indicated concerns with hydrocarbons and R-744, and some referenced HFC/HFO blends as a potential solution. They recommended change of status dates ranging from 2020 to 20 years after the rule becomes final. While we agree that manufacturers will be able to produce equipment using lower-GWP refrigerants addressing a large portion of the market in the period of 2016-2018, we also agree that there are some technical challenges that support a change of status date of 2019 or 2020 for this end-use category.

Manufacturers indicated several necessary steps that will need to occur, including development and testing of components, such as compressors and condensing units, for the full range of stand-alone products. In addition, engineering, development, and testing to meet standards, such as those from UL, DOE and NSF, of the products would start as components became available. Modifications to the factory could be required, ranging from a simpler change of the refrigerant storage area to reconfiguration of the factory to address concerns such as ventilation or other safety measures. Information submitted by the commenters supported that these actions could take a few months or up to a couple of years. However, it is likely that these actions could occur simultaneously with other steps such as equipment design and testing.

Manufacturers identified three distinct refrigerant types. For hydrocarbons, including R-290, we do not see any question regarding chemical supply. NAMA and True Manufacturing indicated that components have already been designed globally, including in the United States, using both R-290 and R-600a. Danfoss, Manitowoc and Unified Brands indicated that 1-2 years are needed to develop air-cooled condensing units for R-290. Components using other hydrocarbon refrigerants, such as R-441A have not been developed, but these refrigerants are offered for sale in the U.S. and are in ample supply.

EPA believes that much of the component and equipment development can occur at the same time; in other words, as certain components become available, appropriate units could be redesigned using those components, prototypes could be built and tested, and final designs could be produced, while additional components are released. Indeed, it appears that many manufacturers have already identified a portion of their products that they could redesign using R-290, as discussed below. Once product models are designed, testing and certification could take place.

In summary, to use hydrocarbon refrigerants, such as R-290, the comments support that approximately three and a half years is needed for equipment to become fully available. This includes one to two years to develop additional components beyond those that are currently available and to test the current and newly developed components in models. Equipment development and testing would occur in series, with the final units being developed and ready for testing approximately one year after the components for that unit were available. Testing and certification would likewise occur as products were developed and would span two to three years, much of which while other actions are occurring. We estimate the final units might take an additional six months to a year to test and certify once developed. As discussed above, any required modifications to the factory line and facilities would occur concurrently if a manufacturer chose to use R-290 or another acceptable hydrocarbon refrigerant. Hence, EPA believes that new stand-alone equipment for medium-temperature applications with a compressor capacity below 2,200 Btu/hr and not containing a flooded evaporator could be available and in compliance with a status change date of January 1, 2019.

The steps in developing products for R-744 would be similar and on a similar time frame as those for hydrocarbons. However, although R-744 is in wide supply, as supported by

commenters such as Hillphoenix, Coca-Cola, Parker-Hannifin, and HC Duke & Son/Electro-Freeze, there has been limited development of components and development of necessary components in a variety of sizes could take two to three years.

Designing stand-alone equipment with R-744 presents challenges such as the need for a complete system redesign due to higher pressures and the different thermodynamic and transport properties. Additionally, as supported by commenters such as HC Duke & Son/Electro-Freeze, while CO_2 system efficiency is good at lower ambient temperatures, CO_2 system efficiency suffers at higher temperatures. Thus, it may take additional time to develop components and equipment for both medium and low-temperature applications.

Although it may not be feasible to develop R-744 equipment for the full spectrum of stand-alone equipment by a status change date of January 1, 2019, other alternatives, such as the hydrocarbons and HFC/HFO blends would be available for those uses by the January 1, 2019, status change date.

The third group of alternatives is the HFC/HFO blends. Refrigerant producers DuPont and Honeywell provided detailed comments on the development of specific HFC/HFO blends and EPA listed one of these, R-450A, as acceptable in October 2014. Concurrently with this rule, EPA is also listing R-513A as acceptable in all stand-alone equipment and two additional HFC/HFO blends, R-448A and R-449A, acceptable in stand-alone low-temperature equipment.

Some samples of these refrigerants are available today and are being tested, as supported by comments from AHRI. However, supplies of some of these blends are limited at this time because of limits on some of the HFO components, HFO-1234yf and HFO-1234ze(E). However, as discussed above in section V.C.2.a.1, production facilities for these refrigerants have commenced operation and thus, as supported by Honeywell and DuPont, we expect adequate

supplies to be available by January 2017 if not before. Unified Brands and Structural Concepts indicated that components for HFC/HFO equipment are being tested and developed today and Unified Brands further projected that it would be three years for a full line of production-ready components.

HFC/HFO blends found acceptable to date or submitted to the SNAP program are nonflammable, acceptable without use conditions, and designed to mimic the performance of either HFC-134a or R-404A, refrigerants in predominant use currently. Thus, as compared with hydrocarbons and R-744, there should be fewer technical challenges in developing equipment using these alternatives. Several commenters, including Master-Bilt, Structural Concepts, and Hoshizaki America, supported that transition to these alternatives would be simpler and quicker once components have been developed and there are adequate supplies.

In summary, should manufacturers choose to pursue HFC/HFO blends, EPA expects such equipment would be widely available in about four years and that R-450A could be available earlier as it was the first such blend found acceptable under SNAP. This includes one to two years for supplies to become widely available, approximately one year for development and testing of components, and approximately one year for equipment development. The short time for development of components and equipment is due to the fact that the properties of the blends are similar to the refrigerants most manufacturers are currently using. Similarly, we expect that there would be limited factory modifications, if any, and that these could occur concurrently with the design work. As with other refrigerants, EPA would expect equipment testing and certification to be rolled out as equipment models are redesigned, with the last units being available approximately six to twelve months after designs are developed.

We are finalizing a status change date of January 1, 2020, for stand-alone low-temperature retail food refrigeration units; stand-alone medium-temperature retail food refrigeration units with a compressor capacity equal to or exceeding 2,200 Btu/hr; and stand-alone retail food refrigeration units employing a flooded evaporator.

For these three types of stand-alone equipment, we find that an additional year beyond January 1, 2019, is needed for the change of status. For equipment using a flooded evaporator, Emerson indicated the lower-GWP refrigerants are all "high glide" often in the range of 7^0F to 10^0F (3.9°C to 5.6°C), and that such a characteristic presents unique redesign and performance challenges. Because of this unique design challenge that will require additional time to address, we are establishing a January 1, 2020, change of status date for new stand-alone equipment that utilizes a flooded evaporator.

The second segment of the stand-alone equipment end-use category that we found faced particular technical challenges was equipment designed to hold products at low temperatures. The choice of refrigerant is in part determined by the desired temperature that food or beverage will be stored. As with "large" equipment, discussed below, commenters, including Hussmann and Hillphoenix, indicated that the charge size limits that apply to the hydrocarbon refrigerants could limit their use in low-temperature equipment, although for some equipment, it may be possible to redesign equipment to use multiple circuits. In addition, these commenters further note that HFC-134a was not a workable refrigerant for low-temperature applications, and thus some of the HFC/HFO alternatives, specifically R-450A and R-513A, which were designed to perform similarly to HFC-134a, would likewise not be workable in these applications. However, other HFC/HFO alternatives, such as R-448A and R-449A, designed to perform similarly to R-404A could be available for low-temperature uses.

We believe that these technical challenges for stand-alone low-temperature equipment will mean the date upon which technically feasible solutions are available will be later than small, medium-temperature equipment. For this reason, we are finalizing a change of status date of January 1, 2020, for stand-alone low-temperature equipment.

EPA points to the 2014 ASHRAE Handbook on Refrigeration, Chapter 15, which reads "medium-temperature refrigeration equipment maintains an evaporator temperature between 0 and 40°F [-18 and 4.4°C] and product temperatures above freezing; low-temperature refrigeration equipment maintains an evaporator temperature between -40 and 0°F [-40 and -18°C] and product temperatures below freezing." We believe the product temperature is a more widely understood criteria, especially amongst equipment owners and users and for purposes of compliance, and therefore clarify here that for purposes of this rule "stand-alone medium-temperature equipment" is defined as that which is designed to maintain product temperatures above 32°F (0°C) and "stand-alone low-temperature equipment" is defined as that which is designed to maintain product temperatures at or below 32°F (0°C).

For large stand-alone equipment with additional cooling capacity requirements, there are challenges with using a number of the lower-GWP refrigerants because the refrigerants are subject to use conditions, including a restriction limiting the charge size to 150 grams per circuit. The charge size use condition applies to the alternative refrigerants that are the farthest along in design and testing for this end-use category, specifically, R-290 and R-600a. Because larger equipment often needs refrigerant charges that are larger than those provided in the use conditions, we sought comment on possible technical challenges in transitioning to another alternative and asked how charge size limits for these flammable refrigerants might affect our determination of whether and when alternatives that pose lower risk are available for larger

equipment. In the NPRM, we sought comment on the possibility of establishing a use restriction that would allow continued use of some refrigerants for which we would otherwise change the status in "large" stand-alone equipment. We sought comment on how we could define "large" and "small" stand-alone units in particular considering charge size.

Several commenters addressed these issues during the comment period. Lennox said that over 98% of its "basic, self-contained refrigeration models exceed 500 grams of refrigerant charge," precluding the use of flammable refrigerants in just one circuit. Manitowoc and Nor-Lake indicated that if they were to use R-290, multiple refrigeration circuits would be required considering the 150 gram use condition that applies to that refrigerant. Some manufacturers discussed the technical difficulties with using multiple circuits. Hillphoenix noted that the use of multiple compressors, each tied to an individual condensing unit, would require "more complex control synchronization that customers must be willing to master" and raised a concern about whether customers would do so. For some equipment, space constraints would limit the practicality of using multiple, separate refrigeration circuits. Minus Forty indicated that "A significant number of our models cannot be or would be very impractical to transition to R-290 due to their size, shape, and custom uniqueness." Nor-Lake stated that multiple circuit equipment would use more energy and believed that the "energy efficiency of a dual system may also create issues with meeting DOE energy requirements."

EPA agrees that there are additional technical challenges faced in converting this equipment that use large charge sizes. In some instances, the challenge may be in developing multi-circuit systems that use refrigerants subject to the charge-size use limits. In other cases, where multiple circuits are not an option, these manufacturers will need additional time to evaluate refrigerants R-744 or the newly listed HFC/HFO blends R-448A, R-449A, R-450A and

R-513A. Therefore, we have established a later status change date of January 1, 2020, for "large" stand-alone equipment.

A few commenters addressed how EPA could distinguish "small" from "large" stand-alone equipment. Nor-Lake suggested a dividing line and recommended that it could be set based on compressor capacity, pointing to 2,400 Btu/hr and 2,200 Btu/hr for medium and low-temperature freezer systems, respectively. Hillphoenix also recommended looking at refrigerant capacity and performed an analysis that, under specific design prescriptions, indicated the maximum capacity achievable using 150 grams of R-290 would be 4,800 Btu/hr and 1,600 Btu/hr for medium-and low-temperature applications, respectively. Supermarket Company ABC suggested making a distinction based on interior volume and refrigeration requirements, but did not offer specifics. Southern Case Art indicated difficulty with using R-290 in its products that are open-display units reaching capacities up to 25,000 Btu/hr. Unified Brands indicated R-290 compressors are available to provide cooling capacity up to 5,000 Btu/hr for medium-temperature and 2,000 Btu/hr in low-temperature applications. Traulsen requested a narrowed use exemption for "large stand-alone units requiring 2 or more systems to operate within the 150 gram limit."

We believe that the compressor capacity limits are a reasonable, easily-understood and easily-enforceable method to distinguish between products that may be unable to rely on flammable refrigerants or that will face greater challenges in doing so, and those that are more easily able to use flammable refrigerants consistent with the 150-gram charge size limits established in the use conditions. We considered separate capacity limits for medium and low-temperature systems as suggested by Nor-Lake and analyzed by Hillphoenix, but determined that establishing just one value would provide more clarity and ease of implementation. We chose the

lower of Nor-Lake's capacity of 2,200 Btu/hr as a dividing line and explain how this applies further below. In setting one value, however, we considered the similarity of the capacities suggested by Nor-Lake, and the fact that these came within the range of sizes analyzed by Hillphoenix.

Although the 2,200 Btu/hr compressor capacity delineation was based on the particular comment from Nor-Lake, neither that commenter nor others indicated how that capacity would be determined. EPA believes consensus standards from AHRI, an association representing manufacturers of such equipment, may be used for this purpose. In today's final rule, we are indicating that the capacity for a stand-alone unit is to be calculated based on the compressor ratings as determined under AHRI 540-2004, Performance Rating of Positive Displacement Refrigerant Compressors and Compressor Units. Although "capacity" is not a rating specifically to be listed under that standard, we note that "Compressor or Compressor Unit Efficiency" and the "Power Input," which are defined in that standard under clauses 3.1 and 3.4, respectively, are required data for the compressor to be listed, per clause 6.2. The compressor capacity is the product of those two items, with adjustment to ensure the result is in the correct units (i.e., Btu/hr). Although a range of capacities may be calculated, EPA is clarifying that to determine whether the compressor capacity is equal to or above 2,200 Btu/hr, we expect the manufacturer to use Table 1 of the standard and choose the "Standard Rating Condition" (defined in clause 3.6.1) most appropriate for the design and intended use of the product. EPA notes that five standard rating conditions are listed in the standard, for instance at Suction Dew Point Temperatures—which is related to the designed food or beverage temperature within the equipment—of 45°F (7.2°C), 20°F (-6.7°C), -10°F (-23°C), -25°F (-32°C), and -40°F (-40°C). By referring to this table EPA believes the dividing line between "small" and "large" condensing

units also considers the product application (e.g., "low" or "medium" temperature), as suggested by Nor-Lake and analyzed by Hillphoenix, and as discussed above.

b) Retrofit stand-alone equipment

For retrofit stand-alone equipment, EPA proposed to change the listing for R-404A and R-507A from acceptable to unacceptable as of January 1, 2016. In today's final rule, we are establishing the change of status date of **[Insert one year from the date of publication in the Federal Register]**.

This action does not apply to servicing existing equipment designed for those two refrigerants or servicing equipment that was retrofitted to use those refrigerants before the January 1, 2016, status change date. For instance, equipment designed for use with or retrofitted to R-404A prior to**[insert date one year after publication]**, would be allowed to continue to operate using and could be serviced with R-404A.

(1) What other alternatives does EPA find pose lower overall risk to human health and the environment?

While we do not believe retrofits are common in stand-alone retail food refrigeration equipment, a number of refrigerants are listed as acceptable for this purpose: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-407A, R-407B, R-407C, R-407F, R-417A, R-417C, 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-450A, R-513A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-02, and THR-03.[79] R-448A and R-449A are also listed acceptable for retrofitting stand-alone low-temperature units. We also note

[79] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production.

that many of the refrigerants remaining acceptable are blends with small amounts of hydrocarbons. The hydrocarbon content allows the possibility of retrofitting equipment from an ODS (which would have used alkylbenzene or a mineral oil) without changing the lubricant, whereas usually a polyolester is required when retrofitting to an HFC or HFC blend. Thus we believe these refrigerants are designed for and would prove successful in retrofits of stand-alone equipment, should such a retrofit be desired by the owner.

In the preamble to the NPRM, EPA provided information on the risk to human health and the environment presented by the alternatives that are being found unacceptable compared with other available alternatives. A technical support document that provides the additional *Federal Register* citations concerning data on the SNAP criteria (e.g., ODP, GWP, VOC, toxicity, flammability) for these alternatives may be found in the docket to this rulemaking (EPA, 2015d). In summary, the other available alternatives have zero ODP as do those that we are finding unacceptable. However, the refrigerants remaining acceptable have GWPs ranging from below 100 to 3,607, lower than the GWPs of the two blends we are finding unacceptable, which have GWPs of 3,922 and 3,985. All of the refrigerants remaining acceptable have toxicity lower than or comparable to the refrigerants whose listing status is changing from acceptable to unacceptable. The other available refrigerants, as well as those we are finding unacceptable, are not flammable. None of the alternatives is considered a VOC; however, some of the other available refrigerant blends include small amounts (up to 3.4% by mass) of VOC such as R-600 (butane) and R-600a (isobutane). However, these amounts are small, and EPA's analysis of hydrocarbon refrigerants shows that even when used neat, they are not expected to contribute significantly to ground level ozone formation (ICF, 2014e). Because the risks other than GWP are not significantly different for the other available alternatives than those we are listing as

unacceptable and because the GWP for the refrigerants we are listing as unacceptable is significantly higher and thus poses significantly greater risk, we are listing the following refrigerants as unacceptable for retrofit stand-alone refrigeration equipment: R-404A and R-507A.

(2) When will the status change?

Commenters did not indicate any technical challenges in retrofitting stand-alone equipment with the refrigerants that remain acceptable. In fact, EIA felt "The poor energy efficiency performance of R-404A is another compelling reason to delist this refrigerant and replace it with R-134a for retrofits, which by comparison, has shown a 10 percent efficiency gain." EPA does not believe retrofits are nearly as common for stand-alone equipment as for other retail food refrigeration uses considered in this final rule, particularly supermarket systems. However, similar to the other types of retail food refrigeration addressed today, EPA is providing one year to ensure that any retrofits that are already underway will have sufficient time to be completed. Therefore, we are establishing a change of status date of **[Insert one year from date of publication in the Federal Register**].

c) How is EPA responding to comments on retail food refrigeration (stand-alone equipment)?

Comment: One commenter, Honeywell, addressed the status change date for retrofits and supported the proposed date of January 2016.

Commenters suggested a wide-range of dates for the status change for new equipment. NRDC and IGSD urged EPA to maintain the proposed status change date of January 1, 2016 for new stand-alone units. These commenters pointed out that coolers using transcritical R-744 have already been developed. Unified Brands stated "it will be impossible to convert all our

equipment from R134a and R404A to R290 by 2016."

A number of commenters supported a change of status a year or two later than that proposed. Two refrigerant producers, Honeywell and DuPont suggested a change of status date of 2017 for new equipment to allow fuller development of HFC/HFO blends that require minimal design changes and offer similar or better performance than current refrigerants. Shecco indicated that a date of January 1, 2018, was needed for "smaller" manufacturers to meet the requirements. Supermarket Company ABC also supported a 2018 change of status date for new stand-alone equipment. H&K International indicated R-290 is very energy efficient and that 2018 would provide enough time to transition. Another manufacturer, Hatco, also believed a "January 1, 2018 implementation date would provide the needed time to do the necessary testing and certification for a safe and effective conversion."

Other commenters supported a much later change of status date for new equipment. Approximately 30 manufacturers, two industry associations representing equipment manufacturers (AHRI and NAFEM), an association representing supermarkets (FMI), and a beverage supplier (Coca-Cola) suggested dates ranging from 2020 to 2025. True Manufacturing, indicated they have been shipping products using hydrocarbons and R-744 for several years. Hillphoenix provided a refrigerant change schedule that discussed the development of R-744, hydrocarbons and HFO blends; this schedule suggested various dates for different tasks for these three refrigerant types. Based on the timeframes associated with these tasks, they suggested a change of status date of January 1, 2022, for stand-alone equipment. Lennox believed the NPRM "generally contemplates a wholesale switch to hydrocarbon refrigerants" in stand-alone equipment. NAFEM indicated it would "take ten to twelve years for manufacturers to convert their product lines to use isobutene or propane."

Response: As provided above in our discussion of the status change dates we are finalizing, we agree with the commenters who suggest a few additional years are needed for the status change. However, we do not agree that commenters advocating a lengthy delay in the change of status provided support for such a delay. As an initial matter, to the extent that these commenters identified concerns with alternatives, their concerns were focused on one refrigerant or class of refrigerants and the commenters did not consider the full range of available or potentially available refrigerants. Specifically, those comments appeared to have focused on alternatives for which the most significant amount of design changes would be necessary and did not appear to consider the range of available refrigerants, many of which could be used with less significant changes to designs. Manufacturers will likely select different refrigerants for different products. Those manufacturers that are not interested in designing equipment that uses hydrocarbon refrigerants, given some of their stated concerns with overcoming challenges with safety and VOC issues, could select a nonflammable fluorinated refrigerant such as an HFC/HFO blend designed to mimic many of the characteristics of the refrigerants they are using today. EPA believes such HFC/HFO blends will become available by the status change dates established in this rule and note that R-448A, R-449A, R-450A and R-513A are listed as acceptable in this end-use category, with the latter two being acceptable in stand-alone medium-temperature equipment and all four being acceptable in stand-alone low-temperature equipment. Furthermore, EPA points to the fact that new HFC/HFO blends have been listed as acceptable and that such blends perform similarly to traditional refrigerants and have proved to be as efficient or even offer an efficiency advantage. As discussed above, the supply of these refrigerants is increasing and the components to use them are in development. EPA believes that by finalizing a status change date for new stand-alone equipment several years later than proposed, manufacturers will have the

ability to choose such HFC/HFO blends for their equipment, as well as the other alternatives, including R-290, R-441A, R-600a and R-744, which have already been listed as acceptable or acceptable, subject to use conditions. There is ample supply of R-290 and R-744; however, the technical difficulties discussed with R-290 (particularly in "large" units) and R-744 suggest that not all manufacturers will be able to convert their products and undergo the testing and certification necessary before that equipment can be sold. Because the HFC/HFO blends are designed to mimic the performance of the refrigerants they replace, the adoption of those is expected to take less time; however, there is only limited supply of those refrigerants now. Given the limited current supply, the initiation of the product conversion, testing and certification would not start until approximately 2016-2017, and hence manufacturers would not be able to provide products using these alternatives until approximately 2019-2020.

As pointed out by Honeywell and DuPont, some of the HFC/HFO blend alternatives, such as R-448A, R-449A, R-450A and R-513A, can be used with little adjustment to existing designs, show energy efficiencies equal to or better than current refrigerants. While there is not currently sufficient supply of these refrigerants, Honeywell and DuPont have indicated that production facilities for the components are on-line (see V.C.2.a.1 above) and that the blends will be made available after listed acceptable with SNAP. As noted previously, Honeywell has stated that R-450A supplies will be "available soon" and multiple component manufacturers are developing equipment that uses these alternatives. Hillphoenix's refrigerant change schedule indicates that "Lab/User Testing" and "Test & Verification" is already underway with such blends. These blends offer equipment manufacturers additional energy efficient options to rapidly transition out of refrigerants listed as unacceptable while also avoiding some of the concerns (e.g., flammability, charge size limits, operation in hot temperatures) manufacturers

indicated exist with other alternatives such as R-290 and R-744.

Several commenters pointed out that at least some part of their product line can be converted to R-290 and some manufacturers are already offering products to the market using these options. For instance, Hillphoenix's refrigerant change schedule indicates that the step of "Convert Products" for "Hydrocarbons (on applicable systems)" can begin in 2015 and continue after that until 2020. They did not provide a full explanation of why the process would continue until 2020; however, EPA sees from commenters that there will be time necessary to develop products and have them undergo the testing and certification necessary to sell such products. EPA believes that by our status change dates of 2019 and 2020, and not before, manufacturers will be able to complete the development of products using R-290 or other hydrocarbons. EPA also believes that testing and certification resources are available to meet this deadline, and that more can be created if there is a demand for them.

As many commenters pointed out, compliance with new DOE energy conservation standards for certain commercial refrigeration equipment is required on March 27, 2017 and for stand-alone walk-in coolers and freezers is required on June 5, 2017 (see also sections V.C.1.b and V.C.7). EPA is establishing change of status dates of January 1, 2019, or January 1, 2020, for stand-alone units. This allows additional time after compliance is required with the DOE standards for manufacturers to potentially redesign any products that require additional engineering to meet both this rule and the DOE standards. With 2019 and 2020 change of status dates, manufacturers have the opportunity to integrate low-GWP refrigerants in their models now as they prepare for the DOE requirements for some or all of their products. Other products already meeting those DOE standards but utilizing refrigerants that we are listing as unacceptable may be redesigned after the DOE deadline to ensure compliance with both EPA

and DOE requirements. Given that some HFC/HFO blends, such as R-450A and R-513A, were designed to mimic HFC-134a in medium-temperature refrigeration, and others, such as R-448A and R-449A, were designed to mimic R-404A in low-temperature refrigeration, EPA believes that these can be adopted into manufacturers' products with minor changes while still meeting the DOE requirements, once supplies of those refrigerants are made available to the manufacturers.

5. What is EPA finalizing for vending machines?

The change of status determination for vending machines is summarized in the following table:

Table 7. Change of Status Decisions for Vending Machines

End-use	Substitutes	Decision
Vending machines (new only)	FOR12A, FOR12B, HFC-134a, KDD6, 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-426A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), SP34E.	Unacceptable as of January 1, 2019
Vending machines (retrofit only)	R-404A, R-507A.	Unacceptable as of **[Insert one year from date of publication in the Federal Register]**

a) New vending machines

EPA proposed to change the listing for HFC-134a and 20 other refrigerants for new vending machines from acceptable to unacceptable as of January 1, 2016. In today's final rule, EPA is changing the listing for HFC-134a and 19 other refrigerants for new vending machines from acceptable to unacceptable as of January 1, 2019. While EPA proposed to change the status from acceptable to unacceptable for IKON B, EPA is not changing the status for this refrigerant in this final rule for the reasons provided below.

The 19 other refrigerants in addition to HFC-134a are: FOR12A, FOR12B, KDD6, 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-426A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), and SP34E.

(1) What other alternatives does EPA find pose lower overall risk to human health and the environment?

A number of other refrigerants are acceptable or acceptable subject to use conditions for new vending machines: IKON A, IKON B, R-290, R-441A, R-450A, R-513A, R-600a, R-744, and THR-02.[80]

In the NPRM, EPA provided information on the risk to human health and the environment presented by the alternatives that are being found unacceptable and those that remain acceptable. Subsequent to the issuance of the proposal, EPA listed R-290, R-441A and R-600a, as acceptable, subject to use conditions (April 10, 2015, 80 FR 19,453). In addition, concurrently with this rule, EPA is listing R-450A and R-513A acceptable in new vending machines. A technical support document that provides the additional *Federal Register* citations concerning data on the SNAP criteria (e.g., ODP, GWP, VOC, toxicity, flammability) for these alternatives may be found in the docket for this rulemaking (EPA, 2015d). In summary, the other available refrigerants for new vending machines have zero ODP and GWPs ranging from 1 to about 630. In contrast, those we are finding unacceptable have GWPs ranging from approximately 1,100 to 3,985. IKON B, which we proposed but are not finalizing to be unacceptable, has a GWP around 600. R-290, R-600a, and R-441A are or are composed

[80] HCFC-22 and some blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production.

primarily of VOCs. We have exempted R-290, R-600a and R-441A used in vending machines from the venting prohibition (80 FR 19,453). EPA's analysis indicates that their use as refrigerants in this end-use are not expected to contribute significantly to ground level ozone formation (ICF, 2014e). These three substitutes are also flammable; however, the use conditions specified ensure that they do not pose greater overall risk than any of the substitutes currently listed as acceptable in new vending machines.[81] None of the refrigerants currently listed as acceptable present significant human health toxicity concerns or other ecosystem impacts. In comparison, the refrigerants we are finding unacceptable are similar in ODP (zero ODP), toxicity (low toxicity), and VOC (non-VOC or not expected to contribute significantly to ground level ozone formation). When the three hydrocarbon substitutes are used in accordance with the use conditions, their flammability risks are not significantly greater than those of the unacceptable alternatives. Because the risks other than GWP are not significantly different for the other available alternatives than those we are listing as unacceptable and because the GWP for the refrigerants we are listing as unacceptable is significantly higher and thus poses significantly greater risk, we are listing the following refrigerants as unacceptable for new vending machines: HFC-134a, FOR12A, FOR12B, KDD6, 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-426A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), and SP34E.

(2) When will the status change?

EPA is establishing a change of status date for the specified HFC refrigerants in new vending machines of January 1, 2019.

[81] The risks due to the flammability of these refrigerants in this end-use were analyzed in the SNAP rule finding them acceptable, subject to use conditions (April 10, 2015; 80 FR 19,453). Refer to Docket ID No. EPA-HQ-OAR-2013-0748.

For new vending machines, there are several alternatives that can meet the technological needs of the market. EIA states that "R-744, R-290, R-441A, and isobutene ('R-600a') can satisfy the vast majority of the current market for refrigerants in … vending machines." We are aware of products using R-290 and R-744 that are already in use. According to Shecco, based on its October 2014 survey, the manufacturers of vending machines they surveyed "are already today able to produce sufficient amount of such equipment [R-290 and R-744] to cover the needs of the entire market. All of the interviewed manufacturers confirmed that they plan to covert [sic] their whole manufacturing facilities to hydrocarbons and/or CO_2 by 2018/2019 latest." While the alternatives that remain acceptable will be able to meet the technical constraints for this equipment, time will be needed for the transition to occur. On the aspect of timing, Shecco supported a status change date of January 1, 2018, although their survey suggested some manufacturers might not convert until 2019. Shecco indicated that the supply of HFC-free vending machines has been increasing over the last two years. Other commenters suggested that four to five years would be required, mentioning in particular the supply of components as a major obstacle in achieving the proposed January 1, 2016, status change date. While we agree that manufacturers will be able to produce equipment using lower-GWP refrigerants addressing a large portion of the market in the period of 2016-2017, we also agree that there are some technical challenges that support a change of status date of 2019 for this end-use.

Commenters indicated several necessary steps that will need to occur, including development and testing of components, such as compressors, for the full range of vending machines. In addition, engineering, development, and testing to meet standards, such as those from DOE, of the products would start as components became available. Modifications to the factory could be required, ranging from a simpler change of the refrigerant storage area to

reconfiguration of the factory to address concerns such as ventilation or other safety measures. Information submitted by the commenters supported that for the portion of the vending machines that have not already transitioned to a lower-GWP refrigerant, these actions could take a few months or up to a couple of years. However, it is likely that these actions could occur simultaneous with other steps such as equipment design and testing.

One manufacturer identified two refrigerant types: R-744 and hydrocarbons. Refrigerant producers also pointed towards HFC/HFO blends as a third group. For R-744, we do not see any question regarding refrigerant supply. Information submitted by the commenters support that some components are already available. Coca-Cola indicated time was needed for testing and certifying new models of vending machines; however, additional information indicated that various types of R-744 vending machines are already available or are expected to be available by January 1, 2016. Pepsi has test-marketed R-744 vending machines in the United States as early as 2009.[82] The Automated Merchandising Systems (AMS) however stated that R-744 was unlikely as a viable substitute for its equipment, especially for the perishable food vending machines it offers. Although EPA did not see the technical detail to allow us to conclude that R-744 would not be a viable choice for such equipment, we agree that additional time beyond our proposed status change date is needed to explore that and other acceptable substitutes for this equipment. The comments support that equipment can be designed, tested and certified using R-744 by January 1, 2019.

Comments also supported that some components and equipment using hydrocarbons are available. AMS stated that one hurdle for using R-290 is finding 120-volt, 60-hertz components

[82] PepsiCo, 2009. "PepsiCo Brings First Climate-Friendly Vending Machines to the U.S.," March 30, 2009, this document is accessible at *www.pepsico.com/live/pressrelease/pepsico-brings-first-climate-friendly-vending-machines-to-the-us03302009.*

for the U.S. and Canadian markets. AMS also echoed the concern of Coca-Cola that more time is needed for testing and certifying new models of vending machines. EPA agrees time beyond the originally proposed January 1, 2016, status change date is necessary for further development of R-290 components and for necessary testing and certification of R-290 vending machines. Information in the comments indicate that some R-290 components are available from multiple suppliers and we believe that these components could be employed in vending machines.

In summary, to use hydrocarbons refrigerants, comments support that approximately three and a half years are needed for equipment to become fully available. This includes six months to test and design products using the available R-290 components and an additional year to two years for development of other components and equipment designs. Equipment development and testing would occur in series, with the final units being developed and ready for testing approximately six months after the components for that unit were available. Testing and certification would likewise occur as products were developed and would span up to three years, much of which while other actions are occurring. We estimate the final units might take an additional six months to test and certify once developed. As discussed above, any required modifications to the factory line and facilities would occur concurrently if a manufacturer chose to use R-290 or another acceptable hydrocarbon refrigerant. Hence, EPA believes that new vending machines could be available and in compliance with a status change date of January 1, 2019.

Comments also support that other options besides R-744 and hydrocarbons may be explored for those products that have not yet transitioned. Concurrently with this rule, EPA is listing two HFC/HFO blends, R-450A and R-513A, as acceptable for new vending machines. Although commenters did not indicate a current supply of components for these refrigerants,

information indicates that component suppliers are committing additional resources to develop them. EPA believes their adoption can happen quickly as they are both nonflammable blends and are designed to mimic the performance of HFC-134a, the only refrigerant indicated by a manufacturer as used in its vending machines. As noted earlier, Honeywell, the producer of R-450A, indicated that it will be supplying that refrigerant soon. We expect that the refrigerant producers will be able to fully supply these blends in a year or two. EPA expects that components designed for the vending machine market using one or both of these blends could be developed within the next year to eighteen months as more refrigerant supplies become available. As components become available, additional design and testing in vending machines could begin. Because the comments indicated only one refrigerant to be replaced, and because the HFC/HFO blends are designed to mimic that refrigerant, equipment development time for vending machines is expected to be shorter than other end-uses, perhaps adding only six months. Limited factory modifications, if any, could happen concurrently with the design work. As with other refrigerants, EPA would expect equipment testing and certification to be rolled out as equipment models are redesigned, with the last units being available approximately six months after designs are developed.

In summary, we find that HFC/HFO blends could be implemented to meet the January 1, 2019, status change date for new vending machines.

b) Retrofit vending machines

For retrofit vending machines, EPA proposed to change the listing for R-404A and R-507A from acceptable to unacceptable as of January 1, 2016. In today's final rule, we are finalizing a change of status of **[insert one year from the date of publication in the Federal Register]** similar to the retail food end-uses considered in this final action. EPA does not believe

retrofits are nearly as common in vending machines as for some of the retail food refrigeration uses, particularly supermarket systems. However, similar to the retail food refrigeration addressed today, EPA is providing one year to ensure that any retrofits that are already underway, will have sufficient time to be completed.

This action does not apply to servicing existing equipment designed for those two refrigerants or servicing equipment that was retrofitted to use those refrigerants before the January 1, 2016, status change date. For instance, vending machines designed for use with or retrofitted to use R-404A or R507A prior to **[Insert one year from date of publication]**, would be allowed to continue to operate using and could be serviced with that refrigerant.

(1) What other alternatives does EPA find pose lower overall risk to human health and the environment?

A number of refrigerants are acceptable for retrofitting vending machines: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-407C, R-417A, R-417C, R-421A, R-422B, R-422C, R-422D, R-426A, R-437A, R-438A, R-448A, R-449A, R-450A, R-513A, RS-24 (2002 formulation), SP34E, and THR-02.[83]

We do not believe retrofits are common in vending machines. Many of the refrigerants remaining acceptable are blends with small amounts of hydrocarbons. The hydrocarbon content allows the possibility of retrofitting equipment from an ODS (which would have used alkylbenzene or a mineral oil) without changing the lubricant, whereas usually a polyolester is required when retrofitting to an HFC or HFC blend. Thus we believe these refrigerants would prove successful in retrofits of vending machines, should such a retrofit be desired by the owner.

[83] HCFC-22 and several blends containing HCFCs are also listed as available but their use is severely restricted by the phasedown in HCFC production.

In the preamble to the NPRM, EPA provided information on the risk to human health and the environment presented by the alternatives that are being found unacceptable and those that remain acceptable. A technical support document that provides the additional *Federal Register* citations concerning data on the SNAP criteria (e.g., ODP, GWP, VOC, toxicity, flammability) for these alternatives may be found in the docket for this rulemaking (EPA, 2015d). In summary, other alternatives have zero ODP and have GWPs ranging from below 100 to 3,085, lower than the GWPs of the two blends we are finding unacceptable, which have GWPs of 3,922 and 3,985. All of the refrigerants remaining acceptable have toxicity lower than or comparable to the refrigerants whose listing status is changing from acceptable to unacceptable. None of the refrigerants that remain acceptable or those that are being listed as unacceptable is flammable. None of the alternatives is considered a VOC; however, some of the refrigerant blends that remain acceptable include small amounts (up to 3.4% by mass) of VOCs such as R-600 (butane) and R-600a (isobutane). However, these amounts are small, and EPA's analysis of hydrocarbon refrigerants show even when used neat they are not expected to contribute significantly to ground level ozone formation (ICF, 2014e). Because the risks other than GWP are not significantly different for the other available alternatives than those we are listing as unacceptable and because the GWP for the refrigerants we are listing as unacceptable is significantly higher and thus poses significantly greater risk, we are listing the following refrigerants as unacceptable for retrofit vending machines: R-404A and R-507A.

(2) When will the status change?

Commenters did not indicate any technical challenges in retrofitting vending machines with the refrigerants that remain acceptable. In fact, EIA felt "The poor energy efficiency performance of R-404A is another compelling reason to delist this refrigerant and replace it with

R-134a for retrofits, which by comparison, has shown a 10 percent efficiency gain." As discussed above, however, commenters indicated that plans may be underway and that adequate time should be given to allow for those plans to be implemented or changed. Therefore, we are establishing a change of status date of **[Insert one year from date of publication]**.

c) How is EPA responding to comments on vending machines?

Comment: Honeywell supported the proposed date for retrofit vending machines. Regarding new vending machines, NRDC and IGSD believed the proposed status change date of January 1, 2016, was feasible and stated that the Consumer Goods Forum has pledged to transition completely out of HFC equipment by the end of 2015. Honeywell and DuPont, suggested a change of status date of 2017 for new vending machines to allow fuller development of additional alternatives that would require minimal design changes and offer similar or better performance than current refrigerants. Shecco felt that while the large manufacturers could meet the proposed date, a date of January 1, 2018, would allow for smaller manufacturers to meet the requirements. The Coca-Cola Company claimed the change of status date for new vending machines should be no earlier than January 1, 2020, to allow time for the development of additional compressor models of its preferred alternative to cover a full range of required capacities. AMS, a vending machine manufacturer, believes that one option that is being pursued on the beverage side, R-744, is not a viable solution for perishable food vending equipment. This manufacturer recommends a January 1, 2020, change of status date to allow for development of additional alternatives. The National Automatic Merchandising Association (NAMA) indicated that the conversion timeline is likely to be four or five years, although some of its members estimate the timeline to be as much as eight years, based on the experience of the mid-1990s when companies phased out the use of CFC-12.

Response: We acknowledge the comment supporting the proposed date of January 1, 2016 for retrofit vending machines and note that we are finalizing that change of status date as proposed.

We do not agree with NAMA that the switch away from CFC-12 in the mid-1990s supports a four, five or even eight year period. The phaseout of CFC-12 consumption was January 1, 1996, less than two years after the initial SNAP listings were issued. Regardless, each transition is unique and the timing for transitions can vary end-use by end-use and even for the same end-uses depending on a number of factors, such as whether alternatives that perform similarly to the current refrigerant can be used or whether significant design changes may need to occur.

Regarding this current action for vending machines, the transition away from the substitutes we are listing as unacceptable is already underway based on public commitments made by some of the largest purchasers of vending machines. Shecco conducted a survey of vending machine manufacturers in October 2014 and found that all were planning to convert to hydrocarbons and/or R-744 in the 2018/2019 timeframe at the latest. Many companies have already made significant progress. For example, the Coca-Cola Company has placed over 1.4 million HFC-free units globally and EIA indicates that "Pepsi is approaching 1 million hydrocarbon vending machines which use 20 percent less energy than Energy Star requirements." There has been success developing and deploying vending machines with R-744, including the manufacture of components for those machines. EIA enumerated four manufacturers offering hydrocarbon compressors and components for light commercial uses, including vending machines. Although Coca-Cola requested a 2020 change of status date, other information listing commercialization plans for low-GWP stand-alone equipment and vending

machines indicated that by January 1, 2016, all of the vending machines in that list were expected to be available with low-GWP refrigerants. However, other commenters indicated that more components need to be developed for different types of vending machines to support a complete transition. AMS stated that more components for R-290 suitable for the U.S. and Canadian power supply (e.g., 60 Hz) were needed. We agree that the choice of components to-date has been limited but we see that it is growing and expect it to continue to grow, especially considering that two large U.S. purchasers of vending machines have committed to move to non-HFC technologies. R-744, R-290 and R-600a components used in other products, like stand-alone retail food refrigeration equipment, may also be adaptable for vending machines.

Thus, although significant progress has been made, in particular with the use of R-744 in vending machines that dispense canned beverages, it is necessary to provide some additional time beyond the proposed date of January 1, 2016 to allow further development of components for different types of vending machines and also to allow further development of components using other alternative refrigerants.

6. General comments on the retail food refrigeration and vending machine end-uses

a) Specific numerical limits for GWP

Comment: Unisom Comfort Technologies requested that EPA consider banning all refrigerants with GWP greater than 10, as there are very many existing alternatives. DuPont recommended that EPA change the status to unacceptable for all alternatives which generally have GWPs above 1,500, such as the R-407 series refrigerants. They suggested this limit "for new and retrofit refrigeration and vending applications." DuPont indicated that by January 1, 2017, there will be multiple low-GWP alternatives commercially available. Another refrigerant

producer, Honeywell, recommended a GWP limit for new supermarket systems and remote condensing units of 1,500 and a GWP limit of 2,000 for retrofitted equipment, based on the IPCC's Fifth Assessment Report (AR5). For new stand-alone equipment and vending machines, Honeywell recommended a GWP limit of 600 (using AR5 GWPs) for HFC-134a replacements and 1,500 for R-404A replacements. CARB suggested adding an additional restriction for all commercial refrigeration to find unacceptable all HFCs with a GWP greater than 1,500 starting in 2018 and all those with a GWP greater than 150 in 2023. Unison Comfort Technologies implored us to "seriously consider banning all refrigerants with GWP>10."

Response: EPA's proposal was limited to determinations for the specific refrigerants proposed which pose significantly greater risk than other available refrigerants, and we cannot take final action changing the status of additional refrigerants without first providing notice and an opportunity for comment. EPA may consider whether to include additional refrigerants in a future proposed status change rule in which EPA would provide the necessary analysis of the SNAP criteria and an opportunity for public comment.

Regarding the suggestion that we establish a specific numerical limit for GWP, as noted in Section IV.B, the structure of the SNAP program, which is based on a comparative framework of available substitutes at the time a decision is being made, does not support the use of such limits. We note that in making our decision for new and retrofit supermarket systems and remote condensing units, EPA pointed to the multi-year history of the successful use of some blends that remain acceptable to support the "availability" of alternatives that pose less risk than those we are listing as unacceptable. Many of these blends have GWPs higher than the limits recommended by the commenters. Thus, at this time, we do not believe an analysis of refrigerants below those limits recommended by the commenters with those above the limit and

which remain acceptable would support a conclusion that the lower-GWP refrigerants are available for use, as many have not been demonstrated to be technically feasible for products and systems in these specific end-use categories. As noted previously, there are a number of technical challenges that must be addressed in selecting a refrigerant for use in a specific system and we do not have information supporting use of these lower-GWP refrigerants. However, as we see from the current action, the refrigeration industry has made great progress in the last five to ten years in moving toward lower-GWP alternatives and we see that momentum continuing. Therefore, it is possible that at some future date, we could determine to list additional alternatives as unacceptable based on a determination that there are lower-GWP alternatives available that, based on consideration of the SNAP review criteria, pose lower overall risk.

b) Comments and responses concerning small businesses

Comment: Commercial Food Equipment Service Association (CFESA), an organization representing service companies and technicians, suggested a timeline "ideally extended to 10 years for small businesses" and "no less than 5 years" for large companies. Shecco believed that many of the smaller manufacturers lag behind the larger companies in the switch away from HFC-134a in stand-alone equipment and vending machines. They suggested a January 1, 2018, change of status date would provide sufficient time for these smaller companies, "enabling them to remain in the marketplace and ensuring healthy competition in this area."

Response: EPA does not agree that a different change of status date should apply to large companies as compared to small companies. The available alternatives that pose lower risk than those subject to the status change are equally available to businesses of all sizes. Under SNAP, EPA has not used the "size" of the user as a basis for its listing decisions and the commenter provides no basis related to the scope and purpose of the SNAP program to do so in this instance.

EPA's decision regarding the status change dates for new retail food refrigeration equipment and new vending machines was based on the technical challenges faced by businesses of all sizes in adopting new refrigerants successfully in these products.

Comment: Some commenters indicated that they believe additional time is needed for smaller companies, especially businesses in the stand-alone/self-contained retail food refrigeration end-use that manufacture custom-built equipment and produce hundreds of models. The commenters also indicated particular challenges and disadvantages for small businesses as compared to larger businesses.

Response: We note that transition timelines in the NPRM were based on the Agency's information concerning the availability of alternatives for businesses of all sizes and we did not provide separate change of status dates for different size businesses. We address these concerns further in the previous comment and response.

c) Suggestion regarding education and training

Comment: CFESA points to the need for "proper education and safety training for a successful and safe transition away from current refrigerants to the flammable or scarce refrigerants EPA deems acceptable." Other commenters likewise stated training of factory employees and service technicians would be required, especially if hydrocarbon refrigerants were employed.

Response: Because CFESA and others reference flammable refrigerants, EPA believes this comment is particular to stand-alone equipment and vending machines, where certain flammable refrigerants are currently acceptable subject to use conditions. However, for these two end-uses, not all refrigerants listed as acceptable are flammable. Acceptable alternatives for stand-alone equipment and vending machines, such as R-448A, R-449A, R-450A and R-513A,

are nonflammable and operate at similar characteristics to R-404A and HFC-134a. CFESA does not specify which refrigerants it considers scarce. Nonflammable R-744 refrigerant, for example, is in ample supply. While some other refrigerants have not been produced in large quantities to date, production is increasing as demand increases, including R-448A, R-449A, R-450A and R-513A. Honeywell indicates that R-450A is soon to be produced in commercial quantities, and EPA expects it, along with other HFC/HFO blends, will be available by the change of status dates of 2019 and 2020 for vending machines and stand-alone equipment. With respect to technician training, EPA agrees proper education and training is valuable, and we note that there are already many manufacturers and suppliers who have been conducting such training. For example, Shecco notes that "The GUIDE North America 2013[84] report has identified at least 165 [Heating, Ventilation, Air Conditioning, and Refrigeration] HVAC&R System & Component Manufacturers, and Engineering Contractors in the United States working with natural refrigerants already today. In reality we have a reason to believe that this number is much higher." Coke noted that it has developed and trained a servicing network as it introduced R-744 equipment. Included in the docket to this rule is *Hydrocarbon Refrigerants—A Study Guide for Service Technicians*, published by the Refrigeration Service Engineers Society (RSES), that could be used for those wishing to service new stand-alone units and new vending machines using R-290, R-441A or R-600a.

The HFC/HFO blend alternatives, identified above, are nonflammable and operate at similar characteristics to those subject to the status change and therefore technicians should require only minimal extra training to use them. Because different change of status dates apply

[84] Shecco, 2013a: GUIDE 2013: Natural Refrigerants - Market Growth for North America, *publication.shecco.com/publications/view/6*

for the different refrigeration end-uses technicians will have an opportunity to stagger training relevant for the different end-uses and they can build their skills across those end-uses over time.

7. Energy efficiency considerations

DOE has promulgated, in separate rulemakings and under separate authority, energy conservation standards for several types of equipment, including products that are affected by this rule. See section V.C.1.b for information regarding DOE energy conservation standards that are applicable to the equipment addressed in this rule. New equipment subject to this rule would need to meet the DOE requirements and the requirements of the status change by the dates established in these rules.[85] We note that for each of these end-uses, there are many compliant models already commercially available that do not use the refrigerants subject to a change of status. Furthermore, for all the equipment subject to today's rule, there are examples, highlighted below, that show the energy efficiency using alternative refrigerants not subject to a change in status can be at least as good as, and often better than, the energy efficiency of equipment using refrigerants whose status will change to unacceptable.

We note that we do not have a practice in the SNAP program of including energy efficiency in the overall risk analysis. We do, however, consider issues such as technical needs for energy efficiency (e.g., to meet DOE standards) in determining whether alternatives are "available." EPA recognizes that the energy efficiency of particular models of equipment is a significant factor when choosing equipment. We also recognize that the energy efficiency of any

[85] Refrigeration equipment in the applicable covered equipment class would still be subject to DOE's standards, regardless of the refrigerant that the equipment uses. If a manufacturer believes that its design is subjected to undue hardship by a regulatory standard prescribed by DOE (in contrast to one that is statutorily prescribed by Congress), the manufacturer may petition DOE's Office of Hearing and Appeals (OHA) for exception relief or exemption from the standard pursuant to OHA's authority under section 504 of the DOE Organization Act (42 U.S.C. 7194), as implemented at subpart B of 10 CFR part 1003. OHA has the authority to grant regulatory relief from a standard promulgated by DOE on a case-by-case basis if it determines that a manufacturer has demonstrated that meeting the standard would cause hardship, inequity, or unfair distribution of burdens.

given piece of equipment is in part affected by the choice of refrigerant and the particular thermodynamic and thermophysical properties that refrigerant possesses. Although we cannot know what energy efficiency will be achieved in future products using a specific acceptable refrigerant, we can point to both actual equipment and testing results that show promise and often better results than the equipment using the refrigerants that we are finding unacceptable. (EPA-HQ-OAR-2014-0198-0134, EPA-HQ-OAR-2014-0198-0184, EPA-HQ-OAR-2014-0198-0077). We recognize that, while theoretical efficiency of any given Rankine cycle is not dependent on the refrigerant used, the refrigerant, the design of the equipment, and other factors will affect the actual energy efficiency achieved.

The efficiency can change based on the refrigerant chosen and there are various metrics, such as Total Equivalent Warming Impact (TEWI) and Life Cycle Climate Performance (LCCP), that account for climate effects of both emissions of the refrigerant and the possible emissions of greenhouse gases, primarily carbon dioxide, from the source of power to operate equipment. Quantification of the portions of TEWI/LCCP from the refrigerant and energy use can only be done using broad assumptions that would not be applicable to all users of the myriad equipment models that are affected by today's rule. As noted in section V.C.1.b, energy conservation standards set by the DOE apply to some of the equipment covered by today's rule (e.g., stand-alone equipment, vending machines). If manufacturers were to offer equipment that meets, but does not exceed, that standard (or any other standard, such as ENERGY STAR®), then the indirect emissions from energy use would be the same regardless of which refrigerant were used. In that case, the refrigerant emissions would be the only factor that would decide which system has a lower TEWI or LCCP. Manufacturers that wish to exceed energy efficiency requirements may do so with any acceptable refrigerant they choose. Although some refrigerants will in the

future be listed as unacceptable as determined in this final action, that does not directly affect the theoretical energy efficiency possible. As noted below, the results to date for actual equipment using acceptable alternatives do not show any significant decline in energy efficiency and often show the reverse. (EPA-HQ-OAR-2014-0198-0134, EPA-HQ-OAR-2014-0198-0184, EPA-HQ-OAR-2014-0198-0077). While various sources of data on energy efficiency results from testing acceptable refrigerants show varying results, we believe that with new designs to use these refrigerants, any lower energy efficiency results can be overcome and likewise existing energy efficiency levels can be improved.

Throughout the history of the SNAP program, EPA has seen the energy efficiency of refrigeration and air-conditioning equipment increase, despite changing refrigerant options. In some cases, this was because new chemicals were developed that possessed unique properties that allowed high energy efficiency levels to be obtained. In many cases, technological improvement and optimization of equipment designs and controls has increased energy efficiency. Although today's rule lists some refrigerants as unacceptable, we do not believe it will have a detrimental effect on this trend in increased energy efficiency. In fact, there are multiple case studies available that highlight the energy efficiency gains achieved by some of the low-GWP refrigerants, such as R-744, which remains acceptable for the refrigeration end-uses addressed in this rule, and R-290 and R-600a, which remain acceptable subject to use conditions for new stand-alone equipment and new vending machines. (EPA-HQ-OAR-2014-0198-0134, Refrigeration and Air Conditioning Magazine, 2015).[86] As part of our review of whether alternatives are "available," we determined that equipment has been designed for and is capable

[86] Refrigeration and Air Conditioning Magazine, 2015. "Coca Cola to narrowly miss HFC-free global refrigeration target" (*www.racplus.com/news/coca-cola-to-narrowly-miss-hfc-free-global-refrigeration-target/8680290.article*).

of meeting existing requirements such as the DOE energy conservation standards. Below we highlight the energy efficiency gains that have been reported for the commercial refrigeration end-uses and end-use categories affected by today's rule.

Theoretical and prototype testing show similarly good energy efficiency results. For instance, in supermarket refrigeration, a theoretical analysis (Emerson Climate Technologies, 2014) examined the energy use of R-407A and R-410A, both of which are on the list of acceptable substitutes, against that of R-404A, which is listed as unacceptable in new supermarket systems as of January 1, 2017. Although this analysis found that both blends would see a 3.6% to 6.7% drop in efficiency in the low-temperature part of the store (e.g., frozen food, ice cream), they would achieve a 4.3% to 13.3% increase in the medium-temperature part of the store (e.g., meat, dairy products, chilled prepared food). Given that supermarkets have significantly larger use of medium-temperature equipment, the net effect would be for the equipment using those alternatives to use less energy than equipment currently designed to use R-404A. We have pointed out in Section V.C.2 above that R-407A in particular is widely used and we might expect it to be used in a large share of supermarkets after the change of status date. This analysis showed similar increases in energy efficiency of new supermarket and stand-alone equipment using a variety of low-GWP refrigerants as compared with equipment currently using R-404A.

The analysis also showed a slightly higher energy consumption by stand-alone equipment designed to use other alternatives as compared with one designed to use R-404A. One user of stand-alone equipment did not provide any specific results, but stated that "HC freezers are significantly more energy-efficient." (Ben and Jerry's, 2014). True recently displayed several stand-alone units using R-290 refrigerant that were reported to be 15% more efficient than

similar equipment using HFC-134a and R-404A.[87] Similar results were seen by DuPont, who found that R-449A reduced energy usage when used in a display case connected to a remote condensing unit. They found that the energy consumption using this refrigerant was 2% to 3% less than R-404A in low-temperature tests and 8% to 12% less in medium-temperature tests. (EPA-HQ-OAR-2014-0198-0077).

Similar results are being seen with vending machines. As noted in the NPRM, one purchaser of vending machines indicated that while introducing over one million units using R-744, they have increased the energy efficiency of their cooling equipment over 40% since 2000, at which time such equipment was exclusively using HFC-134a (Coca-Cola, 2014). More recently, it was reported that 78% of Coca Cola's models (vending machines and stand-alone cases) perform more efficiently than HFC units. (Refrigeration and Air Conditioning Magazine, 2015). Furthermore, it has been reported that PepsiCo has placed nearly one million hydrocarbon vending machines on the market and that these use 20% less energy than ENERGY STAR requirements.

As new products are designed to use particular refrigerants, manufacturers have the opportunity to change designs to take advantage of a given refrigerant's characteristics. The redesign and development phase is also an opportunity to improve other components that will affect the overall efficiency of the equipment, such as the use of more efficient motors and compressors, improved heat exchangers, better controls, improved insulation (e.g., on display cases) and sealing (for products with doors), more efficient lighting, etc. These opportunities and the examples provided are indicative that when redesigning equipment for a new refrigerant,

[87] Shecco, 2013b. "HCs gaining market prominence in US – view from The NAFE Show – Part 1" February 18, 2013. This document is accessible at *www.hydrocarbons21.com/news/viewprintable/3891*.

energy efficiency is often improved. Multiple companies have reported such gains in the equipment covered by today's rule, for instance with R-407A or R-744 in supermarket systems, with HFC/HFO blends in remote condensing units, and with hydrocarbons and R-744 in stand-alone equipment and vending machines

D. Foam blowing agents

1. Background

Foams are plastics (such as PU or polystyrene) that are manufactured using blowing agents to create bubbles or cells in the material's structure. The foam plastics manufacturing industries, the markets they serve and the blowing agents used are extremely varied. The range of uses includes building materials, appliance insulation, cushioning, furniture, packaging materials, containers, flotation devices, filler, sound proofing and shoe soles. Some foams are rigid with cells that still contain the foam blowing agent, which can contribute to the foam's ability to insulate. Other foams are open-celled, with the foam blowing agent escaping at the time the foam is blown, as for flexible foams.

A variety of foam blowing agents have been used for these applications. Historically, CFCs and HCFCs were typically used to blow foam given their favorable chemical properties. CFCs and HCFCs are controlled substances under the Montreal Protocol and subject to regulation under the CAA including a phaseout of production and import under section 604 for CFCs and section 605(b)-(c) for HCFCs and use restrictions on HCFCs under section 605(a). The regulations implementing section 610 of the CAA include a ban on sale or distribution of foam products blown with class I and class II ODS: however, for foam products containing a class II ODS, the ban is subject to an exception for foam insulation products as defined at 40 CFR 82.62.

HCFCs, which have a longer phase-out period than CFCs since they are less potent ozone-depleting substances, have continued to be used to some extent as foam blowing agents. In addition, the SNAP program has found acceptable a variety of non-ODS blowing agents, including HFCs (e.g., HFC-134a, HFC-245fa, HFC-365mfc), hydrocarbons, carbon dioxide, water, methylal, methyl formate, HFO-1234ze(E), HFO-1336mzz(Z), and *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice 1233zd(E)).

Blowing agents are approved on an end-use basis. The SNAP program considers the following end-uses:

- Rigid PU (appliance foam) includes insulation foam in domestic refrigerators and freezers.
- Rigid PU (spray, commercial refrigeration, and sandwich panels) includes buoyancy foams, insulation for roofing, wall, pipes, metal doors, vending machines, coolers, and refrigerated transport vehicles.
- Rigid PU (slabstock and other) includes insulation for panels and pipes.
- Rigid PU and polyisocyanurate laminated boardstock includes insulation for roofing and walls.
- Flexible PU includes foam in furniture, bedding, chair cushions, and shoe soles.
- Integral skin PU includes car steering wheels, dashboards, and shoe soles.
- Polystyrene (extruded sheet) includes foam for packaging and buoyancy or flotation.
- Polystyrene (extruded boardstock and billet) includes insulation for roofing, walls, floors, and pipes.
- Polyolefin includes foam sheets and tubes.
- Phenolic insulation board and bunstock includes insulation for roofing and walls.

2. What is EPA finalizing for foam blowing agents?

For foam blowing end-uses, EPA proposed to change the status for several substitutes, as of January 1, 2017, as follows:

- HFC-134a and blends thereof as unacceptable for all end-uses;
- HFC-143a, HFC-245fa and HFC-365mfc and blends thereof; and the HFC blends Formacel B, and Formacel Z-6 as unacceptable in all foam blowing end-uses where they were on the list of acceptable substitutes at the time of proposal, except for rigid PU spray foam; and
- The HFC blend Formacel TI as unacceptable in all foam blowing end-uses where it was on the list of acceptable substitutes at the time of proposal.

After considering the comments received on the proposed rule, EPA is making several changes to what it proposed in this final action. First, EPA is creating narrowed use limits for HFC-134a and blends thereof, for HFC-365mfc and blends thereof, and HFC-245fa and blends thereof for all foam blowing end-uses except rigid PU spray foam. EPA is also creating narrowed use limits for certain HFC blends, including Formacel TI, Formacel Z-6, and Formacel B, for those end-uses that were on the list of acceptable substitutes at the time of proposal. For all these substitutes, the narrowed use limits would be for military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements. For all other uses in these identified end-uses, the status would change to unacceptable, with the exception of rigid PU spray foam, for which we are not taking final action in this rule. Second, we are establishing change of status dates that range from January 1, 2017, to January 1, 2021. And, further, for the uses subject to the narrowed use limits, the status would change to unacceptable as of January 1,

2022. The change of status determination for each end-use is summarized in the following table:

Table 8. Change of Status Decisions for Foam Blowing Agents

End-use	Substitutes	Decision*
Rigid Polyurethane: Appliance	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2020. Unacceptable for all uses as of January 1, 2022.
Rigid Polyurethane: Commercial Refrigeration and Sandwich Panels	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2020. Unacceptable for all uses as of January 1, 2022.
Rigid Polyurethane: Marine Flotation Foam	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2020. Unacceptable for all uses as of January 1, 2022.
Rigid Polyurethane: Slabstock and Other	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2019. Unacceptable for all uses as of January 1, 2022.
Rigid Polyurethane and Polyisocyanurate Laminated Boardstock	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof	Acceptable subject to narrowed use limits for military or space- and aeronautics-related application*s and unacceptable for all other uses as of January 1, 2017. Unacceptable for all uses as of January 1, 2022.
Flexible Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2017. Unacceptable for all uses as of January 1, 2022.
Integral Skin Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2017. Unacceptable for all uses as of January 1, 2022.
Polystyrene: Extruded Sheet	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2017. Unacceptable for all uses as of January 1, 2022.
Polystyrene: Extruded Boardstock and Billet (XPS)	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel B, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2021. Unacceptable for all uses as of January 1, 2022.
Polyolefin	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2020. Unacceptable for all uses as of January 1, 2022.
Phenolic Insulation Board and Bunstock	HFC-143a, HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* and unacceptable for all other uses as of January 1, 2017. Unacceptable for all uses as of January 1, 2022.

* Under the narrowed use limit, use is limited to military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.

a) What other alternatives does EPA find pose lower overall risk to human health and the environment?

In the NPRM, EPA included a comparative analysis, end-use by end-use, of the substitutes for which EPA proposed to change the status and the other available alternatives. 79 FR at 46,151 to 46,154. Most of the other alternatives that EPA identified as having lower risk than those for which we proposed to change the status have zero ODP or have negligible impact on stratospheric ozone. One alternative that contains chlorine, *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E)), has an ODP of 0.00024 to 0.00034 and estimates of its maximum potential impact on the ozone layer indicate a statistically insignificant impact, comparable to that of other substitutes in the same end-uses that are considered to be non-ozone-depleting.[88,89] For the uses on which we are taking final action, the substitutes remaining acceptable have significantly lower GWP than the substitutes for which we are changing the status, with GWPs ranging from zero (water, vacuum panels) to 124 (HFC-152a) as compared with GWPs ranging from 725 to approximately 1,500. The substitutes changing status and the substitutes remaining acceptable all can be used such that the recommended workplace exposure limit for the substitute is not exceeded in the end-uses where they are listed as acceptable, and thus, toxicity risks are comparable.

Most of the substitutes that remain acceptable are not VOC (e.g., water) or are exempt from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the

[88] Wang D., Olsen S., Wuebbles D. 2011. "Preliminary Report: Analyses of tCFP's Potential Impact on Atmospheric Ozone." Department of Atmospheric Sciences. University of Illinois, Urbana, IL. September 26, 2011.
[89] Patten and Wuebbles, 2010. "Atmospheric Lifetimes and Ozone Depletion Potentials of *trans*-1-chloro-3,3,3-trichloropropylene and *trans*-1,2-dichloroethylene in a three-dimensional model." *Atmos. Chem. Phys.*, 10, 10867–10874, 2010.

development of SIPs to attain and maintain the national ambient air quality standards. Examples of VOC-exempt blowing agents include acetone, CO_2, ecomate, HFC-152a, HFO-1234ze(E), methyl formate, and Solstice 1233zd(E). Other acceptable foam blowing agents are VOC, including saturated light HCs, Exxsol blowing agents, and methylal. In the risk screens that EPA performs when we review a substitute, we consider VOC emissions impacts, taking into account the rate of blowing agent emissions of particular foam end-uses, estimated market size, and the presence of emission controls in manufacturing for different end-uses. Estimated emissions for these three substitutes is sufficiently low that we do not expect significant air quality impacts (ICF, 2014h). The manufacturer of HFO-1336mzz(Z) claims that this substitute has low photochemical reactivity and has petitioned EPA to exempt it from the definition of VOC for purposes of the development of SIPs to attain and maintain the national ambient air quality standards, but EPA has not yet acted on that petition. Given the large variety of alternatives that do not increase VOC emissions, and the estimated low impacts from those alternatives that are VOC, we believe that changing the status of certain HFC foam blowing agents through this action will not significantly increase environmental or health risks.

Some of the substitutes that remain acceptable are flammable, but the hazards of these flammable compounds can be adequately addressed in the process of meeting OSHA regulations and fire codes in all end-uses except certain rigid PU spray foam applications. Examples of acceptable flammable blowing agents are HFC-152a, ecomate, Exxsol blowing agents, methylal, methyl formate, and saturated light hydrocarbons.

Although EPA has listed a number of flammable alternatives as acceptable for most foam end-uses, that is not the case for rigid PU spray foams. Some of the lower-GWP, flammable alternatives that are listed as acceptable in other foam blowing end-uses, such as C3-C6

hydrocarbons and methylal, are not acceptable for use in rigid PU spray foam. For rigid PU spray foam applications, flammability risks are of particular concern, because they are applied onsite, sometimes in proximity to hot, flammable substances such as tar. Flammability risks are more difficult to mitigate in rigid PU spray foam than in most other foam end-uses because, unlike in a factory setting, in many cases ventilation cannot be provided that removes flammable vapors and maintains them below the lower flammability limit, and it is not practical to make all electrical fixtures explosion proof when applying rigid PU spray foam in a residential building. There are three main types of rigid PU spray foam: high-pressure two-part spray foam systems, low-pressure two-part spray foam systems, and one-component foam sealants.

For rigid PU spray foam, we are not taking final action in this rule. We intend to conduct a more extensive comparative risk analysis of the substitutes available before taking final action. Thus, the substitutes currently listed as acceptable for spray foam are not affected by this rule but may be the subject of future rulemaking.

For more information on the environmental and health properties of the different foam blowing agents, please see the proposed rule at 79 FR 46,151 to 46,154 and a technical support document that provides additional *Federal Register* citations (EPA, 2015d) in the docket.

b) When will the status change?

For foam blowing agents, the time at which the status will change varies by end-use.

For the *flexible PU, polystyrene extruded sheet, and phenolic insulation board and bunstock* end-uses, many users have already transitioned from the foam blowing agents subject to the status change. No commenters suggested that, or provided information that would suggest, a later change of status date is necessary for these end-uses. Therefore, as proposed, we are establishing January 1, 2017 as the date of the status change for those end-uses.

For *PU integral skin*, the systems house BASF stated that they have had limited success thus far with HFO blowing agents in this end-use and would require at least two years to formulate and test a system and another six months for the new system to be commercialized and accepted by their customers in this end-use. However, this commenter did not provide specific details of the technical challenges they face nor why they believe two years, rather than a shorter time, is required for formulation and testing. Nor did the commenter explain why customer acceptance of the new system was related to technical feasibility that would require an additional six months beyond the time needed for formulation and testing. A period of two and a half years after issuance of the NPRM would be January 2017, rather than the July 1, 2017 suggested by the commenter. There are alternative foam blowing agents in addition to HFOs in this end-use that pose less risk overall to human health and the environment, such as HFC-152a and light saturated hydrocarbons. Therefore, as proposed, we are establishing January 1, 2017, as the date of the status change for PU integral skin foam.

For the *rigid PU and polyisocyanurate laminated boardstock end-use*, we did not receive any specific technical information nor any comments stating that a change of status date later than the proposed date of January 1, 2017, was warranted. We received a general comment from EIA that the change of status date should be January 1, 2016, but they provided no information supporting this earlier date. We received a comment from one systems house, Huntsman, that provided specific technical information supporting a later change of status date for other PU end-uses, but not PU and polyisocyanurate laminated boardstock. Another systems house, Dow Chemical, specifically mentioned that polyisocyanurate boardstock has previously safely transitioned to use of hydrocarbons. Therefore, as proposed, we are establishing January 1, 2017 as the date of the status change for PU and polyisocyanurate laminated boardstock.

For all other foam blowing end-uses for which we are taking final action, we received comments identifying technical challenges that mean other alternatives would not be available until a later date than January 1, 2017. Systems houses and appliance manufacturers also mentioned the need for third-party testing for end-uses such as extruded polystyrene boardstock and billet, rigid PU appliance, and rigid PU commercial refrigeration and sandwich panels. Systems houses and DuPont, a manufacturer of foam blowing agents, also were concerned with the supply of lower-GWP foam blowing agents, especially supply of HFOs (HFO-1234ze(E) and HFO-1336mzz(Z)) and *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, and indicated this was a constraint that prevents transitioning away from higher GWP HFCs by January 1, 2017. EPA agrees that there is validity to these concerns, as discussed further below for each end-use.

For *rigid PU slabstock*, a systems house (Huntsman) commented they need additional time for testing and suggested a change of status date of January 1, 2019. Huntsman gave three specific reasons for why there should be a later change of status date than January 1, 2017 for this end-use: they believe it will take more than two years to develop products with alternatives, including third-party certification; they believe the long-term performance of HFO foams is not widely proven; and they believe there is insufficient supply and competition in the market for HFOs. Huntsman mentioned specific technical challenges, such as testing the compatibility and stability of the blowing agents with the polyol blends (i.e., other components needed in the foam formulation) and difficulties with stability of the catalysts when used with HFO blowing agents. They also stated that extended testing of more than six months was required to test strength, thermal insulation capability and dimensional stability of the foam, including aging testing. Huntsman also mentioned testing the fire properties of the foams with different foam blowing agents as well as optimization of the blends. Huntsman stated that these steps required one to one

and a half years initial development by the systems house that would then be followed by trials and custom modification at their customers' facilities using their specific equipment and claimed that would require one to two years in addition. Considering the technical constraints described by the systems house such as the need to research different catalysts and the lower stability of some alternative foam blowing agents, we agree that it is reasonable to expect it would take three and a half years after this rule is final for alternatives to be available for this end-use. Therefore, we are establishing a change of status date of January 1, 2019, for rigid PU slabstock.

For *rigid PU appliance foam*, one systems house, BASF, commented that it took five years for them to assist the appliance manufacturer Whirlpool in its conversion from an HFC-blown foam to an HFO-blown foam, excluding flammability certification testing. While the Agency recognizes that as industry builds experience with new blowing agents, future transitions may be quicker because of the knowledge gained from earlier transitions, the Agency also understands that it may not be possible by 2017 to complete a full transition to alternative blowing agents for all appliance manufacturers, particularly if appliance manufacturers are maintaining or improving the thermal insulating value of the foam to meet DOE energy conservation standards. Appliance manufacturers and BASF have described the difficulty and time needed to overcome technical difficulties when using alternative blowing agents, particularly olefins such as *trans*-1-chloro-3,3,3-trifluoroprop-1-ene or HFOs, that result in cracking, thinning of the foam, and irreparable field failures of the equipment. Appliance manufacturers and systems house Huntsman also mentioned the need for energy efficiency testing and third-party certification of equipment and claimed that would require at least one and a half to two years after the system house's development of foam formulations. However, the time required for ensuring adequate performance and third-party testing warrants a date as late as

January 1, 2020. In addition to technical constraints, we also considered that there is unlikely to be a sufficient supply of alternatives before January 1, 2017, for appliance foam; the supply is likely to increase once a commercial plant for HFO-1336mzz(Z) opens (currently scheduled to open in 2017). We considered the supply constraints mentioned by both systems houses and chemical producers (until 2017), technical constraints with alternative foam blowing agents that could result in failed appliances with insufficient research (requiring one to two years), and the need for third-party certification of each model (requiring one and a half to two years), and we agree that it is reasonable to expect it would take until 2020 for alternatives to be available for this end-use. We are establishing a change of status date of January 1, 2020, for appliance foam which allows sufficient time to work out these technical issues and to ensure a sufficient supply of various alternatives.

For *rigid PU commercial refrigeration and sandwich panels*, equipment manufacturers and systems houses such as Huntsman, Dow and BASF mentioned similar issues to those raised for appliance foam. Huntsman mentioned technical challenges in developing new formulations for PU insulation foam, such as testing the compatibility and stability of the blowing agents with the polyol blends (i.e., other components needed in the foam formulation) and difficulties with stability of the catalysts when used with HFO blowing agents. They also stated that extended testing of more than six months was required to test strength, thermal insulation capability and dimensional stability of the foam, including aging testing. Huntsman also mentioned the need for testing fire properties of foams with different foam blowing agents and optimization of the blends. Huntsman stated that these steps required one to one and a half years initial development by the systems house in a process involving iterative testing. Huntsman specifically mentioned steps such as developing new foam formulations (one to one and a half years), trials at the

customers' plants (half to one year), third-party certification by UL, Intertek or Factory Mutual (one to one and a half years), and implementation of engineering changes at the customers' facilities (half to one year). We also considered that based on the information and comments we have received, there is unlikely to be a sufficient supply of alternatives for this end-use before January 1, 2017, as discussed above for appliance foam. The Laboratory Products Association, whose members manufacture very low temperature freezers such as those used in the pharmaceutical industry, mentioned that some laboratory products using alternative foam blowing agents are medical devices listed by FDA, which would require re-approval after changing the blowing agent. Representatives of this application suggested coordinating with timelines of EU regulations (2022), without describing specifically why more time might be required for very low temperature freezers than for foam blowing agents in other commercial refrigeration equipment which also require third-party review. It is reasonable to expect that the timeframe required for commercial refrigeration foam and sandwich panels is comparable to that for appliance foam, requiring until 2017 for sufficient supply, and then another three years for development and testing of formulations and third-party testing of the resulting equipment or panels. We are establishing a status change date of January 1, 2020, for commercial refrigeration and sandwich panel foams, based on the time needed to resolve technical issues and on supply of alternative foam blowing agents.

For *PU marine flotation foam*, we received a comment from BASF indicating that systems houses will require at least a year for technical development, a year for certification testing to U.S. Coast Guard standards, a year for testing of the stability of the foam product, as well as one to two years for customer approval, given the large number of customers for this type of foam. BASF expected issues similar to those for appliance foam, such as dimensional stability

and cracking, because injecting flotation foam is a similar process and uses similar polymers in the foam formulation. BASF asked that EPA clarify whether marine flotation foam fits under spray foam and whether this application is "exempted" or instead must transition to alternatives. EPA consulted with the U.S. Coast Guard regarding their certification process and the necessary time for manufacturers to test and certify that they meet the requirements at 33 CFR part 183 (Boats and Associated Equipment), Subparts F (Flotation Requirements for Inboard Boats, Inboard/Outdrive Boats, and Airboats), G (Flotation Requirements for Outboard Boats Rated for Engines of More than 2 Horsepower), and H (Flotation Requirements for Outboard Boats Rated for Engines of 2 Horsepower or Less), which require all manufacturers of monohull recreational boats less than twenty feet in length (except sailboats, canoes, kayaks, inflatable boats, submersibles, surface effect vessels, amphibious vessels, and race boats) to provide sufficient flotation foam within the boat to ensure that the boat will not sink if the boat swamps or capsizes. This requirement allows the occupants to hold onto the boat until they can be rescued. We also met with representatives from the marine industry and heard directly from them about the necessary steps for transition. After considering the various steps needed to complete the transition, we conclude that the need for the systems houses to perfect formulations that perform similar or better than what is being used today will take additional time beyond what the Agency considered. In particular, in order to research and test foam formulations sufficiently to avoid issues with dimensional stability and field failures, and to ensure safety of the flotation foam and boats built with it, we expect it would take at least another two and a half to three years beyond the proposed date of January 1, 2017. Thus, we are establishing January 1, 2020 as the change of status date for marine flotation foam. We do not believe there is sufficient information at this time to support a change of status date later than January 1, 2020. However, given the concern

for safety associated with marine floatation foam, we will monitor the situation carefully and consult with the U.S. Coast Guard. Given that under 33 CFR 183 manufacturers are required to certify to the U.S. Coast Guard that their boats have sufficient flotation to meet the regulations, EPA recognizes that the U.S. Coast Guard may be able to provide information concerning certification with the alternatives. As January 2020 approaches, we will continue to consult with the U.S. Coast Guard and consider whether it is appropriate to adjust the change in status date or to otherwise modify the SNAP listing to address any uses for which there may be technical challenges beyond January 1, 2020. We are listing this use separately from spray foam due to differences in the manner in which the foam is dispensed which make this use more similar to appliance foam and commercial refrigeration foam than spray foam. Our understanding is that flotation foam is typically injected rather than sprayed.

For *polyolefin*, there are niche applications and specialized plants that may have particular difficulty in transitioning away from HFC-134a because of the time required to build a pilot plant to work with products using a new gaseous blowing agent and to retrofit current facilities to work with an alternative blowing agent. One manufacturer, Pregis, stated that they must upgrade facilities if they are to safely adopt flammable blowing agents when they have been using a nonflammable agent in the past. EPA recognizes that such changes to a facility may take several years. Considering the heightened challenges with these specialized facilities, we are establishing a change of status date of January 1, 2020, for polyolefin.

For *XPS*, manufacturers of XPS raised concerns about the energy efficiency of the foam using alternative agents, the extensive testing required, third-party certification, and the lack of alternatives and recommended that the status of HFC-134a change on January 1, 2021. Owens Corning mentioned specific steps such as laboratory studies to develop or test an alternative

blowing agent, pilot tests, conversion of pilot testing to line production, quality assurance and quality control testing of the final product, and product certification. Dow and Owens Corning estimated it would take at least six years to convert multiple lines and multiple facilities from HFC-134a to an alternative. Owens Corning and Dow also cited an EPA memorandum supporting a transition away from HCFC-22 and HCFC-142b as foam blowing agents, which found that four years was necessary. Owens Corning raised concerns about the viability of CO_2 based on its impact on energy efficiency; the safety of hydrocarbons because of their flammability and the need to consider impacts of additional flame retardants on the foam; and the commercial availability of HFO-1234ze(E) and its technical viability. Dow stated that of the acceptable alternatives that EPA mentioned in the NPRM, only HFO-1234ze(E) has sufficiently low thermal conductivity and low permeability to meet industry standards (e.g., ASTM C 578). We agree that additional time is required to test and improve the quality of XPS manufactured using alternative foam blowing agents to ensure that it meets or improves upon thermal insulation requirements and passes third-party certification testing; it is reasonable to expect that at least five years is likely to be required for all steps to transition away from HFC-134a, given the status of current efforts to adopt lower-GWP alternatives for XPS. Members of the Extruded Polystyrene Association (XPSA) have stated that with XPS, it is not always possible to increase the thickness of the foam to maintain thermal insulation requirements, because other construction materials (e.g., boards) may limit the thickness of boardstock foam. Thus, if alternative foam blowing agents did not produce foam meeting thermal insulation requirements, the transition in this end-use might not reduce climate effects as intended. Given the technical constraints, the need for third-party certification testing, and building code requirements for energy efficiency that may limit the available blowing agents, we are establishing a change of status date of

January 1, 2021, for XPS. EPA notes that there is now a plant producing HFO-1234ze(E) in commercial quantities (Honeywell, 2015) and thus we do not believe that supply will limit the availability of alternatives.

c) Military and space- and aeronautics-related applications

We proposed to create a narrowed use limit exception to the unacceptable listing for military and space, and aeronautics uses that would allow continued use of HFC and HFC blend foam blowing agents through December 31, 2021. These blowing agents were proposed to be unacceptable for military or space- and aeronautics-related applications as of January 1, 2022. For the reasons discussed in the proposed rule, we are finalizing these provisions as proposed.

EPA received comments from DoD and NASA supporting EPA's proposed narrowed use limit, and suggesting that this additional time is needed to identify, test and qualify substitutes for certain specialty applications. Boeing commented that the DoD and NASA need adequate time to develop, test and qualify an acceptable substitute for HFC-245fa, which is used in many foams they rely on for density foam insulation for a number of space and defense applications (e.g., rockets). Boeing did not identify any specific technical challenges but raised a general concern that, based on its experience with developing substitutes for foam blowing agents and the normal course of time to develop and qualify a substitute, it will take until 2027 to fully test and qualify a substitute. We do not believe there is sufficient information at this time to support a change of status date later than January 1, 2022; however, as January 2022 approaches, we can consider whether it is appropriate to adjust the change in status date or to otherwise modify the SNAP listing to address any uses for which there may be technical challenges beyond January 1, 2022.

Users that wish to use one of the substitutes listed as acceptable, subject to narrowed use

limits, in a military or space- and aeronautics-related application must make a reasonable effort to ascertain whether other substitutes or alternatives are technically feasible and, if not, to document such results. See 40 CFR 82.180(b)(3). Users are not required to report the results of their investigations to EPA, but must retain the documentation in their files for the purpose of demonstrating compliance.

Documentation should include descriptions of:

- Process or product in which the substitute is needed;
- Substitutes examined and rejected;
- Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or
- Anticipated date other substitutes will be available and projected time for switching.

d) How will the requirements apply to exports and imports?

Since regulations establishing the SNAP program were promulgated in 1994, we have interpreted the unacceptability determinations in this sector to apply to blowing foam with the foam blowing agent and not to products made with foam (e.g., 65 FR 42,653, 42,656; July 11, 2000). That is, an unacceptable foam blowing agent may not be used in, imported into, or exported from the United States. However, products made overseas with unacceptable foam blowing agents may be imported. For example, commercial refrigerators containing appliance foam blown with an unacceptable blowing agent may be imported into the United States, though appliances manufactured in the United States may not be manufactured with foam blown by that same agent.

In the proposal, EPA took comment on a different interpretation of our regulations under which the unacceptability determination would apply to imported products containing closed cell

foam that contain any of the blowing agents listed as unacceptable, as well as applying to the blowing agent itself. Public commenters stated that this was a significant departure from the Agency's previous interpretation and suggested that EPA needed to explain the basis for such a change. In addition, some commenters pointed out that the proposal only allowed 60 days before this change in interpretation would apply to HCFC-141b, which they viewed as insufficient time to adjust. EPA is not finalizing this change in its interpretation in this action; however, we plan to continue assessing the merits of this change and may provide further explanation and opportunity for comment in a subsequent rulemaking.

3. How is EPA responding to comments concerning foam blowing end-uses?

a) Timeline

Comment: EPA received comments from more than 500 commenters concerning the proposal of January 1, 2017, as the status change date for the foam blowing agents addressed in the proposed rule. EIA and Honeywell suggested an earlier date of January 1, 2016, for all or most foam end-uses. Most other commenters suggested later dates, varying from July 1, 2017, to January 1, 2025. Some commenters indicated that they are small companies and they believe additional time is needed beyond that in the NPRM to reduce cost pressures. Some commenters suggested different dates for specific uses and gave a number of reasons for which dates would be appropriate for those uses. General reasons given for the need for additional time include: time needed for capital investments, for employee training, for re-formulating systems; for designing, purchasing, awaiting receipt of and converting equipment; for obtaining local permits for VOC emissions; for meeting company and external testing requirements (e.g., UL/Factory Mutual (FM) fire safety requirements, DOE energy conservation standards, building codes, R-

value testing for aged foam), and if switching to a flammable foam blowing agent, facility engineering design and refurbishment. Several commenters stated that there are no "drop in" replacements, and that product research and development is an iterative process. Owens Corning cited EPA's previous recognition of time limitations in the conversion away from HCFC-142b to HFC-134a, including an EPA staff memorandum that estimated a four-year transition time period in the foam sector. Some commenters also suggested that EPA adopt the same dates for transition for foams as in the European Union's "F-gas" rule: 2020 for XPS and 2023 for other foam types. In addition, some commenters suggested that there is an insufficient supply of low-GWP foam blowing agents that will maintain energy efficiency and insulation value of foam. Huntsman stated that there will not be enough capacity and competition in the HFO foam blowing market by January 1, 2017, to meet the needs of the PU foam industry. DuPont commented that while multiple low GWP alternatives will be available for foam, they will not be broadly available in the proposed timeframe.

Response: EPA notes that in a number of foam blowing end-uses, the industry has already effectively transitioned away from HFCs and any additional transitions for these end-uses can be made by January 1, 2017. Further, we received no comments suggesting a later transition date is necessary specifically for these end-uses. We received comments suggesting that this change of status could be made by January 1, 2016, but in the unlikely event that there are any end users that have not already transitioned, we are concerned that this date may be too soon to finish adopting an alternative. Therefore, the final rule retains the proposed change of status date of January 1, 2017, for those uses (polystyrene extruded sheet, flexible polyurethane, and phenolic insulation board and bunstock). In addition, we received no comments specific to rigid PU and polyisocyanurate laminated boardstock that indicated there were challenges for this

end-use that would prevent a transition to alternatives that pose lower overall risk to human health and the environment by January 1, 2017. EIA suggested that we set a status change date of January 1, 2016, for this end-use, but did not provide information supporting an earlier transition for this end-use. Therefore, we are retaining this date in the final rule for rigid PU and polyisocyanurate laminated boardstock.

EPA agrees that additional time is needed for other specific foam types and addresses the basis for establishing later change of status dates in the discussion of each end-use above. We appreciate and agree with commenters that note the importance of maintaining energy efficiency for appliances and buildings by ensuring there is adequate time to develop and deploy new formulations that meet or exceed existing thermal insulating values. Further, we recognize that third-party testing or witness testing will require additional time that may be outside the control of the companies manufacturing the foam. Some of this testing, such as fire safety testing for construction foams, could help reduce any potential flammability risks associated with the use of flammable foam blowing agents. Businesses of all sizes will be able to benefit from the later change of status dates in this final rule. We discuss comments specific to each end-use below in this section.

Comment: Huntsman, a systems house, commented they need additional time for testing alternatives in the PU slabstock end-use and suggested a change of status date of January 1, 2019. Huntsman mentioned specific technical challenges with reformulating these foam products, such as testing the compatibility and stability of the blowing agents with the polyol blends (i.e., other components needed in the foam formulation). They also stated that extended testing of more than six months was required to test strength, thermal insulation capability and dimensional stability of the foam, including aging testing. Huntsman also mentioned testing the

fire properties of the foams with different foam blowing agents as well as optimization of the blends. Huntsman stated that these steps required one to one and a half years initial development by the systems house, to be followed by trials and custom modification at their customers' facilities using their specific equipment that would require another one to two years. The commenter also raised concerns about whether sufficient supply of alternative foam blowing agents would be available by January 1, 2017, and mentioned that there is currently a single supplier of a key low GWP foam blowing agent, *trans*-1-chloro-3,3,3-trifluoroprop-1-ene.

Response: Considering the technical constraints raised by the systems house, such as the need to research different catalysts and fire retardants and the lower stability of some alternative foam blowing agents, we agree that safer alternatives will not be available for this end-use for three to three and a half years. Therefore, we are establishing a change of status date of January 1, 2019 for PU slabstock foams.

Comment: Commenters suggested change of status dates for rigid PU appliance foam, ranging from July 1, 2017 to January 1, 2020. BASF suggested a transition date of July 1, 2017 for foam used in domestic refrigerators. In support of a July 1, 2017, change of status date, BASF indicated that HFO-containing foams are incompatible with common polymers used in household refrigerators and that it will take a minimum of six months to perform durability and field testing and possibly to change construction materials to resolve this known problem, as well as at least six months for testing for compliance with federal energy conservation standards and 12 more months for conversion at each customer's facility. BASF also stated that they had already developed commercially available systems using cyclopentane and HFOs, so they expected this transition to take less time than the five years that it took to assist the appliance manufacturer Whirlpool in its conversion from an HFC-blown foam to an HFO-blown foam,

excluding flammability certification testing. Solvay commented that technical questions about alternatives still remain, such as whether substitutes other than HFCs attack panel walls or appliance walls, which could compromise product integrity and safety, and whether other alternatives adhere properly to appliance and panel walls, or to walls and roofs, which is necessary to satisfy energy efficiency mandates. Huntsman mentioned the need for energy efficiency testing and third-party certification of equipment that would require at least one and a half to two years after the system house's development of foam formulations, which it estimated to take one to one and a half years. Huntsman suggested a change of status date of 2019 for PU appliance foam. The Association of Home Appliance Manufacturers (AHAM) raised concerns about the potential adverse impacts on appliance quality, performance, and longevity, as well as costs, of a transition by January 1, 2017, and stated that the easiest and cheapest transitions have been done, and will be done, first. AHAM suggested a change of status date of 2020 for appliance foam to allow for coordination with DOE energy conservation standards that could take effect in 2020 for household refrigerators and freezers. In addition, AHAM claimed a 2020 change of status date was necessary because of the extensive time required for testing and third-party certification of multiple models, and additional time needed to ensure proper development of new alternatives to avoid field failures of the equipment.

Response: We agree that it is important that appliance manufacturers are able to ensure the quality, performance, and useful lifetime of their equipment. Multiple commenters provided information and photographs demonstrating that improperly implemented alternative foam blowing agents can create defects in the appliances, such as cracking or improper adhesion to the appliance cabinet. BASF suggested that it would take closer to two and a half to three years to work out the technical issues since they have already developed commercially available systems

using HFOs and hydrocarbons for other appliance manufacturers. Because of the time required for ensuring adequate performance and third-party testing, we believe that other alternatives will not be available for an industry-wide transition until January 1, 2020. In addition to technical constraints, we also considered that there is unlikely to be a sufficient supply of alternatives before the change of status date we proposed - January 1, 2017 for appliance foam. The supply is likely to increase once a commercial plant for HFO-1336mzz(Z) opens (currently scheduled to open in 2017) and thus supply would not be a concern for a change of status date of January 1, 2020.

Comment: For rigid PU commercial refrigeration foams and sandwich panels, commenters suggested change of status dates ranging from July 1, 2018, to ten years after the rule is final. The majority of commenters suggested status change dates ranging from July 2018 to January 1, 2020. NAFEM and manufacturers of commercial refrigeration equipment such as Traulsen suggested a much later date of 2025 for all modifications required for commercial refrigeration equipment, including both foam blowing agents and refrigerant.

As an initial matter, Huntsman and DuPont mentioned the lack of sufficient supply of alternatives to allow all foam users to convert in 2017. In support of a later change of status date, equipment manufacturers and systems houses such as Huntsman, Dow and BASF mentioned similar technical issues to those for appliance foam, such as the compatibility and stability of the blowing agents with the polyol blends and dimensional stability of the blown foam. BASF specifically mentioned reactions between the new blowing agents and the catalysts in the foam that could cause the finished foam to shrink, as well as the need to develop a new set of flame retardants. Commenters also stated that extended testing of more than six months was required to test strength, thermal insulation capability and dimensional stability of the foam, including aging

testing. Huntsman specifically mentioned steps such as developing new foam formulations (one to one and a half years), trials at the customers' plants (half to one year), third-party certification by UL, Intertek or Factory Mutual (one to one and a half years), and implantation of engineering changes at the customers' facilities (half to one year), with iterative testing often required. Unified Brands and NAFEM suggested that there are limitations to using methyl formate in commercial refrigeration foam that would not allow a transition by January 1, 2017, stating: "Methyl Formate is also environmentally friendly, but has had significant shrinkage issues once units have been placed in the field. This agent requires very specific foaming processes to be developed to ensure proper stability of the foam over time."

Response: We agree that there are a number of technical challenges that will require approximately four to five years for the industry as a whole to transition to alternatives, including stability of new formulations and difficulty with using existing catalysts with alternative foam blowing agents. We agree that there is unlikely to be a sufficient supply of alternatives for this end-use before the proposed change in status date January 1, 2017. However as discussed above for appliance foam, additional supply should be available in 2017 when a new manufacturing plant is scheduled to open and there should be a more than sufficient supply to meet a status change date of January 1, 2020.

The later dates of ten years after finalization of the rule or 2025 suggested by NAFEM and other OEMs, appear to be based on the assumption that stand-alone retail food refrigeration equipment would need to use propane or other flammable refrigerants and that changes would need to be made to building codes to support the adoption of these flammable refrigerants. However, as discussed above in section V.C on commercial refrigeration, there are other available refrigerants that are nonflammable. Moreover, the commenters did not make clear why,

even assuming that alternative refrigerants would not be available until 2025, the insulation foam for such equipment cannot be made using safer alternatives well before 2025. Thus we do not believe that safe alternative foam blowing agents will not be available before 2025.

Comment: Honeywell stated that "the technical requirements [for flotation foam in boats] may be much simpler than other industries in which customers are already transitioning" and suggested that a transition date of January 1, 2016 might be achievable for this application. BASF commented that systems houses will require at least a year for technical development, a year for certification testing to U.S. Coast Guard standards, a year for testing of the stability of the foam product, as well as one to two years for customer approval, given the large number of customers for this type of foam. This commenter recommended that EPA set a change of status date no earlier than July 1, 2019. BASF expected issues seen with appliance foam also to exist with marine flotation foam, such as dimensional stability and cracking, because injecting flotation foam is a similar process and uses similar polymers in the foam formulation. Ninety-four letters from the marine industry comment that, according to their suppliers in the boating industry, a drop-in replacement for HFC-134a currently does not exist, and will not be readily available by 2017. EPA received comments from 436 boat manufacturers to the effect that the continued introduction of regulations on the boating industry disproportionately affects their small businesses because the cost of compliance with these standards is relatively equal across production scales. According to these comments, EPA's proposed timeline for "phasing out" HFC-134a will have highly negative consequences for all facets of the marine industry, but it will have the greatest impact on their small boats, small businesses, and middle class customers. EPA received 93 letters from the marine industry stating that the boating industry consists primarily of small businesses that would face severe impacts as a result of their limited financial

resources and limited influence on markets and supply chains. The National Marine Manufacturers Association (NMMA) also commented that the NPRM date would present a financial and logistical hardship for many small boat builders. NMMA urged the EPA to provide an extension of the proposed timeline. Commenters from the marine industry suggested 2022 as a transition date and mentioned the lack of availability of feasible options and marine application's dependency upon chemical availability from the larger industry (e.g., HFC-134a for use in MVAC). These commenters also mentioned the need for testing to meet Coast Guard requirements at 33 CFR part 183.

Response: Regarding the supply of alternatives, we recognize that a plant that would produce HFO-1234ze(E) in commercial quantities has recently been built (Honeywell, 2015). Additionally, supply of HFC-134a should not be an issue as many other uses of that substitute will be ending in the next several years. We do not agree that the certification processes will require additional time beyond EPA's understanding at the time of the proposal. It is our understanding that HFOs can be used in this type of foam. However, as with appliance foams, we agree that systems houses will need time to perfect formulations that perform similar or better than what is being used today. In particular, issues with stability of the blown foam likely will require several years to work out, as discussed above for appliance foam. Considering this information, we are establishing January 1, 2020, as the change of status date for marine flotation foam.

Comment: DuPont stated that polyolefin plants typically are specialized plants for niche applications and that this end-use may have particular difficulty in transitioning away from HFC-134a; DuPont suggested that EPA consult with manufacturers in this end-use on appropriate transition timing. One manufacturer, Pregis, stated that they must upgrade facilities if they are to

safely adopt flammable blowing agents when they have been using a nonflammable agent in the past. They also suggested that EPA consider a change of status date of 2022 because of the time required to build a pilot plant to work with products using a new gaseous blowing agent (two years)—which has yet to begin--and the time to retrofit current facilities to work with an alternative blowing agent (another two years).

Response: EPA recognizes that construction of a pilot plant and making the necessary changes to an existing facility could take approximately four years after this rule is final; however, it is not clear from Pregis's description that they will require six years or more. Considering the heightened challenges with these specialized facilities, we are establishing a change of status date of January 1, 2020, for polyolefin.

Comment: Manufacturers of XPS raised the energy efficiency of the foam using alternative agents as an issue, the extensive testing required, third-party certification, and the lack of alternatives as reasons for allowing until January 1, 2021 for a change of status. Owens Corning mentioned specific steps such as laboratory studies to develop or test an alternative blowing agent, pilot tests, conversion of pilot testing to line production, quality assurance and quality control testing of the final product, and product certification. Dow and Owens Corning estimated it would take at least six years to convert multiple lines and multiple facilities from HFC-134a to an alternative. Owens Corning and Dow also cited an EPA memorandum supporting a transition away from HCFC-22 and HCFC-142b as foam blowing agents, which found that four years was necessary. Owens Corning and XPSA commented that a more realistic status change date of 2021 would also be consistent with the proposed status change date for MVAC.

IP Moulding commented that it had tried to use CO_2 and water in its extruded polystyrene molding process in the past and found it did not create sufficient internal pressure for their product; they are further investigating this option with their polystyrene supplier. Mexichem commented that carbon dioxide may not be suitable for the XPS industry because of its high thermal conductivity (low insulation value) and processing difficulties. Owens Corning raised concerns about the viability of CO_2 based on its impact on energy efficiency; the safety of hydrocarbons because of their flammability and the need also to consider impacts of additional flame retardants on the foam; and the commercial availability of HFO-1234ze(E) and its technical viability. Honeywell commented that CO_2 is an option for XPS, and that Dow has commercialized other solutions to improve energy efficiency with CO_2 such as Dow's XENERGY technology, which, according to Dow's website, has up to 20% higher insulating properties than its STYROFOAM™ polystyrene product that uses HFC-134a. XPSA commented that one of the alternatives in the proposed regulations (HFO-1234ze(E)) is commercially sub-optimized, and thus, XPSA's members have not conducted testing to confirm that they can be used to produce products that provide comparable thermal efficiency or if there are any other issues that would make them an unacceptable alternative to HFC-134a. Dow stated that of the acceptable alternatives that EPA mentioned in the NPRM, only HFO-1234ze(E) has sufficiently low thermal conductivity and low permeability to meet industry standards (e.g., ASTM C 578).

Response: Regarding concerns about the supply of HFO-1234ze(E), EPA notes that since the third quarter of 2014, there has been a plant producing HFO-1234ze(E) in commercial quantities (Honeywell, 2015), and a smaller plant was providing lots upon request before this. Based on the information we received, we agree that additional time is required to test and improve the quality of XPS produced using alternative foam blowing agents and for third-party

certification testing. Thus, it is reasonable to expect up to three years to complete formulation development and to conduct pilot testing, an additional two years to convert the existing plant and test the quality of the final product (with some overlap with the pilot testing period), and a year for certification testing. The total time needed is five and a half to six years. Therefore, we are establishing a change of status date of January 1, 2021, for the XPS end-use.

EPA agrees that additional work with CO_2 as the blowing agent for XPS may be required to provide a better performing foam. Available information indicates CO_2 has a higher thermal conductivity than HFC-134a or HFO-1234ze(E), and thus, would be expected to provide lower insulation value in the absence of major changes to the foam formulation. The information on Dow's website that Honeywell references, although encouraging, is not sufficient to determine if CO_2 is the sole blowing agent and if the XENERGY technology that Honeywell mentions may be used in all the applications where XPS blown with HFC-134a is currently used. The information provided by Honeywell implies that with additional work, XPS blown with CO_2 could be more broadly available and could result in XPS with better foam insulation properties than current XPS foam using HFC-134a. Regarding comments suggesting that a status change date of January 2021 is appropriate because it would be consistent with the status change date of MY 2021 for MVAC, we first note that the transition for MVAC is required as of MY 2021, which will be completed in calendar year 2020. More importantly, the change of status date for each end-use is based on an evaluation of when alternatives will be available within that specific end-use. The change of status date for MVAC is not relevant for purposes of determining when safer alternatives will be available for the XPS foam blowing end-use.

b) Foam blowing agents changing status and other alternatives

Comment: Some commenters, including commercial refrigeration equipment

manufacturers and environmental groups, support EPA's proposal to find higher GWP HFCs unacceptable in all foam blowing end-uses. Others, including manufacturers of household appliances and AHAM, advised EPA to reconsider the proposal, stating that it unnecessarily accelerates the transition away from widely used chemicals that still have "significant beneficial uses" in the United States (e.g., HFC-245fa in appliance foam). Solvay stated that the entire foam blowing sector should have been excluded from the proposal to change the status of certain HFCs.

Response: We disagree that this action "unnecessarily accelerates" the transition away from chemicals that have significant beneficial use. EPA applied the SNAP criteria when making determinations on what to include in the proposed rule. For the reasons provided above and in the proposed rule, we have determined in most foam blowing end-uses that there are other alternatives that pose less risk than those for which we are changing the status.

Comment: DuPont commented that the category of Rigid Spray Polyurethane foam incorporates several product sub-categories, including high pressure spray foam and low pressure spray foam, each requiring different foam expansion agent characteristics and therefore different alternatives and different testing requirements. DuPont and the Center for the Polyurethanes Industry recommended that EPA create separate SNAP categories for high-pressure spray foam systems, low-pressure foam systems, and one component spray foam sealants to allow appropriate change of status dates for each. DuPont suggested that EPA not change the status of HFC-134a in low-pressure two-part spray foam and in one-component foam sealants, because these applications require a gaseous foam blowing agent, and not a liquid agent such as HFC-245fa or HFC-365mfc.

Response: EPA recognizes that a gaseous foam blowing agent is required for these uses,

unlike for high-pressure two-part spray foam systems, and thus, there is reason to differentiate between low-pressure two-part spray foam systems, one-component foam sealants, and high-pressure two-part spray foam. We intend to conduct a more extensive comparative risk analysis of the substitutes available in each of these spray foam categories before taking final action. Thus, the substitutes currently listed as acceptable for spray foam are not affected by this rule but may be the subject of future rulemaking.

Comment: Unified Brands and NAFEM commented that water-based blowing agents are environmentally friendly, but suffer from poorer insulation performance and vulnerability towards processing temperatures that would consequently require improved control of fixture temperatures. Thermo Fisher commented that water-blown foam could lead to equipment with reduced energy efficiency and negative environmental impact because of its poor insulating properties.

Response: It is EPA's understanding that water-blown foams offer lower energy efficiency than foams blown with a number of other blowing agents. This is not a barrier to use for foam applications that do not require thermal insulation or for which increased thickness of the foam is not an issue. However, thickness of the foam is likely to be an issue for foams where the dimensions cannot be increased, such as foams used in refrigerated transport or sometimes in construction foams such as XPS or PU spray foam.

Comment: Mexichem commented that using hydrocarbons as a blowing agent may result in less thermally efficient XPS (as compared to use of HFC-134a). Unified Brands and NAFEM suggested there are complications with use of hydrocarbons in commercial refrigeration foam, and that "Pentane based blowing agents are strong candidates due to their insulation performance, but require all foam fixtures and processes to be redeveloped" due to flammability.

Dow stated that that HC technology is well understood, and it has been broadly deemed inappropriate for use as a blowing agent for XPS and SPF building and construction products in the United States. Dow also stated that HCs have been proactively adopted for use with polyisocyanurate foams, where they may be used safely. EIA commented that hydrocarbons have been used as blowing agents in Europe since 1992, including in insulation foams.

Response: It is EPA's understanding that hydrocarbons such as pentane and isopentane have better thermal conductivity than CO_2, but not as good as that of HFCs or HFOs. This is not a barrier to use for foam applications that do not require thermal insulation or where increased thickness of the foam is acceptable. We also recognize that additional safeguards must be taken when using hydrocarbon foam blowing agents, such as improving ventilation, training staff, and explosion-proofing electrical fixtures. These steps can reasonably be taken in a manufacturing facility but are more difficult for installation in place, as with PU spray foam.

Comment: Honeywell commented that in many instances, customers are seeing benefits such as better performance, energy efficiency, nonflammability, and better product yields (less foam for the same performance) when using 1233zd(E) (*trans*-1-chloro-3,3,3-trifluoroprop-1-ene). This commenter claimed that this foam blowing agent has been commercial in the United States in spray foam applications for more than a year, and in Japan, EU and China for a variety of foam applications, including appliance, panel and spray foam. Several users of *trans*-1-chloro-3,3,3-trifluoroprop-1-ene mentioned its properties, such as improved compressive strength, lower density, better dimensional stability, and higher R-value (All-Weather Insulated Panels, West Development Group for spray foam, UTMC for commercial refrigeration foam in refrigerated transport).

Response: Available information indicates that *trans*-1-chloro-3,3,3-trifluoroprop-1-ene has many performance characteristics, including improved insulation value, that should allow its adoption as a foam blowing agent in appliance foam, sandwich panels, and some spray foam applications.

c) Environmental and energy impacts of foam blowing agents

Comment: A number of commenters provided comments on the potential impact of the proposal on greenhouse gas emissions. AHAM state that they believe the proposed rule is unnecessary to protect the environment, because the use and potential emissions of high GWP HFC blowing agents for household refrigerators sold in the U.S. market are far less than what EPA estimated. DuPont comments that given that HFCs remain in these closed cell foams and provide valuable insulating properties, emissions of HFCs from foam production are roughly one-third of total HFC use in foams, or about 5% of total HFC emissions on a CO_2 equivalent basis. Two commenters in the foam blowing industry comment that EPA should consider the greenhouse gas emissions and energy savings over the lifetime of a product.

Response: Some commenters have suggested that because current HFC blowing agents, including HFC-134a in XPS, result in foams with energy efficiency that reduce overall GHG emissions, EPA should not change the status of HFC-134a, or at least should consider overall lifecycle climate impacts. While we do not consider energy efficiency as part of our overall risk analysis, we believe that other alternatives, such as olefin foam blowing agents, could improve energy efficiency even more than HFC-134a and other high GWP HFC blowing agents. Further, as explained below in our discussion of energy efficiency, listing higher GWP HFCs unacceptable likely would improve, rather than worsen, overall lifecycle GHG emissions. EPA recognizes that additional time is needed to ensure that the formulations provide equal or better

thermal insulating value given the iterative process that can involve chemical manufacturers, system houses and end users. The change of status dates reflect the need to ensure that these technical challenges can be addressed.

Comment: Imperial Brown comments they cannot know if what is developed as an alternative will enable the resulting foam panels to meet DOE thickness requirements, because there is not a Class 1 polyurethane foam system on the market that utilizes a new blowing agent. Thermo-Kool comments that new foam formulations are not guaranteed to have insulating capabilities comparable to what is available today to satisfy DOE requirements. American Panel Corporation does not intend to use pentanes in its foam blowing application, because the U.S. DOE has established new requirements that do not permit pentanes for walk-in panel manufacturers, as they would increase the panel thickness size. International Cold Storage, Crown Tonka, and ThermalRite Walk-Ins stated that lower R-Values will require additional insulation thickness to meet the energy regulation, thereby requiring expensive, complex, and costly modifications to new walk-in coolers and freezers that may sit side-by-side with identical existing equipment that offers the same degree of performance and protection.

Response: EPA recognizes that different foam blowing agents result in different insulation values. We note that some of the acceptable alternative foam blowing agents, such as HFO-1234ze(E), *trans*-1-chloro-3,3,3,-trifluoroprop-1-ene, and HFO-1336mzz(Z), are expected to provide better insulation value than the HFC blowing agents listed as unacceptable in this action. EPA is not specifically aware of which, if any, of these alternatives has been tested by Factory Mutual (FM) and already qualifies as a “Class 1 polyurethane system.” Other foam blowing agents are expected to have comparable or lower insulation value, such as CO_2, ecomate and hydrocarbons. Given the variety of foam blowing agents available, we expect that foam

products that need higher energy efficiency will have foam blowing agents available that will result in lowering the GHG emissions and energy savings over the lifetime of a product.

Comment: A number of commenters stated that they believed the proposed rule will result in increased energy consumption, potentially negating the overall net GHG emission reductions. One commenter, AMS, believes the effect of the proposed rule on energy consumption is a big unknown at this time. Structural Composites and Compsys, Inc., stated that the efficiency and reduced manufacturing impact of their PRISMA technology offsets the climate impacts from the small amount of HFC-134a used in their foam. ACMA stated that composite panels made using foam blown with HFC-134a for refrigerated transport dramatically reduce fuel usage, and therefore, exhaust emissions, because the panels are so lightweight. They suggested, therefore, that the environmental benefits of a transition away from HFC-134a are outweighed by emissions reductions achieved through lighter, HFC-134a blown panels. Honeywell provided information on the relative energy efficiency, in terms of lambda values, for CO_2, HFC-134a and HFO-1234ze(E), and stated that HFO-1234ze(E)'s energy efficiency properties are comparable and in some instances better than HFC-134a for XPS. Mexichem claimed that HFO-1234ze(E) is not nearly as energy efficient as HFC-134a and stated that it is not clear that XPS produced with HFO-1234ze(E) will provide the same thermal efficiency as achieved with HFC-134a, because HFO-1234ze(E) is not available for the industry to begin product testing. DuPont comments that the emerging low GWP HFO foam alternatives can deliver marked energy efficiency improvements over current alternatives when they become commercially available.

Response: EPA notes that some of the acceptable alternative foam blowing agents, such as HFO-1234ze(E), *trans*-1-chloro-3,3,3,-trifluoroprop-1-ene, and HFO-1336mzz(Z), can

provide better insulation value than the HFC blowing agents we are listing as unacceptable. Contrary to Mexichem's unsupported assertion that HFO-1234ze(E) is not nearly as energy efficient as HFC-134a, another commenter provided information showing that HFC-134a has a lambda (thermal conductivity) value of 29 to 30, while HFO-1234ze(E) has a lambda value of 27 to 30 that shows better insulation (Honeywell, 2014b). Other foam blowing agents have comparable or lower insulation value, such as CO_2, ecomate and hydrocarbons. Given that there are multiple foam blowing agents available that have lower thermal conductivity and better insulation value in each of the end-uses where we are changing the status of one or more foam-blowing agent, we expect that foam products that require higher energy efficiency will be able to use foam blowing agents that will result in lowering the GHG emissions and energy savings over the lifetime of a product, rather than raising it. For example, home appliances that currently use HFC-245fa could use *trans*-1-chloro-3,3,3,-trifluoroprop-1-ene or HFO-1336mzz(Z) and thereby ensure they meet DOE energy conservation standards. Similarly, information from the supplier of HFO-1234ze(E) indicates that XPS would maintain or improve its energy efficiency if HFO-1234ze(E) were used instead of HFC-134a as the blowing agent. Manufacturers of alternative panels or composite materials have not provided information showing that use of an alternative blowing agent would adversely affect the weight of foam formulations and thereby reduce fuel efficiency.

d) Cost impacts

Comment: Commenters express concern about the costs of the transition required by the proposal, including:

- capital costs;
- research, reformulation, and testing;

- technology and equipment;
- conversion, system re-design, and retrofit;
- certification;
- costs for the recreational boating industry;
- increasing cost of HFC-134a;
- increases in costs to consumers;
- market competitiveness impacts;
- reduction in new product development;
- retesting required due to lack of coordination with timing of requirements for DOE energy conservation standards;
- economic impacts on branding;
- cost savings; and
- other general economic concerns.

Some commenters, such as Mexichem, Solvay, and AHAM, suggested that it was not necessary to change the status of HFC-134a and other HFC foam blowing agents or to require industry to incur the costs that these changes require. Other commenters, such as NMMA, NAFEM, XPSA, and their members, requested additional time for the change of status of HFC-134a and other HFC foam blowing agents in order to allow them to spread costs out over time and thus make costs of the transition more manageable. Imperial Brown suggested a later status change date to allow foam manufacturers to create sufficient supply, thereby alleviating a potential cost premium associated with scarcity of newer alternatives.

Response: EPA recognizes that transitioning to new foam blowing agents is likely to require capital costs and investments in research, updated equipment, and related financial

impacts. However, as explained in more detail in another response to comment, under the SNAP criteria for review in 40 CFR 82.180(a)(7), the only cost information that EPA considers as part of its SNAP review is the cost of the substitute under review (and not the cost of transition when a substitute is found unacceptable).

Although cost is not a consideration in our decision to change the status of certain substitutes, we note that based on technical concerns, the final rule establishes a later change of status date in a number of end-uses, which will allow manufacturers to spread costs over time. Regarding whether there will be a sufficient supply of alternatives, we considered this issue in establishing the change of status dates and believe that there will be more than adequate supplies of alternatives. This will also contribute to lower costs. We have addressed elsewhere why it is necessary to change the status of substitutes for the various end-uses based on whether alternatives that pose lower risk are available. Where we concluded that safer alternatives were available, we determined it was necessary to change the status. Thus, we disagree with the commenters who suggest that it is not necessary to change the status of various HFC foam blowing agents.

VI. What is EPA finalizing for the HCFCs addressed in this rule?

A. What did EPA propose for HCFCs and what is being finalized in this rule?

In the August 6, 2014 NPRM, EPA proposed to change the listings from acceptable to unacceptable for three HCFCs: HCFC-141b, HCFC-142b, and HCFC-22 (79 FR 46,155). As discussed in the proposed rule, EPA proposed to modify the listings for these three HCFCs and blends containing these HCFCs to align the SNAP listings with other parts of the stratospheric protection program, specifically section 605 and its implementing regulations at 40 CFR part 82 subpart A and section 610 and its implementing regulations at 40 CFR part 82 subpart C. HCFCs

are subject to the use restrictions in CAA section 605(a) and these specific HCFCs have been restricted under EPA's implementing regulations at 40 CFR part 82 subpart A since January 1, 2010. Additionally, the nonessential products ban under CAA section 610 restricts sale and distribution of certain products containing or manufactured with these three HCFCs. We believe it is important that the SNAP listings not indicate that these HCFCs may be used when another program under title VI of the CAA would prevent such use. Thus, we are aligning the requirements. The HCFCs addressed in this rule were previously listed as acceptable or acceptable subject to use conditions in the aerosols, foam blowing, fire suppression and explosion protection, sterilants, and adhesives, coatings and inks sectors. For more information, please refer to the relevant section of the proposed rule as noted above. The change of status determinations for the HCFCs addressed in this rule are summarized in the following table:

Table 9. Change of Status Decisions for HCFCs Addressed in This Rule

Sector and End-use	Substitutes	Decision
Aerosols—Propellants	HCFC-22 and HCFC-142b	Unacceptable effective **[DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**
Aerosols—Solvents	HCFC-141b and blends thereof	Unacceptable effective **[DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**
Foams – All end-uses	HCFC-141b, HCFC-142b, HCFC-22, and blends thereof	Unacceptable effective **[DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**
Fire suppression – Total flooding	HCFC-22	Unacceptable effective **[DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**
Sterilants	Blends containing HCFC-22	Unacceptable effective **[DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**
Adhesives, coatings, and inks—All end-uses	HCFC-141b and blends thereof	Unacceptable effective **[DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**

Consistent with the proposal, in today's final rule, EPA is modifying the listings for HCFC-141b, HCFC-142b, and HCFC-22, as well as blends that contain these substances, from

acceptable to unacceptable[90] in non-refrigerant sectors–specifically, aerosols, foam blowing agents, fire suppressants, cleaning solvents, sterilants, and adhesives, coatings and inks.

As provided in the proposal, EPA is not addressing HCFC use for refrigeration and air conditioning in this rulemaking because CAA section 605(a) and our implementing regulations allow for continuing use of HCFCs to service equipment. Recognizing that other HCFCs became subject to the use and interstate commerce prohibitions in 40 CFR 82.15(g) after issuance of the proposed rule, and that limited exemptions are available in section 82.15(g) for certain of those HCFCs, EPA is not modifying the SNAP listings for HCFCs other than HCFC-141b, -142b, and -22 and blends containing those substances at this time. EPA may revisit the acceptability of other HCFCs in a later rulemaking as appropriate. We are finalizing the proposal that the listings be modified 60 days following issuance of a final rule.

B. How is EPA responding to public comments concerning HCFCs?

Comment: EPA received a few comments on the proposed modifications affecting HCFCs, primarily on whether the unacceptability determination should apply to imported products containing closed cell foam that contain any of the blowing agents listed as unacceptable, as well as applying to the blowing agent itself.

Response: As explained in section V.D.2.c, above, EPA is not finalizing the proposed change to the import of closed cell foam products blown with an agent listed as unacceptable. We also explained that we plan to continue assessing the merits of this change and may provide further explanation and opportunity for comment in a subsequent rulemaking. Thus, as of the time of the status change, foam blowing agents containing HCFC-141b, -142b, and -22 and

[90] These three HCFCs have previously been listed as unacceptable in several, but not all, SNAP sectors.

blends are prohibited from being used or imported into the United States, but foam products or products containing foam made with these agents, such as appliances or furniture, may still be imported.

Comment: Hussmann Corporation asked for four years from the issuance of the final rule to make any changes to the acceptability of HCFC-141b in foam blowing applications, stating that considerable time is needed to review what impact new foam has to structural integrity and product efficiency. The commenter stated that this timing would would allow manufacturers to make a transition to new products while remaining within the EPA's new HCFC allocation rule (which will completely phase out HCFC refrigerants in five years).

Response: EPA would like to clarify that anyone still using HCFC-141b to blow foam in the United States is likely out of compliance with longstanding regulations promulgated under the SNAP program (CAA section 612), as well as the HCFC phaseout (CAA section 605). Under SNAP, HCFC-141b was listed as unacceptable effective on November 29, 2004, for all foam uses, with a limited exemption for use in space vehicle, nuclear, and defense applications, as well as for research and development for foreign customers (see 69 FR 58,269). Under the HCFC phaseout program, EPA stopped the production and import of HCFC-141b for use in foams in 2003 (40 CFR 82.16(b)) and prohibited its use as of January 1, 2010, with limited exceptions (40 CFR 82.15(g)). All remaining exemptions for the use of HCFC-141b ended on January 1, 2015. Therefore, this current rule does not affect the use of HCFC-141b to blow foam in the United States; it only ensures the SNAP list is aligned with other existing regulations under Title VI of the CAA.

If the commenter is referring to applying the unacceptability determination for HCFC-141b to products containing HCFC-141b, as discussed above in this section, EPA is not

finalizing the proposed change to the import of closed cell foam products blown with an agent listed as unacceptable.

VII. How is EPA responding to other public comments?

A. Authority

1. General Authority

Comment: The Agency received several comments, including those from Solvay, Arkema, AHAM, BASF, Mexichem, NRDC and IGSD, Whirlpool, and Bally Refrigerated Boxes on its authority to change the status of HFC-134a and other substitutes that were addressed in the proposed rule. NRDC and IGSD asserted that under section 612 of the CAA ((42 U.S.C. 7671k), EPA has the authority – if not the affirmative mandate -- to remove the proposed substances from the SNAP list of acceptable substitutes. They quoted from section 612(a), emphasizing that replacement of ODS with substitutes that reduce overall risk is to occur "to the maximum extent practicable" (42 U.S.C. 7671k(a)). They stated that under section 612(c)(2), EPA has authority to decide which substances may and may not be used in the SNAP sectors. Finally, they asserted that in speaking of both alternatives "currently" available, and those that are "potentially" available, Congress recognized that the universe of alternatives will evolve over time, so that as additional alternatives become available, EPA has an obligation to revise the SNAP list to ensure that the substances included will minimize "overall risks to human health and the environment" (42 U.S.C. 7671k(c)).

In contrast, Mexichem, Solvay, AHAM/Electrolux and Arkema asserted that the proposed actions were outside the scope of Title VI, section 612 of the CAA, and EPA's SNAP regulations. Specifically, these commenters asserted that Congress and EPA designed the SNAP program to safeguard stratospheric ozone, and not to address climate change and greenhouse

gases. AHAM stated that Title VI of the CAA does not provide EPA broad authority to regulate refrigerants, foams and chemicals in circumstances unrelated to ozone depletion. Mexichem stated that the repeated references in section 612 to class I and class II substances demonstrate that Congress was concerned with ODS.

Several commenters emphasized evaluation of a substitute in relation to ODS. Mexichem asserted that EPA recognized "the limited nature of the statute" in 1994 when it promulgated the statement of purpose and scope for the SNAP program (59 FR 13,044, Mar. 18, 1994; 40 CFR 82.170). In its comment, Mexichem provided a quotation from the statement of purpose and scope, suggesting that substitutes are to be compared only to ODS. Arkema quoted an EPA "Guide to Completing a Risk Screen"[91] for the fire suppression sector as explaining that environmental effects would be evaluated by comparing the substitute's GWP to the GWP of the ODS it replaces. Solvay contended that changing the listing status of a previously approved substitute would eliminate the user's ability to use a substance that met the statutory objective of providing better overall health and safety in comparison to the use of an ODS in a specific end-use.

Several commenters also asserted that nothing has happened with respect to any attribute or impact of the HFCs addressed in this rulemaking that would warrant a change in the initial decisions to list HFCs as acceptable.

Response: EPA agrees with NRDC and IGSD's conclusion that the Agency has authority to take the change of status actions included in the proposed rulemaking and disagrees with comments suggesting that the sole purpose of section 612 and the SNAP program is to safeguard the ozone layer. Section 612(c) requires EPA to take action when the Agency (1) determines that

[91] *http://www.epa.gov/ozone/snap/fire/riskscreenfire.pdf*

a substitute may present adverse effects to human health and the environment, and (2) identifies an alternative that reduces overall risk to human health and the environment and is currently or potentially available. That provision makes clear that the mandate of section 612 is to reduce overall risk; it does not limit the risks of concern to those associated with ozone depletion. In addition, while section 612 refers repeatedly to class I and class II substances, it also refers repeatedly to substitutes or alternatives, requiring specific actions with regard to such substances.

EPA cannot fulfill its section 612(c) mandate to compare alternatives with a view to reducing overall risk without considering impacts related to issues other than ozone depletion. Toward that end, the SNAP regulations require submitters to include information on a wide range of factors in addition to ODP, including GWP, toxicity, flammability, and the potential for human exposure (59 FR 13,044, Mar. 18, 1994 and codified at 40 CFR 82.178). Further, the SNAP regulations state that EPA will consider atmospheric effects (including GWP), exposure assessments, toxicity data, flammability, and other environmental impacts such as ecotoxicity and local air quality impacts (59 FR 13,044, Mar. 18, 1994; 40 CFR 82.180).

In addition, while section 612(a) states the Congressional policy of reducing overall risk in broad terms, section 612(c) specifically requires EPA to compare the risk of the substitute under review *to other substitutes or alternatives.* In that regard, Mexichem's comment omits a crucial phrase in the statement of "purpose and scope" in the SNAP regulations. The complete statement reads: "The objectives of this program are . . . to promote the use of those substitutes believed to present lower overall risks to human health and the environment, relative to the class I and class II compounds being replaced, *as well as to other substitutes for the same end-use*, and to prohibit the use of those substitutes found, based on the same comparisons, to increase overall risks [emphasis added]" (59 FR 13,044, Mar. 18,

1994; 40 CFR 82.170). In addition, Arkema's reference to a single document containing language mentioning a substitute-to-ODS comparison ignores the large number of risk screens that EPA has prepared over the years that compare the ODP and GWP, and other environmental and health attributes, of substitutes to those of other substitutes, as well to those of ODS (e.g., risk screens in the following dockets: EPA-HQ-OAR-2013-0798 and EPA-HQ-OAR-2003-0118.) Further, EPA's listings over the years have included comparisons of substitutes to other available alternatives in the same end-uses (e.g., 67 FR 13,272, 67 FR 77,927, 68 FR 50,533, 69 FR 58,903, 71 FR 15,589, 71 FR 55,140, 71 FR 56,359, 74 FR 21, 74 FR 50,129, 75 FR 34,017, 76 FR 17,488, 76 FR 61,269, 76 FR 78,832, 77 FR 47,768, 77 FR 58,035, 78 FR 29,034, 79 FR 62,863). The substitute-to-substitute comparison is essential to fulfilling EPA's obligation under section 612(c) to determine whether there are alternatives that reduce overall risk as compared with the substitute under review.

To the extent possible, the Agency has always sought to ensure that our SNAP decisions are informed by the most current overall understanding of environmental and human health impacts associated with available and potentially available alternatives. In that regard, the Agency has, since the inception of the SNAP program, asserted its authority, consistent with the language of section 612(c) and the section's statement of congressional policy, to review substitutes listed as acceptable and to take action with respect to those substitutes on the basis either of new information generally, including that related to overall risk, or of the availability of new alternatives that pose less overall risk. Specifically, in the preamble to the initial SNAP rule, EPA made clear that "the Agency may revise these [listing] decisions in the future as it reviews additional substitutes and receives more data on substitutes already covered by the program" (59 FR 13,044, 13,047). We interpret section 612 as allowing both addition of new, safer alternatives

to the listings and removal from the listings of substitutes found to pose more risk overall than other available alternatives.

With regard to additional data on substitutes already covered by the program, the Agency has previously responded to the evolution of scientific and technical information by revisiting the listing status of a substitute. For example, on the basis of new information on toxicity, EPA took action in January of 2002 to change the listing for HBFC-22B1 from acceptable, subject to use conditions to unacceptable (67 FR 4,185, January 29, 2002; 40 CFR 82 subpart G, appendix J).

With regard to additional alternatives, the suite of available or potentially available alternatives changes over time. For example, over the past several years, and as standards and familiarity with the safe use of various alternatives has developed, EPA has listed several specific flammable refrigerants as acceptable for some end-uses subject to use conditions (e.g., 76 FR 78,832, December 20, 2011; 40 CFR 82 subpart G appendix R; 80 FR 19,453, April 10, 2015). Most of these refrigerants (e.g., ethane, propane, isobutane, HFC-32) are not new molecules; rather, their recent listing as acceptable subject to use conditions is based on an increased understanding of their ability to be used in a manner that would reduce overall risk. The availability of those alternatives enables a broader review of comparative risk under section 612(c).

Further, we disagree with the notion that our understanding of the impact of HFCs has remained static. Our understanding of the impact that HFCs have on climate has evolved and become much deeper over the years. As mentioned elsewhere in this rulemaking, a significant indication of that change can be seen in EPA's December 7, 2009, Endangerment Finding (74 FR 66,496, 66,517, 66,539) which makes clear that like the ODS they replace, HFCs are potent GHGs. In addition, HFCs are now in widespread usage. The most commonly used HFC is HFC-

134a. HFC-134a is 1,430 times more damaging to the climate system than carbon dioxide (see Table A-1 to subpart A of 40 CFR part 98). Further, HFC emissions are projected to accelerate over the next several decades; if left unregulated, emissions are projected to double by 2020 and triple by 2030.[92] Additional information concerning the peer-reviewed scientific literature and emission scenarios related to HFCs is available in the docket for this rulemaking (e.g., Akerman, 2013; EPA, 2013b and 2014; IPCC, 2007 and 2013; IPCC/TEAP 2005; Montzka, 2012; Velders et al., 2009). This information was taken into account in this rulemaking.

2. Second generation substitutes

Comment: Several comments focused on the term “replace” in section 612(c), suggesting that once a company has switched to a non-ODS alternative, it is no longer "replacing" a Class I or Class II ODS in its products, and that it is unsupportable to read "replacement" as a continuous process rather than as a single event. Solvay stated that the proposed rule would require users that have already “replaced” ODS with non-ODS to make a second replacement, and that EPA lacks authority to require this second replacement. Arkema stated that the statutory terms “replace” and “replacement” must be given their ordinary meanings, and that to replace an ODS means to take the place of an ODS. Arkema further noted that EPA defines a “substitute or alternative” in its SNAP regulations as something “intended for use as a replacement for” an ODS (59 FR 13,044, Mar. 18, 1994 and 40 CFR 82.172). Arkema concluded that Congress and EPA designed the SNAP program to regulate things taking the place of ODS, not to replace substances with no ozone depletion potential. Arkema contended that EPA has interpreted the statute and regulations as excluding non-ODS. In support of this argument, Arkema quoted the

[92] Climate Change and President Obama’s Action Plan. June, 2013. Available in the docket and online at *www.whitehouse.gov/share/climate-action-plan*

preamble to the initial SNAP rule as saying that "a key issue" was "whether there exists a point at which an alternative should no longer be considered a class I or class II substitute as defined by 612" (59 FR 13,044, 13,052). The commenter further quoted the preamble to that rule as saying that "if a hydrofluorocarbon (HFC) is introduced as a first-generation refrigerant substitute for [an ODS], it is subject to review and listing under section 612. Future substitutions to replace the HFC would then be exempt from reporting under section 612 . . . ." (*id.).* In addition, Arkema quoted a 1996 petition response[93] as stating that EPA does not review substitutes for non-ozone-depleting substances such as HFC-134a. Arkema also quoted the SNAP Instruction Manual[94] as instructing applicants to specify the ODS being replaced.

AHAM commented that the appliance industry no longer intends HFCs as a substitute or replacement for ODS. The commenter stated that there are very few remaining models that ever used ODS, and that the substances used in today's models are not substitutes or replacements in the common-sense meaning of those words.

Arkema further stated that EPA should be precluded from comparing non-ODS first-generation alternatives (such as HFC-134a) to second-generation non-ODS alternatives (such as HFO-1234yf, HFC-152a, and R-744). Arkema contended that none of these second-generation compounds is a "substitute" for SNAP purposes.

Response: In this rulemaking, the Agency is revising the listing status of substitutes that are direct replacements for ODS. Arkema admits as much on p. 8 of their comment letter, where they describe HFC-134a as a "first generation refrigerant substitute." While we are not exploring the full scope of the "first generation" concept in this action, there is no question

[93] *Response to Oz Technology's Petition* (Aug 30, 1996).
[94] *www.epa.gov/ozone/snap/submit/appguide.pdf*

that HFC-134a directly replaced ODS in the relevant sectors. For example, with respect to foam blowing, when HFC-134a was listed as acceptable in foam blowing applications, foam was still being blown with HCFCs (59 FR 13,044, March 18, 1994; 64 FR 30,410, June 8, 1999). In this action, we are not addressing the extent of EPA's authority to revise the listings of alternatives that are arguably indirect replacements for ODS, sometimes termed "second-generation alternatives."

EPA does not agree with the commenters who suggest that while HFC-134a may have replaced ODS at one point in time, it no longer does so. The term "replace" is not defined in section 612, EPA therefore interprets this term as it is commonly used. Dictionary definitions can provide insight into how a reasonable or ordinary person would interpret the term. Dictionary definitions of "replace" include the following: "to be used instead of"[95] "to take the place of,"[96] and "to provide a substitute or equivalent for."[97] None of these definitions suggests that something used "instead of" or "to take the place" of something else ceases to "replace" it simply due to the passage of time. Nor does the Agency view the replacement of a ODS with a substitute (e.g., HFC-134a) as limited to the first time a product manufacturer uses the substitute. Indeed, in the preamble to the initial SNAP rule, we interpreted the term "replace" to apply "each time a substitute is used." (59 FR 13,044, 13,047). We noted that "[u]nder any other interpretation, EPA could never effectively prohibit the use of any substitute, as some user could always start to use it prior to EPA's completion of the rulemaking required to list it as unacceptable" (*Id.*). Thus, the fact that HFC-134a is already in use as a replacement for ODS does not mean that its future use is any less of a replacement. In

[95] Merriam-Webster, *http://www.merriam-webster.com/dictionary/replace*
[96] Collins, *www.collinsdictionary.com/dictionary/american/replace*
[97] Id.

context, the language that Arkema quotes ("whether there exists a point at which an alternative should no longer be considered a class I or II substitute") does not suggest that a substance that directly replaces the ODS might somehow cease to qualify as an ODS substitute. Rather, it raises the question of whether a substance that indirectly replaces the ODS might fail to qualify. That question is not addressed in this rulemaking because this rulemaking addresses only substances that are direct replacements for ODS in the relevant sectors.

Similarly, the mere passage of time does not mean that the substances addressed in this rulemaking have somehow ceased to be "substitutes or alternatives" under the regulatory definition at 40 CFR 82.172. No commenter suggests that at the time of their initial SNAP listing these substances were anything other than "chemicals . . . intended for use as a replacement for a class I or II compound." Rather, commenters assert that these substances are no longer intended for use as an ODS replacement. However, introducing a temporal aspect into this definition would mean that a product manufacturer could make an initial substitution for a class I or II substance 90 days after providing the required notification to EPA and thereafter continue to use the substitute while disclaiming any intent to replace the ODS. This is not a supportable interpretation because it would allow the manufacturer to circumvent SNAP requirements simply by beginning to use a substitute prior to its SNAP listing.

In addition, EPA implements the section 612(c) mandate to list substances as acceptable or unacceptable "for specific uses" by listing substitutes on an end-use or sector basis.[98] Similarly, the Agency views transition as occurring on an end-use by end-use or sector-by-sector basis, not -- as one commenter suggests -- on a model-by-model basis. Thus, the act of

[98] This is reflected in the appendices to 40 CFR part 82, subpart G.

"replacing" is not limited to the redesign of a particular model, or the introduction of a new model, but instead occurs repeatedly within a given end-use or sector.

Contrary to Solvay's comment, EPA has authority to regulate the continuing replacement of ODS with HFC-134a and the other substitutes whose listing status is addressed in this action. In this rulemaking, EPA considered whether such replacement should continue to occur given the expanded suite of other alternatives to ODS in the relevant end-uses and our evolving understanding of risks to the environment and public health. The commenter's line of reasoning would undermine EPA's ability to comply with the statutory scheme reflected in section 612(c), under which EPA's authority to prohibit use of a substitute is tied to information on overall risk and the availability of substitutes.

Regarding Arkema's suggestion that HFO-1234yf, HFC-152a, and R-744 are not "substitutes" for SNAP purposes and thus they cannot be used as part of a review of whether EPA should change the status of HFC-134a, we disagree. HFO-1234yf, HFC-152a and R-744 (as well as the other substances we used for comparison purposes in this rulemaking)[99] are currently listed as acceptable or acceptable, subject to use conditions under SNAP. Thus, we have separately taken action to treat these substances as substitutes for the purposes of section 612(c) and the corresponding regulatory provisions. We are not re-examining in this rulemaking whether the substances used for comparison purposes in this action qualify as substitutes. Rather, in this rule, we are making listing determinations for substances that are direct substitutes for

[99] We note that the requirement under section 612 does not limit our analysis of whether there are "safer" alternatives only to "substitutes" listed under the SNAP program. Rather section 612(c) refers to "alternatives" that are currently or potentially available. Thus, in instances where we are aware of other alternatives that may not have completed SNAP review and we have sufficient information for those alternatives relative to the SNAP review criteria, we may include those alternatives in our comparative analysis. In this action, for purposes of the refrigeration end-uses, we included in our comparative analysis several substances we were concurrently reviewing under SNAP and which we have taken action to list as acceptable, subject to use conditions (April 10, 2015, 80 FR 19,453) and for which we are taking action concurrently with this rule to list as acceptable.

ODS based on their overall risk compared to these other alternatives.

3. GWP Considerations

Comment: The Agency received several comments relating to EPA's authority to consider GWP in its comparative risk evaluation, and to take action on the basis of GWP. Specifically, Solvay and Mexichem stated that while section 602 of the CAA requires EPA to publish the GWP of each listed class I and class II substance, the Agency's authority is limited by the language stating that it "shall not be construed to be the basis of any additional regulation under this chapter." Solvay stated that this language expresses Congress's intent that no provision of Title VI – including, but not limited to, §602, §608, §612, and §615 – provides statutory authority for the Agency to implement an overarching program under which it can force users to cease using substances with global warming, but not ozone-depleting, potentials. Mexichem commented that if GWPs of listed compounds cannot be the basis of further regulation under Title VI, it follows that regulation based on comparisons of GWPs of both listed substances and unlisted alternatives was intended by Congress equally to be foreclosed. Commenters asserted that EPA inappropriately used the physical characteristic of GWP as a surrogate for risk; failed to assess the significance to climate change of the emissions reductions estimated to be brought about by the action as they relate to risk for each substance in each sector covered; failed to assess and account for indirect climate impacts; and failed to apply its customary tests for consideration of atmospheric effects.

BASF commented that EPA proposed to find HFCs unacceptable because they have "high GWPs as compared with other available or potentially available substitutes in those end–uses and pose significantly greater overall risk to human health and the environment." BASF noted that while CAA section 612 does require an assessment of risk, it does not explain how

that assessment should be done. BASF added that whatever that assessment should involve, it is possible that Congress did not intend GWP to be part of that assessment.

Response: As noted by some commenters, section 602 of the CAA calls on EPA to publish the GWP for each class I or class II substance, but goes on to say that this mandate "shall not be construed to be the basis of any additional regulation under this chapter." Consistent with this provision, we are not relying on section 602 as authority for the action being taken in this rulemaking. Rather, we are relying on section 612, which specifically provides that EPA is required to list a substance as unacceptable if it "may present adverse effects to human health or the environment" where EPA has identified alternatives that are currently or potentially available and that "reduce the overall risk to human health and the environment."

Considerations of atmospheric effects and related health and environmental impacts have always been a part of SNAP's comparative review process, and the provision of GWP-related information is required by the SNAP regulations (see 40 CFR 82.178 and 82.180). The issue of EPA's authority to consider GWP in its SNAP listing decisions was raised in the initial rule establishing the SNAP program. In the preamble to the final 1994 SNAP rule, EPA stated: "The Agency believes that the Congressional mandate to evaluate substitutes based on reducing overall risk to human health and the environment authorizes use of global warming as one of the SNAP evaluation criteria. Public comment failed to identify any definition of overall risk that warranted excluding global warming" (59 FR 13,044, March 18, 1994).

Consistent with that understanding, the 1994 SNAP rule specifically included "atmospheric effects and related health and environmental impacts" as evaluation criteria the Agency uses in undertaking comparative risk assessments (59 FR 13,044, March 18, 1994; 40 CFR 82.180(a)(7)(i)). That rule also established the requirement that anyone submitting a notice

of intent to introduce a substitute into interstate commerce provide the substitute's GWP (see 40 CFR 82.178(a)(6)). Accordingly, we have considered the relative GWP of alternatives in many SNAP listing decisions. For example, in the decision to list C7-Fluoroketone as acceptable we noted that "C7 Fluoroketone's GWP of about 1 is lower than or comparable to that of other non-ozone-depleting substitutes in heat transfer uses, such as HFE-7100 with GWP of 297, HFC-245fa with a GWP of 1030, and CO_2 with a GWP of 1" (77 FR 47,768, August 10, 2012). In that same action, EPA also considered ODP, VOC status, flammability, toxicity and exposure, concluding that "EPA finds C7 Fluoroketone acceptable in the end-use listed above because the overall environmental and human health risk posed by C7 Fluoroketone is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-use" (*id*). Similarly, in finding the use of isobutane and R-441 acceptable subject to use conditions in household refrigeration, we included an-in depth discussion of the relative GWP of these and other alternatives listed for household refrigeration (76 FR 78,832, December 20, 2011).

In response to comments that EPA inappropriately used the physical characteristic of GWP as a surrogate for risk and that EPA failed to assess the significance to climate change of the emissions reductions estimated to be brought about by the action, as they relate to risk for each substance in each sector covered, we note that GWP is a relative measure and that if comparable amounts of two substitutes are used, then the relative climate effects of resultant emissions will be higher for the substitute with higher GWP. EPA considers factors such as charge size of refrigeration equipment and total estimates of production in its assessment of environmental and health risks of new alternatives, so we can consider if there would be substantial differences that might affect total atmospheric emissions. We believe that we have appropriately considered GWP as a metric for comparing climate effects of substitutes.

In response to comments that EPA failed to assess and account for indirect climate impacts, we note that we do not have a practice in the SNAP program of including indirect climate impacts in the overall risk analysis. We do consider issues such as technical needs for energy efficiency (e.g., to meet DOE standards) in determining whether alternatives are "available," and have followed that practice in this rulemaking. We believe that there is a sufficient range of acceptable alternatives that end users will be able to maintain energy efficiency levels We also note that federal energy conservation standards will continue to ensure that equipment regulated by this rule will not increase its indirect climate impacts. See in particular section V.C.7 for a discussion on energy efficiency for commercial refrigeration products and section V.D.3.c for a response to comments on energy efficiency of foams.

In this action, EPA used the same comparative risk approach it has used in the past, including the consideration of GWP.

4. Takings

Comment: Solvay asserted that the delisting of already approved alternatives constitutes a taking in violation of the Fifth Amendment to the U.S. Constitution. Solvay commented that the delisting would effectuate a regulatory taking for which the United States would owe "just compensation" to regulated parties, including Solvay, that have made significant investments in furtherance of U.S. policies under the CAA and the Montreal Protocol. Solvay quoted the Supreme Court case *Lucas v. South Carolina Coastal Council* as saying that "any limitation [that prohibits all economically beneficial uses of real property] . . . cannot be newly legislated or decreed (without compensation), but must inhere in the title itself, in the restriction that background principles of the State's law of property and nuisance already place upon land ownership" (505 U.S. 1003, 1029 (1992)).

Response: The first question in a takings analysis is whether there is a property interest protected by the Fifth Amendment. The commenter does not identify the property interest that is the subject of the alleged "taking." While the commenter cites a case involving real property, no real property is at stake here. To the extent the commenter has a property interest in the HFCs it imports or produces, such interest would be limited to quantities already in existence, and not those that might be produced or imported in the future. In any event, EPA's change in the listing status of HFCs does not effectuate a taking. First, EPA's action does not "completely deprive" the commenter of "all economically beneficial us[e]" of the HFCs it produces or imports. *See Lingle v. Chevron*, 544 U.S. 528, 538 (2005), quoting *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1019 (1992). EPA is not listing all HFCs as unacceptable in all end-uses; rather, EPA is listing certain HFCs as unacceptable in specified end-uses. In addition, EPA is adopting change of status dates that provide ample time for HFCs already in existence to be sold. Thus, some "economically beneficial use" of the HFCs remains. In such situations, courts typically consider several factors in determining whether a regulatory taking has occurred. Those factors include "the character of the governmental action, its economic impact, and its interference with reasonable investment-backed expectations." *PruneYard Shopping Center v. Robbins*, 447 US 74, 83 (1980).

Here, the change in the listing status of certain HFCs for specified end-uses is designed to "promote the common good" (*see Penn Central Transportation Co. v. New York City*, 438 U.S. 104, 124 (1978)). The alternatives to which EPA compared these HFCs in this action were found to pose less overall risk to human health and the environment in the specified end-uses. Thus, removing these HFCs from the list of acceptable substitutes for these end-uses provides a public benefit. Regarding the economic impact of this action, EPA recognizes that the impact will vary

for the different end-uses. For example, for some foam blowing agent end-uses, transitioning to other alternatives is likely to require capital costs and investments in research, updated equipment, and their related financial impacts. In comparison, for some aerosol propellant uses and some refrigeration end-uses, depending on the alternative selected, there may be little or no need for capital costs or research. However, EPA notes that chemical producers have been investing in low-GWP alternatives for years, and many have either submitted SNAP notifications or expressed interest in submitting SNAP notifications concerning new molecules and blends of existing molecules.

The commenter could not have had a reasonable investment-backed expectation that these HFCs would continue to be listed as acceptable indefinitely in all end-uses, or in any specific end-use, because EPA expressly stated in the preamble to the initial SNAP rule that "the Agency may revise these [listing] decisions in the future as it reviews additional substitutes and receives more data on substitutes already covered by the program" (59 FR 13,044, 13,047). In addition, EPA also noted the "significant global warming potentials" of some HFCs and stated "EPA is concerned that rapid expansion of the use of some HFCs could contribute to global warming" (*id.* at 13,071). EPA characterized HFCs as a "near-term option for moving away from CFCs," not as a long-term solution.

5. Montreal Protocol/International

Comment: Solvay comments that HFCs are not regulated under the Montreal Protocol and are not Class I or Class II substances under Title VI. Mexichem states that the United States, Canada, and Mexico have proposed to amend the Montreal Protocol to provide an across-the-board phase down of HFCs, but until then, EPA's regulatory authority under Title VI is limited to ODS. AHAM adds that if at some point EPA is authorized to phase out HFCs consistent with

future international obligations that may constitute a more appropriate avenue for phase-down measures. AHAM believes there is minimal purpose in promoting an international regulatory regime if EPA is going to apply what it considers to be a "blunt and inappropriate" regulatory instrument domestically, regardless of the shape of a future international scheme. AHAM comments that the appliance industry's transition from HFCs is well underway, and EPA's proposal should reflect and support this progress, rather than impede it. Five commenters commented on the perceived inconsistency of the proposed timeline and the proposed amendments to the Montreal Protocol to adopt a gradual phase down of HFCs.

Response: EPA agrees that the Montreal Protocol does not currently regulate HFCs. Nevertheless, several sections of Title VI call on EPA to take measures that are not required by the Montreal Protocol but are complementary to the ODS phaseout. These sections include, in addition to section 612, sections 608 (national emissions reduction program), 610 (nonessential products), and 611 (labeling). In addition, while HFCs are not a Class I or Class II substance under the Clean Air Act, HFCs are substitutes for Class I and Class II ODS, and section 612 and its implementing regulations specifically call on the agency to restrict substitutes for ODS where the Agency has identified other available or potentially available alternatives that reduce overall risk to human health and the environment.

The CAP considers both domestic and multilateral action to address HFCs. The United States co-proposed and is strongly advocating for an amendment to the Montreal Protocol to phase down production and consumption of HFCs. EPA sees no conflict between the United States' strong support for a global phase-down and this domestic action. The amendment proposal calls for a phase-down of production and consumption of a group of HFCs, including HFC-134a as well as HFC-125 and HFC-143a (components of R-404A, R-507A and other

blends), on a total CO_2-equivalent basis. It applies phase-down steps to this group of HFCs as a basket and does not assign individual deadlines to specific HFCs or address specific uses.

6. Absence of petitions

Comment: Solvay questioned whether the Agency has the authority to issue this proposed rule in the absence of one or more petitions that fully satisfy the requirements of §612(d). Solvay commented that while Congress granted EPA the authority to create an initial list of approved substitutes for ODS under §612(c), §612(d) specifies that additions or deletions to the SNAP list must be proposed via petition, and that petitions "shall include a showing by the petitioner that there are data on the substance adequate to support the petition." Solvay stated that the CAA puts the burden on a petitioner to demonstrate that the substance it proposes to list satisfies all of the SNAP criteria. Solvay contended that EPA should not attempt to delist any substances on its own initiative. Solvay commented that to the extent it does, EPA has the burden, standing in the shoes of a petitioner, to demonstrate that it has data adequate to support the petition.

Response: The Agency disagrees with the commenter regarding EPA's authority to independently review and, where appropriate, change the status of substitutes under the SNAP program. In the preamble to the initial SNAP rule, the Agency stated that "section 612 authorizes it to initiate changes to the SNAP determinations independent of any petitions or notifications received. These amendments can be based on new data on either additional substitutes or on characteristics of substitutes previously reviewed" (59 FR 13,044, 13,047). Nothing in section 612(c) contravenes this interpretation. The existence of section 612(d), which provides a right for persons to petition the Agency to revise a listing, does not address in any manner whether EPA has authority to change a listing on its own. Furthermore, section

612(c) requires EPA to take action when the Agency (1) determines that a substitute may present adverse effects to human health and the environment, and (2) identifies an alternative that reduces overall risk to human health and the environment and is currently or potentially available. Section 612(c) does not limit such EPA determinations to initial review of substitutes.

For petitions under section 612(d), the petition must "include a showing . . . that there are data on the substance adequate to support the petition." The Agency disagrees that EPA stands in the shoes of a petitioner under 612(d) when it proposes to change the listing status of an alternative. Rather, EPA's action is governed by section 612(c), and EPA considers the criteria used in reviewing substitutes as provided in 40 CFR 82.180(a)(7). Regardless, we note that we also review section 612(d) petitions based on the same SNAP criteria and thus the "data on the substance adequate to support the petition" necessarily are the data required for review under 40 CFR 82.180(a)(7).

EPA has changed the listing status of substitutes in the past without having received a petition under section 612(d), as, for example, when we changed the listing status of MT-31 (64 FR 3,861, Jan. 26, 1999;40 CFR 82 subpart G appendix E) and HBFC-22B1 (67 FR 4,185, Jan. 29, 2002; 40 CFR 82 subpart G appendix J).

While EPA has the right to act in the absence of a petition, as described above, EPA did receive three petitions filed under section 612(d) that are relevant to this rulemaking. Specifically, NRDC filed a petition on May 7, 2010. On February 14, 2011, EPA found that petition complete for MVAC in new passenger cars and light-duty vehicles and determined it was incomplete for other uses of HFC-134a. This rule responds to the aspect of that petition that we found complete. In addition, EIA filed a petition on April 26, 2012, and NRDC, EIA, and

IGSD filed a petition on April 27, 2012. Although EPA found both of these petitions incomplete, our action in this final rule may be considered responsive to certain aspects of the petitions, given that we are changing the listing of certain HFCs used in sectors noted in those petitions from acceptable to unacceptable for most uses, and placing use conditions or narrowed use limits on some of the remaining uses. A more detailed discussion of the petitions can be found in section IV of this rule.

7. Application of criteria for review of alternatives

Comment: Solvay commented that EPA has failed to properly apply the SNAP factors to a delisting situation, has given undue weight to GWP in its analysis, and has based its decision on comparative GWPs of various non-ODS options to the exclusion of all other factors. Solvay commented that the proposal was deficient in that EPA failed to consider many relevant codes, standards and regulations, including parallel energy efficiency regulations issued by the DOE; building code standards; fire code requirements; and Coast Guard regulations. Solvay also stated that EPA should have considered technical concerns like solubility, compatibility, and shelf stability; equipment limits; supply chain considerations; and safety concerns that affect many end-use products.

Solvay further commented that in making a determination whether to list a substance as an approved substitute to replace an ODS, the Agency must conduct a comprehensive analysis of each alternative in each end-use, including considerations of the cost of the alternative, availability, and the overall practicability of effectuating a replacement. Solvay focused on the phrase “to the maximum extent practicable” in section 612(a) of the CAA, stating that Congress deliberately chose the term “practicable” to mandate an orderly transition from ODS. Solvay stated that the term “practicable” ordinarily includes consideration of cost and availability.

Solvay further argued that EPA had acknowledged and agreed with this understanding of the term by including cost and availability in its list of criteria. Solvay referred to dictum in *Honeywell v. EPA*, 374 F.3d 1363, 1373 (D.C. Cir. 2004) stating that "it is at least facially plausible to read the term 'available' in section 612(c) as permitting consideration of 'economic or practicality' concerns."

Mexichem commented that the text of the proposed rule and the underlying docket, including the SNAP program's comparative risk framework, are vague on how EPA reached the required section 612(c) conclusion that the alternatives reduce overall risks to human health and the environment, leaving the impression that it considered only GWP. Specifically, they state that out of the seven documents that may be relevant to the comparative risk framework analysis, only the "Climate Benefits of the SNAP Program Status Change Rule" report refers to human health and the environment, with a focus on climate benefits, but that the report itself is silent on estimated reduction of "overall risks to human health." Mexichem also noted that EPA promised to prepare a consolidated analysis document in the proposed rule, but no such document was available at the time the comments were drafted. Mexichem further stated that an assessment of HFC-134a and related alternatives is missing, and that such an assessment should have included several specific questions related to the following factors: performance, availability, hazard, exposure, and cost of the alternatives. These questions include whether the other alternatives perform as well as HFC-134a in the specific end-use; whether the other alternatives will be available in the necessary quantities; whether the other alternatives present a better overall hazard profile; whether the other alternatives present a better overall exposure profile; whether use of the other alternatives involves an equivalent cost; and whether use of the other alternatives represents a cost-effective mitigation of CO_2 emissions in each end-use.

Bally Refrigerated Boxes, Inc. questioned whether the CAA authorizes EPA to delist non-ODS solely on the basis of GWP. Arkema commented that EPA is focusing on the potential hazard of GWP alone and stated that EPA is not evaluating HFC-134a within a comparative risk framework. Arkema stated that if the CAA were to authorize the SNAP program to "delist" previously approved non-ozone depleting substances based on climate, then EPA would need to develop an objective measure for deciding which substitute poses a greater risk and communicate that standard to the regulated community. Arkema claimed that any such measure would need to include methods for weighing different types of risks against one another (such as flammability versus climate) and for including mitigation, as the existing SNAP program, which did not originally provide for quantitative indexing of risks, does not convey sufficient information to the Agency or the regulated community regarding risk management decisions.

Response: EPA disagrees with the commenters' views regarding the Agency's consideration of overall risk. In this rule, we applied the same comparative risk framework that was established for the SNAP program in 1994 and that has been used successfully for over 20 years. When we issued the proposal, we did not re-open fundamental parts of the SNAP program, such as the factors we evaluate and the manner in which we weigh them. Under the SNAP regulations, proponents of a substitute are required to submit a wide array of information, including information on ODP, GWP, toxicity, environmental fate and transport, flammability, exposure data and the cost and availability of the substitute under review (see 40 CFR 82.178 for a full list of the information required with SNAP submissions). EPA reviews these data and applies the regulatory criteria adopted in 1994, which include, in addition to atmospheric effects, general population risks from ambient exposure to compounds with direct toxicity and to increased ground-level ozone, ecosystem risks, occupational risks, consumer risks, flammability,

and cost and availability of the substitute under review (see 40 CFR 82.180(a)(7)). As regards specific quantification of reductions in overall risk to human health and the environment, in the 1994 rulemaking, we considered and rejected comments suggesting that we develop an index to rank all substitutes based on risk. In the preamble to the rule, we specifically noted that "a strict quantitative index would not allow for sufficient flexibility in making appropriate risk management decisions" (59 FR 13,044, March 18, 1994). Our subsequent experience with the SNAP program has given us no reason to revisit this approach.

While EPA prepared a variety of documents in association with the proposed rule, the bulk of the comparison of human health and environmental impacts of alternatives appeared in the preamble to the NPRM.[100] For this final rule, we have added a technical support document to the docket which provides the *Federal Register* citations for information such as ODP, GWP, VOC status, flammability, and workplace exposure limits both for the substitutes remaining acceptable and for those with a changed status (EPA, 2015d). This information was discussed in the preambles to both the NRPM and the final rule and is provided in tabular format in the technical support document for easier comparison and consistency of presentation.

As stated in the NPRM, the documentation associated with the proposed rule includes "market characterizations, analyses of costs associated with sector transitions, estimated benefits associated with the transition to alternatives, and potential small business impacts" (79 FR 46,126). These documents provide information to the public about estimated environmental benefits, the affected markets, and potential cost impacts, as well as provide EPA's screening analyses to determine whether this rule may have significant economic impacts or significant

[100] EPA also placed in the docket a document on exposure limits for alternatives in the foam blowing sector, titled, "Information on workplace exposure limits for foam blowing agents."

impacts on a substantial number of small businesses; they are not part of EPA's comparison of human health and environmental effects of alternatives.

Mexichem noted in its comments that EPA had included these documents in the docket for the proposed rule, but raised a concern about the availability of the consolidated analysis document anticipated in the NPRM. The consolidated analysis is included in the docket for the final rule, but was not available during the public comment period (ICF, 2015a). This document is a consolidated sector-by-sector market characterization for those sectors addressed in this action. While it incorporates some suggestions and information provided by commenters, it otherwise does not add new substantive information other than that provided in the individual market characterizations at the time of the proposed rulemaking. It merely consolidates the information for ease of reference.

We disagree with the comments suggesting that EPA did not consider factors other than GWP. In the NPRM, for each end-use or sector, EPA provided information comparing the alternatives and applying the full set of regulatory criteria, not solely GWPs, in deciding whether to change the status of a listed substitute, consistent with SNAP's past practices. As one example, in discussing the change in status for HFC-227ea in the aerosol propellant end-use, the Agency explained in the preamble that other available substitutes have zero ODP, are relatively low in toxicity, are capable of remaining below their respective exposure limits, and are expected to have negligible impact on ground-level ozone levels (79 FR 46,126, 46,173). In each case, consistent with the decision criteria listed at 40 CFR 82.180(a)(7), EPA has considered environmental impacts, flammability, toxicity, and exposure. In the context of this review, we considered a large amount of information including, among other things: scientific findings, information provided by the Technology and Economic Assessment Panel (TEAP) that supports

the Montreal Protocol, journal articles, submissions to the SNAP program, dockets for other EPA rulemakings, presentations and reports presented at domestic and international conferences, and materials from trade associations and professional organizations. References cited in the NPRM were listed in section IX of that document and the references cited in this final action are listed in section IX of this document.

Solvay suggested a number of considerations they believe should have been included as part of EPA's decision-making criteria, such as various standards and codes, product shelf-life, and equipment limits. Solvay does not discuss how the various considerations mentioned relate to the existing SNAP review process. In general, we took such considerations into account to the extent relevant to the criteria for review of a substitute or to the availability of other alternatives. For example, we considered such issues as the supply and characteristics of alternatives as well as the status of various regulations and codes and standards as they relate to the availability of the alternatives and thus the appropriate time for the change of status. EPA specifically mentioned building codes (*id.* at 46,143) and energy efficiency and requested comment on "the effect, if any, [the] proposal would have on meeting applicable DOE standards." (*id.* at 46,147). We also noted that plans for the production of an alternative to HFC-134a in the MVAC end-use "are in place to make it available in volumes that meet current and projected domestic auto industry demand."(*id.* at 46,141)

We also addressed certain of these issues in the context of the potential mitigation of risks both for those substitutes subject to the status change and those that remain available. For example, we noted in the preamble to the NPRM, in the context of alternatives in several of the foams end-uses, that flammability issues would be addressed in the process of meeting OSHA regulations and fire codes (*id.* at 46,152, 46,153); and in the context of the retail food

refrigeration and vending machine end-uses, that exposure limits for the alternatives, including workplace exposure limits of the AIHA and from OSHA and NIOSH, would be met. (*id.* at 46,144). Concerning other technical concerns such as solubility, compatibility, and shelf stability, this is not information that the SNAP program has routinely requested or received, either for the substitutes used for comparison purposes or for those being evaluated for listing. We have recognized, and when warranted, made changes responding to such technical considerations in this final rule where commenters provided information relevant to the availability of alternatives: for example, in establishing the change of status date for stand-alone refrigeration equipment, we took into consideration that certain larger capacity commercial stand-alone refrigeration equipment requires charge sizes larger than those established in the use conditions for most flammable refrigerants.

Similarly, Mexichem suggested that EPA was required to evaluate specific questions regarding performance, availability, hazard, exposure, and cost. Again, this ignores the established criteria that EPA uses in determining whether a substitute is acceptable or unacceptable in a specified end-use. In the NPRM, in determining whether other substitutes were available that posed lower risk than those for which we proposed to change the status, EPA evaluated the ozone-depletion, climate, local air quality, toxicity and flammability risks of the substitutes undergoing a change of status as well as of other alternatives, thereby addressing hazard and exposure concerns. We note that the statute refers to *overall* risk to human health and the environment, and does not require that the substitutes be better in terms of each potential human health and environmental concern. EPA does not typically compare the performance or efficacy of substitutes except in considering whether a substitute is technically feasible (see definition of “potentially available” at 40 CFR 82.172). In other

words, it is not necessary for EPA to evaluate whether other alternatives perform as well as HFC-134a (or other HFCs) in the specific end–use in order to determine that overall risks to human health and the environment would be reduced through use of those alternatives.

We have considered whether other alternatives will be available in sufficient quantities as part of our analysis of the availability of alternatives. As discussed in the NPRM, we set dates for the proposed status changes that reflect when there will be a sufficient supply of the alternatives. (*id.* at 46,141) In some instances, we have revised those dates in this final action after taking into account information on supply of alternatives submitted by commenters.

One of the regulatory criteria for review of a substitute is the "cost and availability of the substitute" (59 FR 13,044, Mar. 18, 1994; 40 CFR 82.180(7)(vii)). The consideration of cost under this criterion is limited to the cost of the substitute under review; it is distinct from consideration of costs associated with the use of other alternatives to which the substitute is being compared. *See Honeywell*, 374 F.3d at 1,378 (J. Rogers, concurring in part and dissenting in part) ("While the SNAP regulations make the 'cost and availability of the substitute' an element of acceptability . . . that concern is limited to whether EPA 'has . . . reason to prohibit its use,' not to whether cleaner alternatives for the substance are already 'currently or potentially available'. . . . Consideration of transition costs is thus precluded by the SNAP regulations as currently written, irrespective of whether it might be permitted under CAA § 612(c) . . . .") Contrary to Solvay's contention, including the cost of the substitute in the list of review criteria does not amount to an acknowledgment that the term "practicable" as used in section 612(a) necessarily involves consideration of the costs associated with using other alternatives. EPA has not determined whether the term "practicable," the term "available," or other terms in section 612 provide discretion to consider such costs. Similarly, our existing regulations do not direct us

to consider whether use of the other alternatives involves an equivalent cost to that of HFC-134a or a cost-effective mitigation of CO_2 emissions. We are not addressing in this rulemaking whether to revise the regulatory criteria to include an expanded role for the consideration of costs in SNAP listing decisions. We have simply applied the existing regulatory criteria in determining whether to change the listing status of the substitutes addressed in this action. Thus, we have not considered the costs of transition to other alternatives.

Several commenters suggested or implied that EPA's action was based "excessively" or solely on GWP. As discussed above, we performed a full comparative risk analysis for each of the substitutes and for each end-use for which we are changing the status. However, as noted in the preamble to the NPRM, EPA issued this proposal in response to the CAP. As such, in determining which substitutes and end-uses to address in the proposed rule, we evaluated the existing listing decisions in the eight sectors covered by the SNAP program. In three of the sectors, we identified a subset of substitutes that have a high GWP relative to other listed alternatives and for which we also had reason to believe other alternatives were "available" for the end-use. For those substitutes included in the proposed rule on the basis of having a relatively higher GWP, in most cases, EPA did not find significant potential differences in risk with respect to the other criteria, with the exceptions of flammability and local air quality impacts. However, where flammability risk was a potential concern, we concluded that such risk is mitigated by the existing use conditions or through other existing regulations (e.g., OSHA). In the case of spray foam, we proposed to change the status of fewer HFCs than in other foam blowing end-uses in consideration of greater flammability risks in that end-use. Regarding VOC emissions and potential impacts on local air quality, for the aerosol propellant end-use, we did not propose to change the status of HFC-152a, a VOC-exempt aerosol propellant.

B. Cost and economic impacts of proposed status changes

EPA received a number of comments on the cost and economic impacts of the proposed rule. Some of these comments are summarized in the response to comments sections for the end-uses addressed in this final rule. We summarize and respond to the more general cost comments below.

1. Costs of proposed rule

Comment: EPA received several comments indicating that the commenters believe EPA should provide more time in order to avoid undue burden on the U.S. economy. NAFEM comments that if this rule is finalized as proposed, the change from using R-404A will be very costly. NAFEM stated that compliance cost estimates range from $500,000 to several million dollars depending on the number and variety of custom products the manufacturer offers. They further comment that testing costs are routinely several hundred thousand dollars and increase with the variety and level of customization. NAFEM comments that in addition, manufacturers will lose revenues waiting for the limited number of testing facilities able to accommodate the industry's products. The Alliance for Responsible Atmospheric Policy (the Alliance) requests that greater weight be given to economic considerations where the Agency is determining dates for availability of new alternatives, or changing the listing status, which unlike SNAP listing, may require businesses to alter practices and business models. The Alliance also requests that these economic considerations also be undertaken cognizant of competing regulatory initiatives. The Alliance also comments that the SNAP change of status process should be used sparingly, since its economic implications should require a higher scrutiny in considering transition dates and market assumptions than is needed for the SNAP listing approval process. DuPont comments that it is important to reduce emissions in a way that does not slow down global trade, and to

achieve emissions reductions in a cost-effective manner. Arkema comments that no SNAP rule should impose unreasonable burdens on the U.S. economy. Arkema believes that EPA must allow more time for transitions to avoid that outcome. Mexichem believes EPA failed to take into account the economic implications of the proposed rule.

Response: As discussed more fully in section VII.A.7, under the SNAP criteria for review in 40 CFR 82.180(a)(7), the only cost information that EPA considers as part of its SNAP reviewof substitutes is the cost of the substitute under review. The transition timelines in this final rule are based on information concerning the availability of alternatives.

Comment: Arkema commented that EPA underestimated the costs of the NPRM. Arkema believes EPA's cost estimates are unduly optimistic given all that must be done to redesign equipment. Arkema further commented on three areas of economic analysis that they state need to be addressed. First, Arkema stated that EPA does not include the "wasted costs" incurred by those manufacturers that have actually changed designs of their equipment to meet DOE standards, based on the continued availability of existing SNAP substitutes, but that now may need to change their designs again. Second, Arkema suggested that EPA should account for "economic effects" on U.S. plants that produce HFC-134a and the other HFCs and HFC blends whose listing the Agency proposed to change. Third, Arkema suggested that the economic analyses should disclose how EPA expects prices and availability to change once it eliminates competing products, including stimulation of short-term demand for the HFCs and HFC blends whose listing the Agency proposed to change, longer term increases in prices for the HFCs and HFC blends, and increased demand for next-generation fluorinated products. Solvay commented that given the cumulative regulatory burden, EPA has dramatically underestimated the costs of the NPRM. As an example, Solvay pointed to the DOE energy conservation standards.

Response: Although EPA did not consider the costs of transitioning to other alternatives in making the listing decisions in this rulemaking, we did prepare a cost analysis and a small business impacts analysis for this rule for businesses that are directly regulated.

We do not typically analyze cumulative regulatory burden in our cost analyses. Nonetheless, EPA notes that to the extent that affected entities recently incurred costs to comply with DOE rulemakings, the change of status dates in the final rule for the foam blowing sector and for some of the refrigeration end-uses (e.g., vending machines) may reduce the potential for additional costs due to complying with both rules compared to the change of status dates in the NPRM, since equipment manufacturers should better be able to coordinate DOE's requirements and these SNAP requirements. For example, the change of status date for rigid PU appliance foam is January 1, 2020, while based on the 2014 compliance date of the most recent DOE standards, the compliance date for any revised energy conservation standard for household refrigerators and freezers would be no earlier than 2020. For vending machines, the final change of status date is January 1, 2019, which will likely coincide with compliance requirements for any new or amended DOE refrigerated beverage vending machine standards, as compliance with such standards would be required three years after the publication of a final rule. Material in the docket for that action indicate DOE's plans for a final rule with a compliance date three years later (see EERE-2013-BT-STD-0022).

Second, EPA has analyzed the costs of users that are directly regulated and has not analyzed the impacts on chemical producers, which are indirectly affected by the regulation. The commenters did not provide specific cost or supply information regarding redesigning equipment or specific information on operating costs for chemical plants that would have allowed us to analyze the impacts as requested by Arkema. We disagree with Arkema that it is necessary or

appropriate to analyze the indirect impacts upon chemical plants and producers. Such analysis would be highly speculative about the degree of cost pass-through from producers to consumers of these chemicals. The total cost estimates would be unchanged; rather such an analysis would relate to transfers between producers of the substitutes undergoing a change of status, producers of the acceptable alternatives for the same uses, and consumers of these products rather than losses to the economy or to a market sector as a whole. We note that the transition affecting the majority of HFC-134a production, the transition away from HFC-134a in MVAC, is already occurring because of other regulations, and therefore changes to production and cost of HFC-134a cannot easily be attributed to this action.

EPA recognizes that transitioning to other alternatives is likely to require capital costs and investments in research, updated equipment, and their related financial impacts. Many chemical producers have either submitted SNAP notifications or expressed interest in submitting SNAP notifications concerning new molecules and blends of existing molecules. EPA agrees with Arkema that this rule is likely to stimulate demand in next-generation alternatives further.

EPA also notes that, for example, HFC-134a likely will be a component of many low-GWP blends that are being developed specifically to replace HFC-134a. EPA listed as acceptable one of those blends, R-450A, on October 21, 2014 at 79 FR 62,863. The Agency is aware of additional blends that multiple chemical producers are developing. As noted throughout this document, the range of alternatives includes new molecules and existing compounds, encompassing fluorinated, non-fluorinated and in some cases not-in-kind alternatives.

Third, we question Arkema's assumption that competition will decrease and thus cost for low-GWP alternatives will rise. For each of the status changes in this final action, more than one other alternative is currently listed as acceptable or acceptable, subject to use conditions, for the

relevant end-use. Moreover, we expect new SNAP submissions that would result in the introduction of further alternatives to increase, rather than reduce, competition. Further, because this rule does not regulate production of individual chemicals directly and allows servicing of existing refrigeration and AC equipment with the refrigerants for which they are designed, we expect there will continue to be a market for HFC-134a and other HFC refrigerants for years to come.

In those cases where commenters provided specific, detailed cost information, we used that information to revise the cost assumptions in our updated cost analysis for this final rule. For additional information on economic analysis conducted for this rule, see the supporting document "Revised Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives" (ICF, 2015c).

Comment: NRDC and IGSD commented that the rule is important because it provides a needed signal to various industrial sectors that as safer alternatives are brought to market, substitutes with high GWPs will be removed from the SNAP list. NRDC and IGSD commented that this provides American companies with an opportunity to become industry leaders as the global market moves away from high-GWP substances, by developing new chemicals and processes to transition the refrigeration, cooling, aerosol and foams markets as quickly as possible. NRDC further commented that this rule will establish U.S. industry as a leader in safer chemicals, helping pave the way for global action under the Montreal Protocol. NRDC noted that when EPA previously proposed phasing down CFCs and ODS, there were warnings about dire impacts on industry that did not come to pass, and NRDC expects this will be true for this rule as well. NRDC commented that 25 years of experience with the Montreal Protocol and the CAA has shown us that transitioning to safer chemicals works smoothly.

Response: EPA appreciates this comment and agrees that there are many innovative U.S. companies bringing new low-GWP, energy-efficient products to market.

2. EPA's cost analysis and small business impacts screening analysis

Comment: EPA received a number of comments indicating that small businesses bear a disproportionate share of the regulatory burden and that the NPRM represents a "significant regulatory action," NAFEM comments that EPA must conduct a complete analysis of the impacts on small entities before any final regulation can be promulgated. NAFEM comments that EPA's analysis is too narrow, is incomplete, and that its conclusions are unsupported. NAFEM further comments that the NPRM disproportionately affects small entities. NAFEM comments that the NPRM represents a major rule and will have a $100 million effect on the economy and a major impact on the commercial refrigeration industry and its consumers. NAFEM commented that the docket lacks a robust industry analysis of the effects on small business manufacturers and customers, or reasonable support for EPA's Regulatory Flexibility Act conclusions. NAFEM recommends that EPA initiate a Small Business Regulatory Enforcement Fairness Act (SBREFA) Small Entity Representative review panel to help inform final rulemaking, as required by the Regulatory Flexibility Act. Solvay also commented that EPA should convene a Small Business Advocacy Review Panel under the SBREFA.

Response: E.O. 12866 states that rules that have an impact on the economy of $100 million per year qualify as significant regulatory actions. EPA disagrees that this rule would have an impact on the economy of $100 million more per year. We performed an analysis of the costs of the proposed rule on businesses and estimated the total annualized upfront compliance costs to range from $8.9 million to $41.6 million; total annual savings are estimated to be about $25.1 million (ICF, 2014g). This cost analysis did not evaluate the share of costs likely to be borne by

consumers, since it is not clear what proportion of cost impacts may be carried on to consumers, and further, such economic analyses typically look at costs to the regulated community rather than indirect impacts on consumers. We updated this analysis based upon the regulatory options and change of status dates in the final rule, and using cost information provided by commenters. The changes in the final rule—especially with respect to compliance dates—reduce the cost impacts on small businesses, while the updated cost information resulted in higher cost estimates. In this updated analysis, we estimated the total annualized upfront compliance costs to range from $28.0 million to $50.6 million, using a 7% discount rate, and from $19.5 million to $37.8 million, using a 3% discount rate. Total annual savings are estimated to be about $19.3 million (ICF, 2015c). In either case, this is well below the $100 million per year threshold to consider this an economically significant rule on economic grounds.

EPA disagrees with the commenter that the "docket lacks a robust industry analysis on the effects on small business manufacturers and customers, or reasonable support for EPA's Regulatory Flexibility Act conclusions." The Agency's screening analysis at proposal stage is included in the docket (ICF, 2014f). The commenters do not point to any specific aspect of that analysis that they believe are deficient. A Small Business Advocacy Panel is convened when a proposed rulemaking is expected to have a significant impact on a substantial number of small entities, or "SISNOSE." We have updated our small business impacts screening analysis using the change of status decisions and dates in the final rule, adding boat manufacturers as affected entities, and using detailed cost information provided by commenters (ICF, 2015b). EPA's preliminary and final screening analyses concluded that this rulemaking would not pose a SISNOSE. In the analyses, EPA recognized that some small businesses may experience

significant costs, but concluded that the number of small businesses that would experience significant costs was not substantial.

Both the screening analysis for purposes of determining whether there was a SISNOSE and the analysis to determine whether the rule was significant based upon economic grounds were conducted based on the best market and cost information available to the Agency. Where commenters provided specific market or cost information, the Agency used that information to update these analyses. The updated analyses came to the same conclusions: that the final rule would not pose a SISNOSE and that it is not an economically significant rule (ICF, 2015b,c).

C. Environmental effects of proposed status changes

EPA received submissions from 42 commenters related to the environmental impacts of the proposed status changes. Additionally, EPA received 7,022 mass mailing letters commenting on the importance of transitioning away from HFCs to more climate-friendly alternatives. Ten commenters referred to the CAP.

1. General comments

Comment: EPA received over 7,000 substantially identical comments regarding the climate impacts of HFCs and supporting action to address the growth in usage of these potent greenhouse gases. The commenters also stated that that the rest of the world, including Europe and Japan, is taking action to reduce HFC emissions, so the United States should also transition away from HFCs to protect the planet from the catastrophic impacts of climate change. They also stated that it is of the utmost importance to limit “super-potent” greenhouse gases from use in refrigerators, air conditioners, aerosols and foams and substitute them with safer, more climate-friendly alternatives. They also noted that some HFCs remain in the atmosphere for decades or even centuries after they are released, so that they have a strong cumulative effect. NRDC stated

that if EPA were only considering human health risks, HFCs should be banned immediately given the climate risks. NRDC commented that we know these chemicals are extremely potent agents of climate change, and we know that continuing to use them only exacerbates the climate problem. EIA requested that EPA continue to remove high GWP HFCs from the lists of acceptable substitutes, given that HFC emissions are set to double by 2020 and triple by 2030, and given that this rule has the potential to reduce 42 $MMTCO_2eq$ by 2020. EIA urged EPA to address all sectors covered in the SNAP program, given the needs of climate and the existence of climate-friendly alternatives. DuPont commented that they acknowledge the environmental need to avoid future growth in GHG emissions, and have thus developed low-GWP, energy efficient products.

Response: The Agency appreciates the support of actions to list change the status of certain HFCs. Other actions urged by the commenters are outside the scope of this rulemaking.

2. EPA's benefits analysis

Comment: EPA received a number of comments regarding the importance, significance, and magnitude of the environmental benefits of avoided HFC emissions that would result based on the proposed rule.

CARB comments the current regulations and the SNAP proposal meet only half of the 80% reduction necessary for the HFC sector if California is to meet its overall GHG reduction goal contained in California Executive Order (EO) S-3-05 (2005). Therefore, CARB believes additional HFC reductions are required to reduce this fastest-growing source of GHGs.

NRDC and IGSD comment that even though HFCs may currently make up a small piece of global climate emissions, their projected rapid growth underscores the urgent need to replace these chemicals with lower-GWP alternatives. Further, NRDC and IGSD comment that without

stringent rules in place, HFC emissions increases could counteract the progress EPA is striving to make in other sectors to reduce carbon pollution.

Response: EPA appreciates the support for reducing GHG emissions, and appreciates the estimates of the benefits in terms of $MMTCO_2eq$ that the commenters provide. CARB's comment concerning meeting GHG reduction goals in a California EO are beyond the scope of this rule; we may consider additional status changes in a future rule. We agree with NRDC and IGSD that HFC emissions are growing rapidly and that it is timely to act now to encourage use of lower-GWP alternatives and ensure continuing progress. The Agency notes that both EPA's estimates cited in the NPRM and the estimates the commenters provide are based on the provisions of the proposed rule, and that the benefits from this final rule differ. For further information, see EPA, 2014 and EPA, 2015b.

Comment: Arkema comments that at this time, it is not possible to provide a more detailed critique of the Vintaging Model's assumptions and the levels of sector emissions given the lack of meaningful information in the docket. Arkema comments that the docket does not provide all the model inputs, nor does EPA disclose the specific emission factors that it used to derive its estimates, how recent those estimates are, and how they are expected to change over time. Arkema comments that EPA's benefits analysis nowhere details the extent of the uncertainties in its emissions estimates, even though the record elsewhere acknowledges that such emissions estimates may be unreliable.

Response: As an initial matter, EPA did not rely on the Vintaging Model in reaching decisions about whether other alternatives present lower overall risk. Nor did EPA otherwise rely on the benefits analysis that accompanied the proposed rule. We estimated emissions reductions resulting from this rulemaking in order to provide information to the public. Consistent with

section 612(c) of the CAA, EPA relied on the criteria for review specified in the SNAP regulations at 40 CFR 82.180(a)(7) in determining whether the substitutes for which we proposed to change the status presented greater risk to human health and the environment than other available alternatives.

As part of the process for listing alternatives, EPA evaluates information concerning a substitute according to the criteria in EPA's regulations at 82.180(a)(7)(e.g., atmospheric effects, ecosystem risks, occupational and consumer risks, availability) in comparison with other available substitutes for the same end-uses. At the time of review, we prepare a risk screen and place it in the relevant public docket for our listing decisions. It is rare for risk screens to include information from the Vintaging Model, although such information may be used in some cases to estimate emissions (e.g., VOC emissions from an end-use where the submitter has provided insufficient information). The preambles to this final rule and the NPRM include information summarizing the comparisons to other alternatives. In addition, we also have docketed a document which provides the *Federal Register* citations for the information on the health and environmental characteristics of various alternatives in the end-uses covered in this final rule (EPA, 2015d).

See the next response for further information about where one can find information on the modeling assumptions and methodology.

Comment: Arkema commented that in order to calculate HFC sector emission savings, the Vintaging Model needs to be revised since it is over-estimating chemical demand. Arkema also commented that the basis and methodology for the Vintaging Model's emissions estimates are unclear, but a comparison to publicly available information should have raised red flags because a steady growth rate of HFC emissions in the U.S. is extremely unlikely for at least three

of the four covered sectors (i.e., MVAC, aerosols, and foams). For MVAC, Arkema comments that refrigerant charge sizes have been dropping, and new cars will be transitioning to low-GWP alternatives over time. Arkema notes that for aerosols, a significant portion of the aerosol product manufacturing industry has already transitioned out of the HFCs proposed for regulation. In addition, Arkema points out that UNEP's 2014 TEAP report shows that hydrocarbon technologies already dominate the foam sector.

Response: EPA's Vintaging Model has been explained annually in the *Inventory of U.S. Greenhouse Gases and Sinks*[101] report and other places. For example, the 2015 annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks* report, EPA Report 430-R-15-004 (EPA, 2015c), covers emissions, including emissions of HFCs used as ODS alternatives, for the years 1990 through 2013 and provides in detail the basis and methodologies used. The commenter is misinformed with respect to the assumptions used in the model. Specifically, the model does assume that MVAC refrigerant charge sizes have dropped over time, and it utilizes detailed sector information to calculate such changes. In addition, it does assume that a significant portion of the aerosol product manufacturing industry has transitioned out of HFCs. Although the cited 2014 TEAP report—which the commenter states indicates hydrocarbon technologies dominate the foam sector—applies globally rather than specifically to the United States, EPA notes that its Vintaging Model does specifically assume that significant transition in the foam industry to non-ozone-depleting, low-GWP substances, including hydrocarbons, has occurred.

Comment: Arkema comments that as far as they are aware, EPA has never submitted its Vintaging Model for external peer review. Arkema comments that the Vintaging Model qualifies under the Agency's Peer Review Handbook as "influential scientific information" for which

[101] Available online at *www.epa.gov/climatechange/ghgemissions/usinventoryreport/2014.html*

external peer review is warranted. Arkema believes that the underlying data has been kept a secret. Arkema comments that EPA's NPRM is not consistent with Administrator McCarthy's three pillars of EPA's scientific conclusions: transparency, rigorous peer review, and robust, meaningful public comment. Arkema comments that EPA cannot obtain robust, meaningful comments if the Vintaging Model is not subject to peer review and if underlying data is kept secret.

Response: As explained above, EPA used its Vintaging Model to provide information to the public, but does not rely on that information to support today's rule. Thus, the issue of whether the Vintaging Model should be subject to a peer review process is outside the scope of this rulemaking action.

3. Energy efficiency

Comment: EPA received a number of comments regarding energy efficiency and LCCP of refrigeration equipment. NAFEM commented that the life-cycle climate performances of manufacturers show that only about 10% of the environmental impact is due to a combination of refrigerant leak, charge amount and GWP of the refrigerant; the rest relates to energy efficiency. NAFEM asserted that the proposed SNAP rule does not account for nor can EPA claim any significant environmental benefits to offset significant costs. The Alliance noted that given the important energy efficiency consequences of this proposed rule, it is unclear how this action will meet the statutory standard of no greater risk to human health and the environment. The Alliance commented that by taking previously acceptable substitutes off the market, these proposals could result in less efficiency in the near term. The Alliance further comments as EPA evaluates the timing of transitions in various end-use segments, it is important that life cycle greenhouse gas

emissions, including those associated with energy use, are given proper consideration as part of ensuring the alternative presents "no greater risk to human health and the environment."

Response: EPA provided estimates of the climate benefits associated with the NPRM, and we have also estimated the climate benefits associated with this final rule (EPA, 2014; EPA, 2015b). These estimates are based on avoided direct HFC emissions. They are distinct from our evaluation of whether other alternatives are currently or potentially available that present less overall risk to human health and the environment. EPA does not have a practice in the SNAP program of including indirect climate impacts or energy efficiency in the overall risk analysis. We do consider issues such as technical needs for energy efficiency (e.g., to meet DOE standards) in determining whether alternatives are "available." Elsewhere in this final action, EPA addressed and responded to comments concerning energy efficiency (see in particular sections V.C.3.c, V.C.4.c, V.C.7 and V.D.3.c). EPA notes that the refrigerant is only one of many factors affecting energy efficiency. Moreover, even as refrigerant transitions have taken place over past decades, we have seen improved energy efficiency. This is often due to equipment redesigns and technology advancements that include factors besides the choice of refrigerant. EPA notes that a number of models are already commercially available that do not use the refrigerants subject to a change of status in this final rule and also meet or exceed the relevant energy conservation standards and thus reduce both direct and indirect climate impacts.

4. The Climate Action Plan

Comment: EPA received six comments commending the EPA for quickly proposing a rule to achieve the goals in the President's CAP.

Response: EPA appreciates the support from this wide variety of interested stakeholders on addressing the goals in the President's CAP.

Comment: EPA received two comments questioning whether the President's CAP provides authority to regulate HFCs.

Response: Section 612 of the CAA, not the CAP, provides the authority for this action. CAA section 612(c) requires EPA to list a substitute as unacceptable if other available alternatives pose lower risk to human health and the environment.

Comment: Two comments stated that EPA's response to the President's CAP in the NPRM did not consider full ramifications of the challenges to industry.

Response: The NPRM proposed changes to listings based on the information the Agency had at the time of the proposal. We requested comments to further our understanding of any potential challenges relating to technical feasibility or supply. We considered that additional information as we developed the final rule.

D. Potential exemptions

Comment: EIA commented on potential exemptions, specifically the need for a mechanism to petition for an essential use exemption or for more time with a valid basis. The commenter recognized that the potential for the misuse of such a mechanism could overwhelm the resources of the EPA available for this transition. As a result, EIA recommended that EPA grant no blanket exemptions or delays due to the needs of one or a few sectors but that EPA establish an exemption mechanism with a penalty clause to avoid misuse.

Response: The SNAP regulations do not currently contain an across-the-board mechanism for petitioning for an exemption, and EPA did not propose such a mechanism in the NPRM. To make such a change in our regulations, we would first need to provide an opportunity for public comments. In some instances in the final rule EPA has changed a listing to acceptable, subject to narrowed use limits. The narrowed use limits identify a narrow part of the end-use in

which an end user could use an otherwise unacceptable substitute if they can support that no other acceptable substitutes are available for their specific application.

E. Interactions with other rules

Comment: The Alliance, AHAM, AHRI, and a number of other commenters in the commercial refrigeration and home appliance industries expressed concern about the feasibility of using other alternatives to meet DOE energy conservation standards. AHRI and Coca-Cola stated that DOE's federal minimum energy conservation standards are based on refrigerants and foam blowing agents that EPA is now proposing to list as unacceptable. NAFEM comments that manufacturers are now finding that developing a product to meet both the energy conservation standards and also utilizes acceptable alternative refrigerants and blowing agents is daunting if not impossible. Commenters pointed out that they have redesigned products to meet DOE energy conservation standards due to take effect in 2017. See section V.C.1.b for a discussion of DOE energy conservation standards that apply to the equipment affected by this rule.

Response: Given that today's rule contains later deadlines than proposed, as well as a phased-in approach with different status change dates for different kinds of equipment as suggested by many commenters, this should address commenters' concern about meeting both sets of requirements.[102] EPA continues to coordinate with DOE as EPA reviews alternative refrigerants and foam blowing agents, DOE tests energy efficiency of certain alternative refrigerants, and the two agencies discuss each other's rulemakings in development. EPA sees

[102] If a manufacturer believes that its design is subjected to undue hardship by DOE's regulations, the manufacturer may petition DOE's Office of Hearing and Appeals (OHA) for exception relief or exemption from the standard pursuant to OHA's authority under section 504 of the DOE Organization Act (42 U.S.C. 7194), as implemented at subpart B of 10 CFR part 1003. OHA has the authority to grant such relief on a case-by-case basis if it determines that a manufacturer has demonstrated that meeting the standard would cause hardship, inequity, or unfair distribution of burdens.

the redesign of products as an integral part of business operations, and believes redesigning equipment to use refrigerants that pose a lower overall risk to human health and the environment is in many ways similar to past redesigns. We believe that manufacturers can incorporate lower-GWP refrigerants in stand-alone retail food refrigeration equipment and remote condensing units while designing for DOE energy conservation standards for commercial refrigeration equipment and for walk-in coolers and freezers, both of which have compliance dates in 2017, and can incorporate lower-GWP foam blowing agents while designing for DOE standards for household refrigerators/freezers. Based on the 2014 compliance date of the most recent DOE standards for residential refrigerators and freezers, the compliance date for any revised energy conservation standard for household refrigerators and freezers would be no earlier than 2020. As discussed in the previous and following responses and in sections V.C.7 and V.D.3.c) as well as other sections of this preamble, there are both refrigerants and foam blowing agents with lower GWPs available that allow for improved energy efficiency compared to the substitutes we are finding unacceptable in this rule. EPA anticipates that innovative companies will seize this opportunity to develop more efficient and profitable designs.

Comment: A number of manufacturers of commercial refrigeration products commented on the relative energy efficiency of alternative refrigerants, compared to the refrigerants proposed to be unacceptable. Lennox commented that the substitution of R-407 family refrigerants in place of R-404A and R-507A will negatively affect the efficiency performance of refrigeration equipment for walk-in coolers and freezers. Structural Concepts stated that switching from R-404A to R-744, and consequently switching to thicker piping and new compressors, would increase energy usage overall by 45%, which would cause the unit to exceed the allowable energy level determined by the DOE. AMS commented that after studying the

suitability of the acceptable (R-744) and proposed acceptable (R-290, R-600a and R-441A) alternatives extensively, it concluded that only R-290 will allow it to meet DOE energy conservation mandates. NAMA stated that because of DOE requirements, CO_2's use would be limited to indoor self-contained units, limiting locations of refrigerated vending machines, reducing revenues for the entire supply chain and reducing consumer choice. Information in the Agency's possession describes a manufacturer's testing of the energy efficiency of condensing units with R-404A compared to R-407A, finding that the energy efficiency was typically higher with R-407A in medium-temperature equipment but was typically lower with R-407A in low-temperature equipment (EPA-HQ-OAR-2014-1098-0184). Structural Concepts comments that R-744 is not flammable, but it is less energy efficient than the acceptable, flammable refrigerant propane, and to meet the EPA proposed regulation would likely mean they fail to meet DOE regulations or go out of business trying to meet them.

Response: EPA expects that no single refrigerant will improve energy efficiency compared to the unacceptable refrigerants in every type of equipment or in every situation. For example, the information regarding a manufacturer's test results indicates that R-407A may provide improved energy efficiency compared to R-404A for medium-temperature refrigeration equipment (refrigerators), but not necessarily for low-temperature refrigeration equipment (freezers); this information indicates that Lenox's comment about lower energy efficiency of R-407A compared to R-404A or R-507A may be correct for low-temperature equipment and incorrect for medium-temperature equipment. We agree with the commenters who noted that R-744 may be more energy efficient in locations with lower ambient temperatures and thus may be more suitable for use indoors than outdoors. R-290 may provide better energy efficiency than HFC refrigerants in many situations, but not necessarily all, and not all end users will want to use

a flammable refrigerant. In response to the comment from Structural Concepts expressing concern about the ability to meeting energy conservation standards using CO_2 and the cost of using propane, we note that there are additional refrigerant choices available for stand-alone refrigeration equipment and vending machines besides CO_2 and hydrocarbon refrigerants, such as the nonflammable refrigerants R-448A, R-449A, R-450A and R-513A. As discussed in section V.C.7, these blends may show improved energy efficiency over HFC-134a and R-404A. In addition, design and operation of refrigeration equipment affects energy efficiency and not just the refrigerant used. Given the variety of currently or potentially available alternatives, EPA believes it is unlikely that manufacturers will have to use refrigerants that will result in reduced energy efficiency compared to the refrigerants being listed as unacceptable or otherwise restricted in this final rule, and we expect that manufacturers will be able to meet DOE energy conservation standards with the remaining available alternatives.

Comment: Some manufacturers of commercial refrigeration products commented on how design changes needed to accommodate alternative refrigerants may negatively affect energy efficiency. Parker Hannifin stated that most of the alternatives result in higher discharge temperatures and that some of the discharge temperature control methods employed negatively affect system efficiency. Nor-Lake and Structural Concepts indicated that they expected to need dual compressor systems, and stated that the increased energy usage of the dual system may outweigh the environmental gains of using the alternate lower-GWP refrigerant.

Response: EPA agrees that some design changes could have negative impacts on energy efficiency if they were done without broader considerations for the overall performance of the appliance. As stated elsewhere, many models that comply with DOE energy conservation standards are already commercially available that do not use the refrigerants subject to a change

of status in this final rule. We agree with Nor-Lake and Structural Concepts that dual compressor systems are more likely needed for larger equipment, particularly larger equipment using hydrocarbon refrigerants which have use limits restricting the refrigerant charge in a single refrigeration circuit. Recent listings of additional nonflammable refrigerants (e.g., R-450A) allow for additional options that would not require dual compressors. In response to Parker Hannifin's comment about discharge temperatures, we note that producers of some alternative refrigerant blends under review by the SNAP program claim that these new blends have operating properties similar to those of HFC refrigerants, such as similar operating pressures and discharge temperatures.

Given the variety of currently or potentially available alternatives, EPA believes it is unlikely that manufacturers will have to use refrigerants that will result in reduced energy efficiency compared to the refrigerants being listed unacceptable in this final rule.

Comment: The Alliance, AHAM, AHRI, and a number of other commenters in the commercial refrigeration and home appliance industries suggested that the SNAP rulemaking schedule should be better coordinated with the ongoing DOE energy conservation standard rulemaking schedules. AHAM comments that firms have invested millions of dollars to meet new DOE conservation standards that were based on the assumption of the availability of HFCs, and have diverted the scarce capital that is available for regulation-driven investment. The National Association of Manufacturers (NAM) requested that the EPA harmonize the rule with the DOE rule in order to ease the capital- and design-intensive manufacturer transition. Scotsman Ice Systems and Whirlpool Corporation stated that as a result of the potential regulatory measures, their ability to develop any customer focused products or new product features during this time will be constrained. GE Appliances notes that the burden of overlapping regulatory

requirements between SNAP and the DOE require consideration and review under the executive orders issued by President Obama and his predecessors that require consideration of cumulative regulatory burden.

Response: EPA's timeframes are based upon our understanding of the availability of alternatives, considering technical challenges and supply. The timeframes in this final rule take into account additional information on availability provided to the Agency during the comment period. These timeframes account for the time needed to meet the technical challenge of designing equipment using alternative refrigerants that can meet the DOE requirements. We note that EPA and DOE coordinate to the extent possible. For example, each agency has reviewed the other's rules. The list of acceptable SNAP alternatives is evolving. EPA is also coordinating with DOE to ensure more alternative refrigerants are being tested for energy efficiency. We recognize that as manufacturers focus on designing equipment to meet the DOE standards and to use refrigerants acceptable under the SNAP program, they may need to divert design resources from other projects for that period of time. However, as provided in section VII.A.7, this type of transition cost is not a part of the SNAP review criteria. As explained in the Statutory and Executive Order sections at the end of the NPRM and of this final rule, EPA has complied with those requirements.

Comment: The National Restaurant Association (NRA) comments that the food industry is already being affected by the EPA's rule *Listing of Substitutes for Refrigeration and Air Conditioning and Revision of the Venting Prohibition for Certain Refrigerant Substitutes*. NRA believes the EPA should consider the impacts of the cumulative regulatory burden of rulemakings and standards imposed nearly simultaneously on manufacturers of this equipment in the final rulemaking.

Response: The rule entitled "*Listing of Substitutes for Refrigeration and Air Conditioning and Revision of the Venting Prohibition for Certain Refrigerant Substitutes*" lists additional substitutes as acceptable, subject to use conditions. It does not mandate use of the newly listed substitutes. Thus, it is unclear how it might result in cumulative regulatory burden together with this rule. Equipment designed using the refrigerants in that rule is not affected by this rule, which concerns different refrigerants. Finally, that rule also has an exemption from requirements under section 608 of the CAA that will reduce regulatory burden.

Comment: Danfoss commented that several of the refrigerants listed as acceptable in the rule titled *Listing of Substitutes for Refrigeration and Air Conditioning and Revision of the Venting Prohibition for Certain Refrigerant Substitutes* are severely restricted by building codes and would not be acceptable for use in most areas of the U.S, mainly due to their flammability. Danfoss stated they believe that the proposed replacement refrigerants are not able to be used as short term alternatives to those being found unacceptable because changes to model building codes and subsequent adoption by states and localities will likely be much later than 2020.

Response: EPA acknowledges that some building codes may currently restrict or prohibit use of flammable refrigerants. We note that other available or potentially available refrigerants that are not flammable and have relatively low GWP (roughly 600 or less), including R-744 and R-450A, are listed as acceptable for use in retail food refrigeration and in vending machines.

Comment: A number of manufacturers of laboratory refrigeration equipment and several foam manufacturers suggested that EPA align the timelines for transition of foam blowing agents and refrigerants with the requirements of the EU F-Gas regulations. The commenters summarized the deadlines for foams as: 2008 for one-component foams, January 1, 2020, for XPS, January 1, 2023, for other foams, and provisions for a four-year extension of time where

(1) "alternatives are not available or cannot be used for technical or safety reasons" or (2) "the use of technically feasible and safe alternatives would entail disproportionate costs." Commenters summarized the deadlines for refrigerants in commercial refrigerators and freezers as being January 1, 2020, for HFCs with GWP of 2,500 and January 1, 2022, for HFCs with GWP of 150 or more.

Reasons given for this coordination of timeline with EU regulations include: many companies are trans-national and had already been planning on a transition in line with the EU regulatory deadlines; the SNAP program has deferred to other regulations in the past; and the later deadlines will allow for redesign of refrigeration equipment for both alternative, flammable refrigerants and for new foam blowing agents and for needed third-party testing. Commenters stated that the proposed deadlines would create an extreme burden, particularly on small businesses; that part supplies needed for compliance are not offered in the United States; and that the transition is a complicated undertaking that cannot be performed in 18 months.

Response: EPA disagrees that it should align the timelines in this rule with the EU timelines. The EU regulations are based upon different authority from the SNAP program and we must decide upon timelines based upon the availability of alternatives in the United States. Concerning the suggestion that EPA has deferred to other regulations, we note that there are several key differences. As an initial matter, we have deferred to U.S. regulations. More importantly, we have not deferred to other regulations in a manner that overrides the statutory mandate governing the SNAP program. Rather, in the context evaluating risks of alternatives under our comparative risk framework we have looked to regulations in effect, such as workplace regulations from OSHA or the National Emission Standards for Hazardous Air Pollutants, to determine whether a specific alternative may be used as safely as other available

alternatives. This is different from aligning with a timeline in another nation's regulations that are not effective within the United States or deferring to considerations in those regulations, such as transition costs, that are not part of the SNAP decision criteria.

F. Other comments

Additional public comments not already discussed above along with EPA's responses are available in the Response to Comments document which accompanies this action (EPA, 2015a).

VIII. Additional Analyses

EPA does not consider the cost of transition to other alternatives in making listing decisions because under the SNAP criteria for review in 40 CFR 82.180(a)(7), consideration of cost is limited to cost of the substitute under review. However, EPA has prepared technical support documents including analyses of costs associated with sector transitions, estimated avoided GHG emissions associated with the transition to alternatives, and potential small business impacts.[103,104,105]

The transition scenarios analyzed possible ways to comply with the final rule. The transition scenario in the cost analysis reflects a direct compliance cost method and does not assume the regulated community chooses higher-cost solutions where known less costly solutions exist. The scenarios analyzed in the avoided GHG emissions analysis reflect possible transitions for compliance based on considerations of the market and activity towards lower-GWP solutions. While the emission reductions have been quantified, they have not been monetized. Thus, higher or lower GHG emission reductions do not necessarily correlate to

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

[104] ICF, 2015b. Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives--Revised. July 2015.

[105] EPA, 2015. Climate Benefits of the SNAP Program Status Change Rule, July 2015.

higher or lower costs due to the different assumptions and methodologies used in the different analyses. However, the transitions assumed in the lower, less aggressive scenario here are similar to the transitions assumed in the cost analysis.

To extend the assessment to all-sized businesses potentially affected by the rulemaking, EPA conducted an analysis on costs to all-sized businesses building on the approach taken to estimate potential economic impacts on small businesses. Using a 7% discount rate, total annualized compliance costs across affected businesses are estimated to range from $28.0 million to $50.6 million; total annual savings are estimated to be about $19.3 million. Using a 3% discount rate, total annualized compliance costs across affected businesses are estimated to range from $19.5 million to $37.8 million, total annual savings are estimated be about $19.3 million.

EPA conducted an analysis on the potential avoided GHG emissions associated with implementation of this final rule. The emissions avoided from this final rule are estimated to be 26 to 31 MMTCO_2eq in 2020. The avoided emissions are estimated to be 54 to 64 MMTCO_2eq in 2025 and 78 to 101 MMTCO2eq in 2030 (EPA, 2015b) .

IX. Statutory and Executive Order Reviews

Additional information about these statutes and Executive Orders can be found at *www2.epa.gov/laws-regulations/laws-and-executive-orders.*

A. *Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review*

This action is a significant regulatory action that was submitted to the Office of Management and Budget (OMB) for review. Any changes made in response to OMB recommendations have been documented in the docket.

B. *Paperwork Reduction Act*

This action does not impose any new information collection burden. OMB has previously approved the information collection requirements contained in the existing regulations and has assigned OMB control number 2060–0226. This final rule contains no new requirements for reporting or recordkeeping.

C. *Regulatory Flexibility Act*

I certify that this action will not have a significant economic impact on a substantial number of small entities. The requirements of this final rule with respect to HFCs, will impact manufacturers of some consumer and technical aerosol products, retail food refrigeration equipment, vending machines, motor vehicles, and products containing phenolic, polyisocyanurate, polyolefin, PU, and polystyrene foams. The requirements of this final rule with respect to HCFCs could theoretically affect manufacturers of aerosols, foams, industrial cleaning solvents, fire suppressants, and adhesives, coatings, and inks; however, due to existing regulations that restrict the use of HCFCs in these products, no actual impact is expected. In some uses, there is no significant impact of the final rule because the substitutes proposed to be prohibited are not widely used (e.g., use of HFC-134a as a propellant in consumer aerosol products, use of HFC-134a as a foam blowing agent in various polyurethane foams). A significant portion of the businesses regulated under this rule are not small businesses (e.g., car manufacturers, appliance manufacturers). About 500,000 small businesses could be subject to the rule, although more than 99% of those businesses are expected to experience zero compliance costs because other available substitutes for supermarket refrigeration systems and condensing units have costs similar to those of the refrigerants listed as unacceptable. For those small businesses with compliance costs, impacts are estimated to range from 0% to 48% of annual

sales, with approximately 57 businesses expected to experience an impact of 3.0% of annual sales or more. Details of this analysis are presented in the document, *Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives – Revised* (ICF, 2015b). In our analysis, we found that while some small businesses may experience significant costs, the number of small businesses that would experience significant costs is not substantial. We have therefore concluded that this action will not have a significant impact on a substantial number of small entities.

D. *Unfunded Mandates Reform Act (UMRA)*

This action does not contain any unfunded mandate as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. This action imposes no enforceable duty on any state, local, or tribal governments or the private sector.

E. *Executive Order 13132: Federalism*

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

F. *Executive Order 13175: Consultation and Coordination with Indian Tribal Governments*

This action does not have tribal implications, as specified in EO 13175. It will not have substantial direct effects on tribal governments, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes. Thus, Executive Order 13175 does not apply to this action.

G. *Executive Order 13045: Protection of Children from Environmental Health and*

Safety Risks

This action is not subject to Executive Order 13045 (62 FR 19,885, April 23, 1997) because it is not economically significant as defined in EO 12866, and because the environmental health or safety risks addressed by this action do not present a disproportionate risk to children. This action restricts the use of certain substitutes that have greater overall risks for human health and the environment, primarily due to their high global warming potential. The reduction in GHG emissions would provide climate benefits for all people, including benefits for children and future generations.

H. *Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use*

This action is not a "significant energy action" as defined in Executive Order 13211, (66 FR 28,355 (May 22, 2001)) because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Aerosol uses are not related to the supply, distribution, or use of energy. For the end-uses that are related to energy effects, including refrigeration and air conditioning and some rigid cell PU and polystyrene insulation foams, a number of alternatives are available to replace those refrigerants and foam blowing agents that are listed as unacceptable in this action; many of the alternatives are as energy-efficient or more energy-efficient than the substitutes being listed as unacceptable. As described in more detail in this document, energy efficiency is influenced, but not determined, by the refrigerant. Similarly, although foam blowing agents influence the insulation properties of rigid cell foams, this also can vary due to other properties of the foam (e.g., thickness). Thus, we have concluded that this rule is not likely to have any adverse energy effects.

I. *National Technology Transfer and Advancement Act*

This action does not involve technical standards.

J. *Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*

EPA has determined that this action will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population. This action would prohibit a number of substances with ODPs or high GWPs. The reduction in ODS and GWP emissions would assist in restoring the stratospheric ozone layer and provide climate benefits.

K. *Congressional Review Act (CRA)*

This action is subject to the CRA, and the EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is not a "major rule" as defined by 5 U.S.C. 804(2).

X. References

This preamble references the following documents, which are also in the Air Docket at the address listed in section I.B.1. Unless specified otherwise, all documents are available electronically through the Federal Docket Management System, Docket # EPA-HQ-OAR-2014-0198.

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This document is a prepublication version, signed by Administrator Gina McCarthy on 7/2/2015. We have taken steps to ensure the accuracy of this version, but it is not the official version.

List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control, Incorporation by reference, Recycling, Reporting and recordkeeping requirements, Stratospheric ozone layer.

Dated:

_____

Gina McCarthy,

Administrator.

For the reasons stated in the preamble, 40 CFR part 82 is amended as follows:

PART 82 - PROTECTION OF STRATOSPHERIC OZONE

1. The authority citation for part 82 continues to read as follows:

Authority: 42 U.S.C. 7414, 7601, 7671 - 7671q.

Subpart G – Significant New Alternatives Policy Program

2. Appendix B to subpart G of part 82 is amended as follows:

   a. By revising the entry for the substitutes HFC-134a, HCFC Blend Beta, and R-401C and adding three new rows immediately after this row in the table titled "Refrigerants—Acceptable Subject to Use Conditions".

   b. By adding a new row at the bottom of the table "Refrigerants—Acceptable Subject to Narrowed Use Limits".

   c. By adding three new rows at the end of the table titled "Refrigerants—Unacceptable Substitutes".

   The revisions and additions read as follows:

Appendix B to Subpart G of Part 82—Substitutes Subject to Use Restrictions and Unacceptable Substitutes

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS

Application	Substitute	Decision	Conditions	Comments
CFC-12 Automobile Motor Vehicle Air Conditioning (New Equipment/NIKs only)	HFC-134a	Acceptable subject to use conditions, for passenger cars and light-duty trucks manufactured for Model Year 2020 or earlier, and for vehicles other than passenger cars or light-duty trucks	—must be used with unique fittings —must be used with detailed labels	EPA is concerned that the existence of several substitutes in this end-use may increase the likelihood of significant refrigerant cross-contamination and potential failure of both air conditioning systems and recovery/recycling equipment.
CFC-12 Automobile Motor Vehicle Air Conditioning (New Equipment/NIKs only)	HCFC Blend Beta (R-416A)	Acceptable subject to use conditions, for passenger cars and light-duty trucks manufactured for Model Year 2016 or earlier, and for vehicles other than passenger cars or light-duty trucks	—must be used with unique fittings —must be used with detailed labels	EPA is concerned that the existence of several substitutes in this end-use may increase the likelihood of significant refrigerant cross-contamination and potential failure of both air conditioning systems and recovery/recycling equipment.
CFC-12 Automobile Motor Vehicle Air Conditioning (New Equipment/NIKs only)	R-401C	Acceptable subject to use conditions	—must be used with unique fittings —must be used with detailed labels	EPA is concerned that the existence of several substitutes in this end-use may increase the likelihood of significant refrigerant cross-contamination and potential failure of both air conditioning systems and recovery/recycling equipment.
CFC-12 Automobile Motor Vehicle Air Conditioning (Retrofit Equipment only)	HFC-134a, R-401C, HCFC Blend Beta (R-416A)	Acceptable subject to use conditions	—must be used with unique fittings —must be used with detailed labels —all CFC-12 must be removed from the system prior to retrofitting Refer to the text for a full description.	EPA is concerned that the existence of several substitutes in this end-use may increase the likelihood of significant refrigerant cross-contamination and potential failure of both air conditioning systems and recovery/recycling equipment. No distinction is made between “retrofit” and “drop-in” refrigerants; retrofitting a car to use a new refrigerant includes all procedures that result in the air conditioning system using a new refrigerant.
* * * * * * *				

REFRIGERANTS—ACCEPTABLE SUBJECT TO NARROWED USE LIMITS

End-use	Substitute	Decision	Further Information
* * * * * * *			
Motor vehicle air conditioning (new equipment in passenger cars and light-duty trucks only)	HFC-134a	Acceptable for use in Model Year (MY) 2021 through MY 2025 passenger cars and light-duty trucks destined for export, where reasonable efforts have been made to ascertain that other alternatives are not technically feasible because of lack of infrastructure for servicing with alternative refrigerants in the destination country.	Vehicle manufacturers must document their determination that the infrastructure is not in place for each country to which they plan to export vehicles and must retain the documentation in their files for at least five years after date of its creation for the purpose of demonstrating compliance. Documentation is to include descriptions of: • Products in which the substitute is needed; • Substitutes examined and rejected for the destination country; • Reason for rejection of other alternatives; and • Anticipated date other substitutes will be available and projected date of transition in the destination country.

REFRIGERANTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further Information
* * * * * * *			
Motor vehicle air conditioning (new equipment in passenger cars and light-duty trucks only)	HFC-134a	Unacceptable as of Model Year 2021 except where allowed under narrowed use limit	HFC-134a has a Chemical Abstracts Service Registry Number (CAS Reg. No.) of 811-97-2 and it is also known by the name 1,1,1,2-tetrafluoropropane. HFC-134a has a GWP of 1,430. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. This listing does not prohibit the servicing or replacement of motor vehicle air conditioning systems manufactured to use HFC-134a.
Motor vehicle air conditioning (new equipment in passenger cars and light-duty trucks only)	R-406A, R-414A (HCFC Blend Xi, GHG-X4), R-414B (HCFC Blend Omicron), HCFC Blend Delta (Free Zone), Freeze 12, GHG-X5, HCFC Blend Lambda (GHG-HP), R-416A (FRIGC FR-12, HCFC Blend Beta)	Unacceptable as of Model Year 2017	These refrigerants all contain HCFCs. They have GWPs ranging from 1,080 to 2,340 and ODPs ranging from 0.008 to 0.056. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.

Motor vehicle air conditioning (new equipment in passenger cars and light-duty trucks only)	SP34E, R-426A (RS-24, new formulation)	Unacceptable as of Model Year 2017	These blends have GWPs ranging from approximately 1,410 to 1,510. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.

3. Appendix D to subpart G of part 82 is amended by revising the first sentence of the third paragraph to read as follows:

APPENDIX D TO SUBPART G OF PART 82—SUBSTITUTES SUBJECT TO USE RESTRICTIONS AND UNACCEPTABLE SUBSTITUTES

Summary of Decisions

Refrigeration and Air Conditioning Sector Acceptable Subject to Use Conditions

* * * * *

In addition, the use of a) R–406A/‘‘GHG’’/‘‘McCool’’, “HCFC Blend Lambda “/‘‘GHG–HP’’, R-414A/”HCFC Blend Xi”/‘‘GHG–X4/‘‘Autofrost’’/‘‘Chill-It’’, R-414B/‘‘Hot Shot’’/‘‘Kar Kool’’, and R-416A/”HCFC Blend Beta”/‘‘FREEZE 12’’ as CFC–12 substitutes in retrofitted MVACs, and b) * * *.

* * * * *

4. Subpart G of part 82 is amended by adding Appendix U to read as follows:

Appendix U to Subpart G of Part 82- Unacceptable Substitutes and Substitutes Subject to Use Restrictions Listed in the [INSERT DATE OF PUBLICATION OF FINAL RULE IN THE FEDERAL REGISTER] Final Rule, Effective [INSERT DATE 30 DAYS AFTER PUBLICATION OF FINAL RULE IN THE FEDERAL REGISTER].

AEROSOLS—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further Information

Propellants	HFC-125	Unacceptable as of January 1, 2016.	HFC-125 has a Chemical Abstracts Service Registry Number (CAS Reg. No.) of 354-33-6 and it is also known by the name 1,1,1,2,2-pentafluoropropane. HFC-125 has a GWP of 3,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. Products using this propellant that are manufactured prior to January 1, 2016 may be sold, imported, exported, distributed and used after that date.
Propellants	HFC-134a	Unacceptable as of [insert date one year after publication in the Federal Register], except uses listed as acceptable, subject to use conditions.	HFC-134a has a Chemical Abstracts Service Registry Number (CAS Reg. No.) of 811-97-2 and it is also known by the name 1,1,1,2-tetrafluoropropane. HFC-134a has a GWP of 1,430. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. Products using this propellant that are manufactured prior to [insert date one year after publication in the Federal Register] may be sold, imported, exported, distributed and used after that date.
Propellants	HFC-227ea and blends of HFC-134a and HFC-227ea	Unacceptable as of [insert date one year after publication in the Federal Register], except uses listed as acceptable, subject to use conditions.	HFC-227ea has a Chemical Abstracts Service Registry Number (CAS Reg. No.) of 431-89-0 and it is also known by the name 1,1,1,2,3,3,3-heptafluoropropane. HFC-134a has a Chemical Abstracts Service Registry Number (CAS Reg. No.) of 811-97-2 and it is also known by the name 1,1,1,2-tetrafluoropropane. HFC-227ea and HFC-134a have GWPs of 3,220 and 1,430, respectively. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. Products using these propellants that are manufactured prior to [insert date one year after publication in the Federal Register] may be sold, imported, exported, distributed and used after that date.
Propellants	HCFC-22 and HCFC-142b	Unacceptable effective **[INSERT DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**	Use or introduction into interstate commerce of virgin HCFC-22 and HCFC-142b for aerosols is prohibited as of January 1, 2010 under EPA's regulations at 40 CFR part 82 subpart A. These propellants have ozone depletion potentials of 0.055 and 0.065, respectively.
Solvents	HCFC-141b and blends thereof	Unacceptable effective **[INSERT DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**	Use or introduction into interstate commerce of virgin HCFC-141b for aerosols is prohibited as of January 1, 2015 under EPA's regulations at 40 CFR part 82 subpart A. HCFC-141b has an ozone depletion potential of 0.11.

This document is a prepublication version, signed by Administrator Gina McCarthy on 7/2/2015. We have taken steps to ensure the accuracy of this version, but it is not the official version.

SUBSTITUTES ACCEPTABLE SUBJECT TO USE CONDITIONS

End-use	Substitute	Decision	Use Conditions	Further Information
Propellants	HFC-134a	Acceptable subject to use conditions	The classes of products listed below are acceptable for use from [insert date one year after publication in the Federal Register] through December 31, 2017 and are unacceptable thereafter. • products for functional testing of smoke detectors • products for which new formulations require governmental review, including: EPA pesticide registration, approval for conformance with military or space agency specifications, or FDA approval (other than MDIs) The classes of products listed below are acceptable for use and other uses are unacceptable as of [insert date one year after publication in the Federal Register]: • metered dose inhalers approved by the U.S. Food and Drug Administration for medical purposes • cleaning products for removal of grease, flux and other soils from electrical equipment or electronics • refrigerant flushes • products for sensitivity testing of smoke detectors • lubricants and freeze sprays for electrical equipment or electronics • sprays for aircraft maintenance • sprays containing corrosion preventive compounds used in the maintenance of aircraft, electrical equipment or electronics, or military equipment • pesticides for use near electrical wires or in aircraft, in total release insecticide foggers, or in certified organic use pesticides for which EPA has specifically disallowed all other lower-GWP propellants • mold release agents and mold cleaners • lubricants and cleaners for spinnerettes for synthetic fabrics • duster sprays specifically for removal of dust from photographic negatives, semiconductor chips, specimens under electron microscopes, and energized electrical equipment • adhesives and sealants in large canisters • document preservation sprays • wound care sprays • topical coolant sprays for pain relief • products for removing bandage adhesives from skin	HFC-134a has a Chemical Abstracts Service Registry Number (CAS Reg. No.) of 811-97-2 and it is also known by the name 1,1,1,2-tetrafluoropropane. HFC-134a has a GWP of 1,430. Use is allowed for the specified uses because of the technical and safety demands in these applications. Aerosol products using this propellant that are manufactured prior to [insert date one year after publication in the Federal Register], may be sold, imported, exported, distributed and used after that date.

Propellants	HFC-227ea and blends of HFC-227ea and HFC-134a	Acceptable subject to use conditions	Acceptable for use in metered dose inhalers approved by the U.S. Food and Drug Administration for medical purposes and unacceptable for all other uses as of [insert date one year after publication in the Federal Register].	HFC-227ea has a Chemical Abstracts Service Registry Number (CAS Reg. No.) of 431-89-0 and it is also known by the name 1,1,1,2,3,3,3-heptafluoropropane. HFC-227ea has a GWP of 3,220. Aerosol products using this propellant that are manufactured prior to [insert date one year after publication in the Federal Register] may be sold, imported, exported, distributed and used after that date.

REFRIGERATION AND AIR CONDITIONING—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further Information
Retail food refrigeration (supermarket systems)(new)	HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of January 1, 2017	These refrigerants have GWPs ranging from 2,729 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Retail food refrigeration (supermarket systems)(retrofit)	R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of [insert date one year after publication in the Federal Register]	These refrigerants have GWPs ranging from 2,729 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Retail food refrigeration (remote condensing units)(new)	HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of January 1, 2018	These refrigerants have GWPs ranging from 2,729 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Retail food refrigeration (remote condensing units) (retrofit)	R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	Unacceptable as of [insert date one year after publication in the Federal Register]	These refrigerants have GWPs ranging from 2,729 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.

Retail food refrigeration (stand-alone medium-temperature units with a compressor capacity below 2,200 Btu/hr and not containing a flooded evaporator) (new)	FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03.	Unacceptable as of January 1, 2019	These refrigerants have GWPs ranging from approximately 900 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. "Medium-temperature" refers to equipment that maintains food or beverages at temperatures above 32°F (0 °C).
Retail food refrigeration (stand-alone medium-temperature units with a compressor capacity below 2,200 Btu/hr and containing a flooded evaporator) (new)	FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03.	Unacceptable as of January 1, 2020	These refrigerants have GWPs ranging from approximately 900 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. "Medium-temperature" refers to equipment that maintains food or beverages at temperatures above 32°F (0 °C).
Retail food refrigeration (stand-alone medium-temperature units with a compressor capacity equal to or greater than 2,200 Btu/hr) (new)	FOR12A, FOR12B, HFC-134a, 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-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03.	Unacceptable as of January 1, 2020	These refrigerants have GWPs ranging from approximately 900 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. "Medium-temperature" refers to equipment that maintains food or beverages at temperatures above 32°F (0 °C).
Retail food refrigeration (stand-alone low-temperature units) (new)	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, RS-44 (2003 formulation).	Unacceptable as of January 1, 2020	These refrigerants have GWPs ranging from approximately 1,800 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date. "Low-temperature" refers to equipment that maintains food or beverages at temperatures at or below 32°F (0 °C).
Retail food refrigeration (stand-alone units only) (retrofit)	R-404A, R-507A.	Unacceptable as of [insert date one year after publication in the Federal Register]	These refrigerants have GWPs of approximately 3,922 and 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.

Vending machines (new only)	FOR12A, FOR12B, HFC-134a, KDD6, 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-426A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), SP34E.	Unacceptable as of January 1, 2019	These refrigerants have GWPs ranging from approximately 1,100 to 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Vending machines (retrofit only)	R-404A, R-507A.	Unacceptable as of [insert date one year after publication in the Federal Register]	These refrigerants have GWPs of approximately 3,922 and 3,985. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.

FOAM BLOWING AGENTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS

End-use	Substitute	Decision	Narrowed Use Limits	Further Information
Rigid Polyurethane: Appliance	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2020, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.
Rigid Polyurethane: Commercial Refrigeration and Sandwich Panels	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2020, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.

Flexible Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2017, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.
Rigid Polyurethane: Slabstock and Other	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits .	Acceptable from January 1, 2019, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.
Rigid Polyurethane and Polyisocyanurate Laminated Boardstock	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2017, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.

Rigid Polyurethane: Marine Flotation Foam	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2020, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.
Polystyrene: Extruded Sheet	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2017, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.
Polystyrene: Extruded Boardstock and Billet	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel B, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2021, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.

Integral Skin Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits .	Acceptable from January 1, 2017, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.
Polyolefin	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2020, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.
Phenolic Insulation Board and Bunstock	HFC-143a, HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	Acceptable Subject to Narrowed Use Limits	Acceptable from January 1, 2017, until January 1, 2022, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and projected time for switching.

UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further Information
All Foam Blowing End-uses	HCFC-141b and blends thereof	Unacceptable effective **[INSERT DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**	HCFC-141b has an ozone depletion potential of 0.11 under the Montreal Protocol. EPA previously found HCFC-141b unacceptable in all foam blowing end-uses (appendix M to subpart G of 40 CFR part 82). HCFC-141b has an ozone depletion potential (ODP) of 0.11.
All Foam Blowing end-uses	HCFC-22, HCFC-142b, and blends thereof	Unacceptable effective **[INSERT DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**	Use or introduction into interstate commerce of virgin HCFC-22 and HCFC-142b for foam blowing is prohibited after January 1, 2010 under EPA's regulations at 40 CFR part 82 subpart A unless used, recovered, and recycled. These compounds have ODPs of 0.055 and 0.065, respectively.
Flexible Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	Unacceptable as of January 1, 2017 except where allowed under a narrowed use limit.	These foam blowing agents have global warming potentials (GWPs) ranging from 725 to 1,430. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Polystyrene: Extruded Sheet	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Unacceptable as of January 1, 2017 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 370 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Phenolic Insulation Board and Bunstock	HFC-143a, HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	Unacceptable as of January 1, 2017 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from 725 to 4,470. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Integral Skin Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Unacceptable as of January 1, 2017 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 370 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid Polyurethane: Slabstock and Other	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Unacceptable as of January 1, 2019 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 370 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid Polyurethane and Polyisocyanurate Laminated Boardstock	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof	Unacceptable as of January 1, 2017 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from 725 to 1,430. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid Polyurethane: Marine Flotation Foam	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6;	Unacceptable as of January 1, 2020 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 370 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.

Rigid Polyurethane: Commercial Refrigeration and Sandwich Panels	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Unacceptable as of January 1, 2020 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 370 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid Polyurethane: Appliance	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, and Formacel Z-6	Unacceptable as of January 1, 2020 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 370 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Polystyrene: Extruded Boardstock and Billet	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel B, and Formacel Z-6	Unacceptable as of January 1, 2021 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 140 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Polyolefin	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, and Formacel Z-6	Unacceptable as of January 1, 2020 except where allowed under a narrowed use limit.	These foam blowing agents have GWPs ranging from higher than 370 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.

FIRE SUPPRESSION AND EXPLOSION PROTECTION AGENTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further Information
Total Flooding	HCFC-22	Unacceptable effective **[INSERT DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**	Use or introduction into interstate commerce of virgin HCFC-22 for total flooding fire suppression and explosion protection is prohibited as of January 1, 2010 under EPA's regulations at 40 CFR part 82 subpart A. This chemical has an ozone depletion potential of 0.055.

STERILANTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further Information
Sterilants	Blends containing HCFC-22	Unacceptable effective **[INSERT DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**	Use or introduction into interstate commerce of virgin HCFC-22 for sterilants is prohibited as of January 1, 2010 under EPA's regulations at 40 CFR part 82 subpart A. This chemical has an ozone depletion potential of 0.055.

ADHESIVES, COATINGS AND INKS—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further Information

Adhesives, coatings and inks	HCFC-141b and blends thereof	Unacceptable effective **[INSERT DATE 60 DAYS AFTER PUBLICATION OF FINAL RULE]**	Use or introduction into interstate commerce of virgin HCFC-141b for adhesives, coatings and inks is prohibited as of January 1, 2015 under EPA's regulations at 40 CFR part 82 subpart A. This chemical has an ozone depletion potential of 0.11.