ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 82

[EPA–HQ–OAR–2015–0663; FRL–9941–84–OAR]

RIN 2060–AS80

Protection of Stratospheric Ozone: Proposed New Listings of Substitutes; Changes of Listing Status; and Reinterpretation of Unacceptability for Closed Cell Foam Products Under the Significant New Alternatives Policy Program; and Revision of Clean Air Act Section 608 Venting Prohibition for Propane

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of proposed rulemaking.

SUMMARY: Pursuant to the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy program, this action proposes to list a number of substances as *acceptable, subject to use conditions;* to list several substances as *unacceptable;* and to modify the listing status for certain substances from *acceptable* to *acceptable, subject to narrowed use limits,* or to *unacceptable*. Specifically, this action proposes to list as acceptable, subject to use restrictions, propane and HFO-1234yf in the refrigeration and air conditioning, and 2-bromo-3,3,3-trifluoroprop-1-ene in the fire suppression and explosion protection sectors; to list as unacceptable certain hydrocarbons and hydrocarbon blends in specific end-uses in the refrigeration and air conditioning sector; and to modify the listing status for certain high-global warming potential alternatives for certain end-uses in the refrigeration and air conditioning, foam blowing, and fire suppression and explosion protection sectors. This action also proposes to exempt propane in certain refrigeration end-uses from the Clean Air Act section 608 prohibition on venting, release, or disposal on the basis of current evidence that its venting, release, or disposal does not pose a threat to the environment. In addition, this action proposes to apply unacceptability determinations for foam-blowing agents to closed cell foam products and products containing closed cell foam that are manufactured or imported using these foam-blowing agents. This action also proposes to clarify the listing for Powdered Aerosol D (Stat-X®), which is currently listed as both *acceptable* and *acceptable subject to use conditions,* by removing the listing as *acceptable subject to use conditions*.

DATES: Comments must be received on or before June 2, 2016. Any party requesting a public hearing must notify the contact listed below under **FOR FURTHER INFORMATION CONTACT** by 5 p.m. Eastern Daylight Time on May 3, 2016. If a hearing is held, it will take place on or about May 18, 2016 in Washington, DC and further information will be provided on EPA's Stratospheric Ozone Web site at *www.epa.gov/ozone/snap*.

ADDRESSES: Submit your comments, identified by Docket ID No. EPA–HQ–OAR–2015–0663, to the *Federal eRulemaking Portal: http://www.regulations.gov*. Follow the online instructions for submitting comments. Once submitted, comments cannot be edited or withdrawn. EPA may publish any comment received to its public docket. Do not submit electronically any information you consider to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Multimedia submissions (audio, video, etc.) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. EPA will generally not consider comments or comment contents located outside of the primary submission (*i.e.,* on the web, cloud, or other file sharing system). For additional submission methods, the full EPA public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit *http://www2.epa.gov/dockets/commenting-epa-dockets*.

FOR FURTHER INFORMATION CONTACT: Chenise Farquharson, Stratospheric Protection Division, Office of Atmospheric Programs (Mail Code 6205 T), Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Washington, DC 20460; telephone number: 202–564–7768; email address: *Farquharson.chenise@epa.gov*. Notices and rulemakings under EPA's Significant New Alternatives Policy program are available on EPA's Stratospheric Ozone Web site at *www.epa.gov/snap/snap-regulations*.

SUPPLEMENTARY INFORMATION:

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I. General Information

A. Executive Summary

Under section 612 of the Clean Air Act (CAA), EPA is required to evaluate substitutes [1] to ozone-depleting substances (ODS) for their risks to human health and the environment. 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 alternatives 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. Instead, the program evolves the list as EPA makes decisions informed by our overall understanding of the environmental and human health impacts as well as our current knowledge about other alternatives. 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. However, in some cases, the SNAP list has been modified by listing a substitute as unacceptable for one or more end-uses or by restricting the use of a previously listed substitute by changing its status for a particular end-use to unacceptable, acceptable subject to use conditions, or acceptable subject to narrowed use.

In the decades since ODS were first invented in the 1920s, American consumers relied on products using ODS for diverse uses including aerosols, air conditioning, insulation, solvent cleaning, and fire protection. The agreement by governments to phase out production of ODS under the *Montreal Protocol on Substances that Deplete the Ozone Layer* led to inevitable questions about whether suitable alternatives could be found in all cases, and in the larger sense, about how to limit negative societal impacts from use of alternatives.

Over the past twenty years, the SNAP program has played an important role in assisting with a continuous smooth transition to safer alternatives, by addressing in concrete and highly technical terms, end-use by end-use, these myriad issues. From the first SNAP framework rule published in 1994, which provided confidence and certainty by identifying safer alternatives in key consumer and industrial uses, the SNAP program has continued to ensure that businesses and consumers have access to information about suitable alternatives. The SNAP program works with many stakeholders, domestically and abroad, to continuously evaluate and provide updates on safer alternatives and new technologies. Thanks to these efforts and the work of individuals, businesses, and organizations, the transitions generally have been successful. Perhaps the best evidence of the program's success has been the lack of fanfare with which so many important consumer and industrial uses have moved to adopt safer SNAP-listed alternatives. When reviewing a substitute, EPA compares the risk posed by that substitute to the risks posed by other alternatives and determines whether that specific substitute under review poses significantly more risk than other alternatives for the same use. EPA recently has begun to review the lists in a broader manner to determine whether substitutes added to the lists early in the program pose significantly more risk than substitutes that have more recently been added. As with initial listing decisions, decisions to change the status of an already listed alternative are based on applying our comparative risk framework.

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) [2] 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.'' On July 20, 2015 (80 FR 42870), EPA issued a final regulation that was our first effort to take a broader look at the SNAP lists, where we focused on those listed substitutes that have a high GWP relative to other alternatives in specific end-uses, while otherwise posing comparable levels of risk.

In this action, EPA is proposing to list a number of substances as acceptable, subject to use restrictions; to list several substances as unacceptable; and to modify the listing status for certain substances from acceptable to unacceptable. We performed a comparative risk analysis, based on our criteria for review, with other alternatives for the relevant end-uses. For particular substances, EPA found significant potential differences in risk with respect to one or more specific criteria, such as flammability, toxicity, or local air quality concerns, while otherwise posing comparable levels of risk to those of other alternatives in specific end-uses. EPA is also proposing that the existing listing decisions for foam blowing agents apply to closed cell foam products and products containing closed cell foam. See section VI.C.4 for the details of this proposal. Additionally, EPA is proposing to list propane (R-290) as acceptable, subject to use conditions, as a refrigerant in new self-contained commercial ice machines, in new water coolers, and in new very low temperature refrigeration equipment. EPA is proposing to exempt propane in these end-uses from the venting prohibition under CAA section 608(c)(2). See section VI.A.2.a, ''What is EPA's proposal regarding whether venting of propane in the end-uses in this action would pose a threat to the environment?'' for the details of this proposal.

Per the guiding principles of the SNAP program, this action does not specify that any alternative is acceptable or unacceptable across all sectors and end-uses. Instead, in all cases, EPA considered the intersection between the specific alternative and the particular end-use and the availability of substitutes for those particular end-uses. In the case of refrigeration and air conditioning (AC), we consider new equipment to be a separate end-use from retrofitting existing equipment with a different refrigerant from that for which the equipment was originally designed. EPA is not setting a ''risk threshold'' for any specific SNAP criterion, such that the only acceptable substitutes pose risk

[1] The terms ''alternatives'' and ''substitutes'' are used interchangeably in this document.

[2] The White House, 2013. President's Climate Action Plan. This document is accessible at: *https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.*

below a specified level of risk. Because the substitutes available and the types of risk they may pose vary by sector and end-use and under the SNAP comparative risk framework, our review focuses on the specific end-use and the alternatives for that end-use, including the other risks alternatives might pose. Thus, there is no bright line that can be established. Also, EPA recognizes that there are a range of substitutes with various uses that include both fluorinated (*e.g.,* hydrofluorocarbons (HFCs), hydrofluoroolefins (HFOs)) and non-fluorinated (*e.g.,* hydrocarbons (HCs), carbon dioxide (CO_2)) substitutes that may pose lower overall risk to human health and the environment. Consistent with CAA section 612 as we have historically interpreted it under the SNAP program, EPA is proposing both initial listings and certain modifications to the current lists based on our evaluation of the substitutes addressed in this action using the SNAP criteria for evaluation and considering the current suite of other alternatives for the specific end-use at issue.

1. Proposed Acceptable Alternatives, With Use Conditions, by End-Use (Initial Listings)

(1) For refrigeration, we are proposing to list as acceptable, subject to use conditions, as of 30 days after publication of a final rule

- Propane in new commercial ice machines, new water coolers, and new very low temperature refrigeration equipment.

(2) For motor vehicle air conditioning (MVAC) systems, we are proposing to list, as acceptable, subject to use conditions, as of 30 days after publication of a final rule

- HFO-1234yf in newly manufactured medium-duty passenger vehicles (MDPVs), heavy-duty (HD) pickup trucks, and complete HD vans.

(3) For fire suppression and explosion protection end-uses, we are proposing to list as acceptable, subject to use conditions, as of 30 days after publication of a final rule

- 2-BTP as a total flooding agent for use in engine nacelles and auxiliary power units (APUs) on aircraft; and
- 2-BTP as a streaming agent for use in handheld extinguishers in aircraft.

2. Proposed Unacceptable Alternatives by End-Use (Initial Listings)

(1) For retrofit residential and light commercial AC and heat pumps—unitary split AC systems and heat pumps, we are proposing to list as unacceptable, as of 30 days after publication of a final rule

- All refrigerants identified as flammability Class 3 in American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 34–2013; and
- All refrigerants meeting the criteria for flammability Class 3 in ANSI/ASHRAE Standard 34–2013. These include, but are not limited to, refrigerant products sold under the names R-22a, 22a, Blue Sky 22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeeze EF-22a, EF-22a, Envirosafe 22a, ES-22a, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, Oz-Chill 22a, Priority Cool, and RED TEK 22a.

(2) For new residential and light commercial AC and heat pumps, cold storage warehouses, centrifugal chillers, and positive displacement chillers, we are proposing to list as unacceptable, as of 30 days after publication of a final rule

- Propylene and R-443A.

3. Proposed Change of Listing Status by End-Use:

(1) For new centrifugal chillers, we are proposing to list as unacceptable, except as otherwise allowed under a narrowed use limit, as of January 1, 2024

- FOR12A, FOR12B, HFC-134a, HFC-227ea, HFC-236fa, HFC-245fa, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R-438A, R-507A, RS-44 (2003 composition), and THR-03.

(2) For new positive displacement chillers, we are proposing to list as unacceptable, except as otherwise allowed under a narrowed use limit, as of January 1, 2024

- FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 composition), SP34E, and THR-03.

(3) For new centrifugal chillers, we are proposing to list as acceptable, subject to narrowed use limits, as of January 1, 2024

- HFC-134a for military marine vessels and HFC-134a and R-404A for human-rated spacecraft and related support equipment

(4) For new positive displacement chillers, we are proposing to list as acceptable, subject to narrowed use limits, as of January 1, 2024

- HFC-134a for military marine vessels and HFC-134a and R-404A for human-rated spacecraft and related support equipment

(5) For new cold storage warehouses, we are proposing to list as unacceptable, as of January 1, 2023

- HFC-227ea, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-438A, R-507A, and RS-44 (2003 composition).

(6) For new retail food refrigeration (refrigerated food processing and dispensing equipment), we are proposing to list as unacceptable, as of January 1, 2021

- 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).

(7) For new household refrigerators and freezers, we are proposing to list as unacceptable, as of January 1, 2021

- FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03.

(8) For rigid polyurethane (PU) high-pressure two-component spray foam, we are proposing to list as unacceptable for all uses, except military or space- and aeronautics-related applications, as of January 1, 2020; as acceptable, subject to narrowed use limits, for military or space- and aeronautics-related applications, as of January 1, 2020; and as unacceptable for military or space- and aeronautics-related applications as of January 1, 2025

- HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.[3]

(9) For rigid PU low-pressure two-component spray foam, we are proposing to list as unacceptable for all uses, except military or space-aeronautics-related applications, as of January 1, 2021; as acceptable, subject to narrowed use limits, for military or space- aeronautics-related applications,

[3] Closed cell foam products and products containing closed cell foams manufactured on or before January 1, 2020, may be used after that date.

as of January 1, 2021; and as unacceptable for military or space-aeronautics-related applications as of January 1, 2025

• HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.[4]

(10) For rigid PU one-component foam sealants, we are proposing to list as unacceptable, as of January 1, 2020

• HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.[5]

(11) For all foam blowing end-uses except for rigid PU spray foam, we are proposing for all HFCs and HFC blends previously listed as unacceptable for space- aeronautics-related applications as of January 1, 2022 that

• These HFCs and HFC blends would be unacceptable for space- aeronautics-related applications as of January 1, 2025.

(12) For flexible PU foam applications, we are proposing to list as unacceptable, as of 30 days after publication of a final rule

• Methylene chloride.

(13) For integral skin PU foam applications, we are proposing to list as unacceptable, as of January 1, 2017

• Methylene chloride.[6]

(14) For polyolefin foam applications, we are proposing to list as unacceptable, as of January 1, 2020

• Methylene chloride.[7]

(15) For fire suppression total flooding uses, we are proposing to list as unacceptable, as of one year after publication of a final rule

• Perfluorocarbons (PFCs) (C_3F_8 and C_4F_{10}).

4. Other Changes

(1) For all foam blowing end-uses, we are proposing to prohibit

• Use of closed cell foam products and products that contain closed cell foam manufactured with an unacceptable foam blowing agent on or after the later of (1) one year after publication of a final rule or (2) the date of the unacceptability listing.

(2) For fire suppression and explosion protection total flooding end-use, we are proposing to clarify the listing for Powdered Aerosol D (Stat-X®), which is currently listed as both ''acceptable'' and ''acceptable subject to use conditions,'' by removing the listing as ''acceptable subject to use conditions,'' as of 30 days after publication of a final rule.

B. Does this action apply to me?

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

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

Category	NAICS Code	Description of regulated entities
Construction	238210	Alarm System (E.G., Fire, Burglar), Electric, Installation Only.
Industry	238220	Plumbing, Heating, And Air Conditioning Contractors.
Industry	325199	All Other Basic Organic Chemical Manufacturing.
Industry	325412	Pharmaceutical Preparation Manufacturing.
Industry	325520	Adhesive Manufacturing.
Industry	325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing.
Industry	326150	Urethane and Other Foam Product (Except Polystyrene) Manufacturing.
Manufacturing ...	332919	Nozzles, Firefighting, Manufacturing.
Industry	333415	Manufacturers of Refrigerators, Freezers, and Other Refrigerating or Freezing Equipment, Electric or Other (NESOI); Heat Pumps Not Elsewhere Specified or Included; and Parts Thereof.
Industry	333415	Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.
Manufacturing ...	334290	Fire Detection and Alarm Systems Manufacturing.
Industry	335222	Household Refrigerator and Home Freezer Manufacturing.
Industry	336120	Heavy Duty Truck Manufacturing.
Industry	336211	Motor Vehicle Body Manufacturing.
Industry	3363	Motor Vehicle Parts Manufacturing.
Industry	3364	Aerospace Product and Parts Manufacturing.
Manufacturing ...	336411	Aircraft Manufacturing.
Manufacturing ...	336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing.
Industry	336992	Military Armored Vehicle, Tank, and Tank Component Manufacturing.
Industry	339113	Surgical Appliance and Supplies Manufacturing.
Manufacturing ...	339999	Fire Extinguishers, Portable, Manufacturing.
Retail	423620	Household Appliances, Electric Housewares, and Consumer Electronics Merchant Wholesalers.
Retail	423740	Refrigeration Equipment and Supplies Merchant Wholesalers.
Retail	423930	Recyclable Material Merchant Wholesalers.
Retail	443111	Appliance Stores: Household-Type.
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.

[4] Closed cell foam products and products containing closed cell foams manufactured on or before January 1, 2021, may be used after that date.

[5] Closed cell foam products and products containing closed cell foams manufactured on or before January 1, 2020, may be used after that date.

[6] Closed cell foam products and products containing closed cell foams manufactured on or before January 1, 2017, may be used after that date.

[7] Closed cell foam products and products containing closed cell foams manufactured on or before January 1, 2020, may be used after that date.

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

Category	NAICS Code	Description of regulated entities
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.
Services	81119	Other Automotive Repair and Maintenance.
Services	811412	Appliance Repair and Maintenance.
Services	922160	Fire Protection.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your entity is regulated by this action, you should carefully examine the applicability criteria found in 40 CFR part 82. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the **FOR FURTHER INFORMATION CONTACT** section.

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:

AIHA—American Industrial Hygiene Association
AC—Air Conditioning
ACGIH—American Conference of Governmental Industrial Hygienists
ACH—Changes Per Hour
ASRAC—Appliance Standards and Rulemaking Federal Advisory Committee
AEGL—Acute Emergency Guideline Limits
AHRI—Air Conditioning, Heating and Refrigeration Institute
AIRAH—Australian Institute of Refrigeration, Air conditioning and Heating
ANSI—American National Standards Institute
APU—Auxiliary Power Unit
ASHRAE—American Society of Heating, Refrigerating and Air-Conditioning Engineers
BTU—British Thermal Units
CAA—Clean Air Act
CAP—Climate Action Plan
CAS Reg. No.—Chemical Abstracts Service Registry Identification Number
CBI—Confidential Business Information
CFC—Chlorofluorocarbon
CFR—Code of Federal Regulations
CH_4—Methane
CMAQ—Community Multiscale Air Quality
CO_2—Carbon Dioxide
CO_2eq—Carbon Dioxide Equivalent
CUAC—Commercial Unitary Air Conditioner
CUHP—Commercial Unitary Heat Pump
DOE—United States Department of Energy
DX—Direct Expansion
EEAP—Environmental Effects Assessment Panel
EIA—Environmental Investigation Agency
EO—Executive Order
EPA—United States Environmental Protection Agency
EU—European Union
FCA—Fiat Chrysler Automobiles
FMEA—Failure Mode and Effects Analysis
FAA—Federal Aviation Administration
FR—Federal Register
FTA—Fault Tree Analysis
GHG—Greenhouse Gas
$GtCO_{2eq}$—Gigatonnes of Carbon Dioxide Equivalent
GWP—Global Warming Potential
GVWR—Gross Vehicle Weight Rating
HBFC—Hydrobromofluorocarbon
HC—Hydrocarbon
HCFC—Hydrochlorofluorocarbon
HD—Heavy-Duty
HD GHG—Heavy-Duty Greenhouse Gas
HF—Hydrogen Fluoride
HFC—Hydrofluorocarbon
HFO—Hydrofluoroolefin
HTOC—Halons Technical Options Committee
ICAO— International Civil Aviation Organization
ICF—ICF International, Inc.
IGSD—Institute for Governance and Sustainable Development
IEC—International Electrochemical Commission
IPCC—Intergovernmental Panel on Climate Change
IPR—Industrial Process Refrigeration
kPa—Kilopascal
LD—Light-Duty
LD GHG—Light-Duty Greenhouse Gas
LFL—Lower Flammability Limit
LOAEL—Lowest Observed Adverse Effect Level
LPG—Liquified Petroleum Gas
MAC Directive—Directive on Mobile Air Conditioning
MDPV—Medium-Duty Passenger Vehicle
MIR—Maximum Incremental Reactivity
$MMTCO_2eq$—Million Metric Tons of Carbon Dioxide Equivalent
MSDS—Material Safety Data Sheet
MVAC—Motor Vehicle Air Conditioning
MY—Model Year
N_2O—Nitrous Oxide
NAAQS—National Ambient Air Quality Standards
NADA—National Automobile Dealers Association
NAICS—North American Industrial Classification System
NESHAP—National Emission Standards for Hazardous Air Pollutants
NFPA—National Fire Protection Association
NHTSA—National Highway Traffic Safety Administration
NIK—Not-In-Kind
NIOSH—United States National Institute for Occupational Safety and Health
NPRM—Notice of Proposed Rulemaking
NRDC—Natural Resources Defense Council
NSF—National Sanitation Foundation
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
PMS—Pantone Matching System
ppb—Parts Per Billion
PPE—Personal Protective Equipment
ppm—Parts Per Million
PSM—Process Safety Management
PTAC—Packaged Terminal Air Conditioners
PTHP—Packaged Terminal Heat Pumps
PU—Polyurethane
RCRA—Resource Conservation and Recovery Act
REL—Recommended Exposure Limit
RfC—Reference Concentration
RMP—Risk Management Plan
RSES—Refrigeration Service Engineers Society
RTOC—Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee
SARPS—Standards and Recommended Practices
SIP—State Implementation Plan
SAE ICCC—SAE International's Interior Climate Control Committee
SAP—Scientific Assessment Panel

SF_6—Sulfur Hexafluoride
SNAP—Significant New Alternatives Policy
SRES—Special Report on Emissions Scenarios
STEL—Short-term Exposure Limit
SUV—Sport Utility Vehicles
TEAP—Technical and Economic Assessment Panel
TFA—Trifluoroacetic Acid
TLV—Threshold Limit Value
TWA—Time Weighted Average
UL—Underwriters Laboratories, Inc.
UMRA—Unfunded Mandates Reform Act
UNEP—United Nations Environmental Programme
VOC—Volatile Organic Compounds
WEEL—Workplace Environmental Exposure Limit

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 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 (CFC), halon, carbon tetrachloride, methyl chloroform, methyl bromide, hydrobromofluorocarbon (HBFC), and chlorobromomethane) or class II hydrochlorofluorocarbon (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/substitutes-sector* 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 13044) 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 include the following: Refrigeration and AC; 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 listed above 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,[8] it may also apply to importers, formulators, equipment manufacturers, or end users [9] when they are responsible for introducing a substitute into interstate 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.[10] 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 sector end-uses 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 them to the list of unacceptable substitutes.[11]

[8] 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.

[9] 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.

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

[11] 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 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.

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 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 CAA section 612 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 generally requires a user of a substitute subject to narrowed use limits to demonstrate that no other acceptable substitutes are available for their specific application.[12] 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 CAA section 612 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 [13] 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 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 13044; 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 (ODP) 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 one substitute for each end-use, and does not intend to restrict substitutes on the market unless a substitute has been proposed or is being used that is clearly more harmful to human health or the environment than other 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, subject 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 Web site, *www.epa.gov/ozone/snap*.

• *Do not endorse products manufactured by specific companies*

[12] In the case of the July 20, 2015, final rule, EPA established narrowed use limits for certain substitutes over a limited period of time for specific MVAC and foam applications, on the basis that other acceptable alternatives would not be available for those specific applications within broader end-uses, but acceptable alternatives were expected to become available over time, *e.g.,* after military qualification testing for foam blowing agents in military applications or after development of improved servicing infrastructure in a destination country for MVAC in vehicles destined for export.

[13] In addition to acceptable commercially available alternatives, the SNAP program may consider potentially available alternatives. 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)

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 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 ODP 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.,* 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.

EPA's consideration of cost in listing decisions is limited to evaluating the cost of the substitute under review pursuant to section 82.180(a)(7)(vii). This is distinct from consideration of costs associated with the use of other alternatives to which the substitute is being compared. *See Honeywell* v. *EPA,* 374 F.3d 1363 (D.C. Cir. 2004) 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) . . . .'').

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 substitutes, the SNAP criteria continue to be informed by our current overall understanding of environmental and human health impacts and our experience with and current knowledge about alternatives. 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 CAA section 612(e) 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 (59 FR 13044, 13047; March 18, 1994). In determining whether to add or remove a substance from the SNAP lists, we consider whether there are other alternatives 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 that may not have been available at the time of our original listing decision, including information on substitutes that were not included in our comparative review at the time of our initial listing decision 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 13044), CAA section 612 requires EPA to list as unacceptable any substitute substance where it finds that there are other alternatives 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 the comparative risk framework it uses to determine whether there are other alternatives that pose significantly lower risk than the substitute under review. 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. When the SNAP program began, the number of substitutes available for consideration was, for many end-uses, somewhat limited. Thus, 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 EPA listed class II ODS (*i.e.,* HCFCs) as acceptable, recognizing that they too would be phased out and, at best, could offer 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 20 rules and 30 notices that generally expand the menu of options for the various SNAP sectors and end-uses. Thus, comparisons today apply to a broader range of alternatives—both chemical and non-chemical—than at the inception of the SNAP program. Industry experience with these substitutes has also grown during the history of the program.

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 proposed rule includes comparative assessments that consider our evolving understanding of a variety of factors. For example, 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 of information has expanded and the quality has improved.

To the extent possible, EPA's ongoing management of the SNAP program considers new information, including new substitutes, 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. On January 26, 1999, EPA listed the refrigerant blend known by the trade name MT-31 as unacceptable for all refrigeration and AC end-uses for which EPA had previously listed this blend as an acceptable substitute (62 FR 30275; June 3, 1997). EPA based this decision on new information about the toxicity of one of the chemicals in the blend.

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 (72 FR 14432; March 28, 2007). 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 alternatives 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 the number of substitutes was far more limited. In light of the expanded availability of other alternatives 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.

In a final rule published on July 20, 2015 (80 FR 42870), various HFCs and HFC-containing blends that were previously listed as acceptable under the SNAP program were listed as unacceptable in various end-uses in the aerosols, foam blowing, and refrigeration and AC sectors where there are other alternatives that pose lower overall risk to human health and the environment for specific uses. The July 2015 rule also changed the status from acceptable to unacceptable for certain HCFCs being phased out of production under the Montreal Protocol and CAA section 605(a). Per the guiding principles of the SNAP program, the July 2015 rule did not specify that any HFCs or HCFCs are unacceptable across all sectors and end-uses. Instead, in all cases, EPA considered the intersection between the specific substitute and the particular end-use and the availability of substitutes for those particular end-uses when making its determinations.

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 Web site 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 13044), 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 proposed action?

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 66496, the Administrator issued an endangerment finding determining that, for purposes of CAA section 202(a), 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, PFCs, and sulfur hexafluoride (SF_6)—threaten the public health and welfare of current and future generations.[14]

Like the ODS they replace, HFCs are potent GHGs.[15] Although they represent a small fraction of the current total volume of GHG emissions, their warming impact is very strong. While GHGs such as CO_2 and CH_4 are unintentional byproducts from industrial activities and mobile source emissions, HFCs are intentionally produced chemicals.[16] The most commonly used HFC is HFC-134a. HFC-134a is 1,430 times more damaging to the climate system than CO_2. Because of their role in replacing ODS, both in the United States and globally, and because of the increasing use of refrigeration and AC, 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 percent annually.[17] At that rate, emissions are projected to double by 2020 and triple by 2030.[18] HFCs are rapidly accumulating in the atmosphere. The atmospheric concentration of HFC-134a, the most abundant HFC, has increased by about 10 percent per year from 2006 to 2012, and the concentrations of HFC-143a and HFC-125 have risen over 13 percent and 16 percent per year from 2007–2011, respectively.[19]

Annual global emissions of HFCs are projected to rise to about 6.4 to 9.9 gigatons of CO_2 equivalent ($GtCO_2eq$) in 2050,[20] which is comparable to the drop in annual GHG emissions from ODS of 8.0 $GtCO_2eq$ between 1988 and 2010.[21] 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).[22] To appreciate the significance of the effect of projected HFC emissions within the context of all GHGs, HFCs would be equivalent to five to 12 percent of the CO_2 emissions in 2050 based on the IPCC's highest CO_2 emissions scenario and equivalent to 27 to 69 percent of CO_2 emissions based on the IPCC's lowest CO_2 emissions pathway.[23] [24] Additional information concerning the peer-reviewed scientific literature and emission scenarios is available in the docket for this rulemaking (EPA–HQ–OAR–2015–0663). Today's notice of proposed rulemaking (NPRM) includes status change proposals for certain HFCs or HFC blends in specific refrigeration and AC end-uses and in rigid polyurethane spray foam.

PFCs are potent GHGs and have very long atmospheric lifetimes. PFCs are produced as a byproduct of various industrial processes associated with aluminum production and the manufacturing of semiconductors, then captured for intentional use or manufactured for use in various industrial applications. PFCs have had limited use in the eight sectors regulated under SNAP. This action includes status change proposals for certain PFCs in fire suppression total flooding and streaming uses.

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

A. Summary of Petitions

EPA recently received two petitions requesting EPA to modify certain acceptability listings of high-GWP substances in various end-uses. The petitions were both submitted on October 6, 2015. The first was submitted by the Natural Resource Defense Council (NRDC) and the Institute for Governance and Sustainable Development (IGSD) and the second by the Environmental Investigation Agency (EIA).[25] [26] Today's proposal is relevant to certain aspects of these petitions.

The NRDC and IGSD petition requests that EPA change the listing status of certain high-GWP chemicals they believe are used most frequently in the United States in various end-uses in the refrigeration and AC, foam blowing, and fire suppression and explosion protection sectors. The EIA petition requests that EPA list additional high-GWP HFCs as unacceptable or acceptable, subject to use restrictions, in a number of end-uses in the refrigeration and AC, and fire suppression and explosion protection sectors. EIA requests that the schedule for changing the status of the substances listed in their petition be based on a three tiered approach: (1) January 1, 2017, or one year following the passage of a final rule for SF_6, HFC-23, and HFC-23 blends R-508A and R-508B; (2) January 1, 2019, for all chemicals with a GWP greater than 3,000 (*e.g.,* includes HFC-236fa, HFC-227ea, R-507A, and R-404A) in all remaining stationary refrigeration end-uses; and (3) January 1, 2022, for all remaining substitutes with

[14] EPA, 2009a. Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. December, 2009. This document is accessible at: *http://www3.epa.gov/climatechange/Downloads/endangerment/Endangerment_TSD.pdf.*

[15] 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. This document is accessible at: *https://www.ipcc.ch/pdf/special-reports/sroc/sroc_full.pdf.*

[16] *HFC-23 is an exception; it is produced as a byproduct during the production of HCFC-22 and other chemicals.*

[17] UNEP, 2011. HFCs: A Critical Link in Protecting Climate and the Ozone Layer, A UNEP Synthesis Report. November, 2011. This document is accessible at: *www.unep.org/dewa/portals/67/pdf/HFC_report.pdf.*

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

[19] Montzka, 2012. HFCs in the Atmosphere: Concentrations, Emissions and Impacts. ASHRAE/NIST Conference 2012. This document is accessible at: *ftp://ftp.cmdl.noaa.gov/hats/papers/montzka/2012_pubs/Montzka_ASHRAE_2012.pdf.*

[20] 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.

[21] UNEP, 2011. HFCs: A Critical Link in Protecting Climate and the Ozone Layer, A UNEP Synthesis Report. November, 2011. This document is accessible at: *www.unep.org/dewa/portals/67/pdf/HFC_report.pdf.*

[22] Ibid.

[23] Ibid.

[24] 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. This document is accessible at: *http://www.ipcc.ch/report/ar5/wg1/*.

[25] NRDC/IGSD, 2015. Petition for Change of Status of HFCs under Clean Air Act Section 612 (Significant New Alternatives Policy). Submitted October 6, 2015.

[26] EIA, 2015. Petition requesting EPA to modify the status under the Significant New Alternatives Policy Program, of certain high-GWP chemicals in various end-uses. Submitted October 6, 2015.

GWPs higher than 1,000, including HFC-134a, R-410A. In support of their petitions, the petitioners identified other alternatives they claimed are available for use in the specified end-uses. NRDC and IGSD stated that these other alternatives ''possess similar thermodynamic characteristics'' and ''can achieve equal or greater energy efficiency in hardware design'' compared to the substances they request the Agency list as unacceptable. The petitions are available in the docket for this rulemaking. While EPA has not found these petitions complete at this time, today's proposal addresses certain aspects of the petitions as described in section I.A and further discussed below.

Parts of two other previously submitted SNAP petitions that EPA found to be incomplete are also relevant to this rulemaking. In a petition EIA submitted to EPA on April 26, 2012, 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 any ozone depleting substance in any non-essential uses under EPA's SNAP program.'' Additionally, NRDC, EIA, and IGSD filed a petition on April 27, 2012, requesting that EPA remove HFC-134a from the list of acceptable substitutes in household refrigerators and freezers, and stand-alone retail food refrigerators and freezers, among other things. On August 7, 2013, EPA found both petitions to be incomplete.

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 proposed rule is also consistent with that call for leadership through domestic actions. As regards international leadership, for the past six 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 are estimated to yield significant reductions in emissions of over 90 $GtCO_2eq$ through 2050.

This action also addresses certain aspects of the various petitions referred to above in section IV.A. While the two recent petitions have not been found complete and earlier petitions have been found incomplete, EPA possesses sufficient information to propose action on some of the end-uses covered by the petitions. EPA's action is responsive to certain aspects of the petitions that relate to the refrigeration and AC, foam blowing, and fire suppression and explosion protection sectors; EPA is proposing to change the listing from acceptable to unacceptable for:

- HFC-134a in new centrifugal chillers, new positive displacement chillers, new household refrigerators and freezers, and rigid PU spray foam;
- R-404A, R-410A, R-410B, and R-507A in new centrifugal chillers, new positive displacement chillers, new household refrigerators and freezers, and new cold storage warehouses;
- R-407A in new cold storage warehouses;
- R-421A, R-422B, R-422C, R-422D, R-424A, and R-434A in new centrifugal chillers and new positive displacement chillers;
- HFC-227ea in new cold storage warehouses, new centrifugal chillers, and new positive displacement chillers;
- HFC-245fa, HFC-365mfc, and HFC-227ea in rigid PU spray foam;
- HFC-245fa and HFC-227ea in new centrifugal chillers and new positive displacement chillers;
- PFCs (*i.e.,* C_3F_8 and C_4F_{10},) for total flooding applications; and
- a number of refrigerant blends with higher GWPs in certain new refrigeration and AC equipment.

EPA is also requesting comment and updated information on total flooding uses of SF_6 HFC-23, and HFC-125, and on both total flooding and streaming uses of HFC-227ea.

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. As noted above, some of the key strengths of the SNAP program, such as its substance and end-use specific consideration, its multi-criteria basis for action, and its petition process, tend to militate against measures some have advocated could provide more certainty, such as setting specific numerical criteria for environmental evaluations (*e.g.,* all compounds with GWP greater than 150). That said, we believe that the action we are taking today 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. How does EPA regulate substitute refrigerants under CAA section 608?

A. What are the statutory requirements concerning venting, release, or disposal of refrigerants and refrigerant substitutes under CAA section 608?

The statutory requirements concerning venting, release, or disposal of refrigerants and refrigerant substitutes are under CAA section 608, and EPA's authority to promulgate the regulatory revisions in this action is based in part on CAA section 608. Section 608 of the Act as amended, titled *National Recycling and Emission Reduction Program,* requires, among other things, that EPA establish regulations governing the use and disposal of ODS used as refrigerants, such as certain CFCs and HCFCs, during the service, repair, or disposal of appliances and industrial process refrigeration (IPR). Section 608(c)(1) provides that it is unlawful for any person, in the course of maintaining, servicing, repairing, or disposing of an appliance (or IPR), to knowingly vent, or otherwise knowingly release or dispose of, any class I or class II substance used as a refrigerant in that appliance (or IPR) in a manner which permits the ODS to enter the environment.

Section 608(c)(1) further exempts from this self-effectuating prohibition *de minimis* releases associated with good faith attempts to recapture and recycle or safely dispose of such a substance. EPA, as set forth in its regulations, interprets releases to meet the criteria for exempted *de minimis* releases if they occur when the recycling and recovery requirements of specified regulations promulgated under sections 608 and 609 are followed. 40 CFR 82.154(a)(2).

Section 608(c)(2) extends the prohibition in section 608(c)(1) to knowingly venting or otherwise knowingly releasing or disposing of any refrigerant substitute for class I or class II substances by any person maintaining, servicing, repairing, or disposing of appliances or IPR. This prohibition applies to any substitute unless the Administrator determines that such venting, releasing, or disposing does not pose a threat to the

environment. Thus, section 608(c) provides EPA authority to promulgate regulations to interpret, implement, and enforce this prohibition on venting, releasing, or disposing of class I or class II substances and their refrigerant substitutes, which we refer to as the ''venting prohibition'' in this action. EPA's authority under section 608(c) includes authority to implement section 608(c)(2) by exempting certain substitutes for class I or class II substances from the venting prohibition when the Administrator determines that such venting, release, or disposal does not pose a threat to the environment.

B. What are EPA's regulations concerning venting, releasing, or disposal of refrigerant substitutes?

Regulations promulgated under CAA section 608, published on May 14, 1993 (58 FR 28660), established a recycling program for ozone-depleting refrigerants recovered during the servicing and maintenance of refrigeration and AC appliances. In the same 1993 rule, EPA also promulgated regulations implementing the section 608(c) prohibition on knowingly venting, releasing, or disposing of class I or class II controlled substances. These regulations were designed to substantially reduce the use and emissions of ozone-depleting refrigerants.

EPA issued a final rule on March 12, 2004 (69 FR 11946) and a second rule on April 13, 2005 (70 FR 19273) clarifying how the venting prohibition in section 608(c) applies to substitutes for CFC and HCFC refrigerants (*e.g.,* HFCs and PFCs) during the maintenance, service, repair, or disposal of appliances. These regulations are codified at 40 CFR part 82, subpart F. In relevant part, they provide that no person maintaining, servicing, repairing, or disposing of appliances may knowingly vent or otherwise release into the environment any refrigerant or substitute from such appliances, with the exception of the certain specified substitutes in the specified end-uses, as provided in 40 CFR 82.154(a).

As explained in an earlier EPA rulemaking concerning refrigerant substitutes, EPA has not promulgated regulations requiring certification of refrigerant recycling/recovery equipment intended for use with substitutes to date (70 FR 19275; April 13, 2005). The Agency has recently proposed, but not yet finalized, regulations to address certification of such equipment used to recover and/or recycle refrigerants that are not exempt from the venting prohibition (80 FR 69458; November 9, 2015). However, as EPA has noted, the lack of a current regulatory provision should not be considered as an exemption from the venting prohibition for substitutes that are not expressly exempted in § 82.154(a) (80 FR 69466, 69478). EPA has also noted that, in accordance with section 608(c) of the Act, the regulatory prohibition at § 82.154(a) reflects the statutory references to *de minimis* releases of substitutes as they pertain to good faith attempts to recover and recycle or safely dispose of non-exempted substitutes but does not provide clear guidance about what constitutes such a ''good faith attempt'' for substitutes. (80 FR 69470).

On May 23, 2014 (79 FR 29682), EPA exempted from the venting prohibition three HC refrigerant substitutes listed as acceptable, subject to use conditions, in the specified end-uses: Isobutane and R-441A, as refrigerant substitutes in household refrigerators, freezers, and combination refrigerators and freezers; and propane as a refrigerant substitute in retail food refrigerators and freezers (stand-alone units only). Similarly, on April 10, 2015 (80 FR 19453), EPA exempted from the venting prohibition four HC refrigerant substitutes listed as acceptable, subject to use conditions, in the specified end-uses: Isobutane and R-441A, in retail food refrigerators and freezers (stand-alone units only); propane in household refrigerators, freezers, and combination refrigerators and freezers; ethane in very low temperature refrigeration equipment and equipment for non-mechanical heat transfer; R-441A, propane, and isobutane in vending machines; and propane and R-441A in self-contained room air conditioners for residential and light commercial AC and heat pumps. Those regulatory exemptions do not apply to blends of HCs with other refrigerants or containing any amount of any CFC, HCFC, HFC, or PFC.

In those actions, EPA determined that for the purposes of CAA section 608(c)(2), the venting, release, or disposal of such HC refrigerant substitutes in the specified end-uses does not pose a threat to the environment, considering both the inherent characteristics of these substances and the limited quantities used in the relevant applications. EPA further concluded that other authorities, controls, or practices that apply to such refrigerant substitutes help to mitigate environmental risk from the release of those HC refrigerant substitutes.

C. What did EPA recently propose regarding management of refrigerant substitutes under CAA section 608?

In addition to the prohibition on knowingly releasing ozone-depleting and substitute refrigerants during the maintenance, service, repair, and disposal of appliances, the existing regulations established under CAA section 608 require that persons servicing or disposing of air-conditioning and refrigeration equipment observe certain service practices that reduce emissions of ozone-depleting refrigerant. The current regulatory provisions only apply to ozone-depleting refrigerants and appliances containing ozone-depleting refrigerants. The current requirements include: Requiring that technicians be certified to work on appliances; restricting the sale of refrigerant to certified technicians; specifying the proper evacuation levels before opening up an appliance; requiring the use of certified refrigerant recovery and/or recycling equipment; requiring the maintenance and repair of appliances that meet certain size and leak rate thresholds; requiring that refrigerants be removed from appliances prior to disposal; requiring that air-conditioning and refrigeration equipment be provided with a servicing aperture or process stub to facilitate refrigerant recovery; requiring that refrigerant reclaimers be certified in order to reclaim and sell used refrigerant; and establishing standards for technician certification programs, recovery equipment, and quality of reclaimed refrigerant.

On November 9, 2015 (80 FR 69457), EPA proposed to update these existing requirements found in 40 CFR part 82, subpart F that currently apply to ozone-depleting refrigerants and then to generally extend those requirements, as appropriate, to non-ozone-depleting substitute refrigerants, including but not limited to HFCs and PFCs. However, as proposed, the rule requirements would not extend to substitute refrigerants that are exempt from the venting prohibition. This proposed rule would also streamline the regulations at 40 CFR part 82, subpart F to improve clarity. For more information on this proposed rule, see docket EPA–HQ–OAR–2015–0453.

VI. What is EPA proposing in this action?

EPA is proposing to list certain newly submitted alternatives as acceptable, subject to use conditions, and other newly submitted alternatives as unacceptable. EPA is also proposing to modify the listings from acceptable to

acceptable, subject to narrowed use limits, or to unacceptable for certain alternatives in various end-uses in the refrigeration and AC, foam blowing, and fire suppression and explosion protection sectors. In each instance where EPA is proposing to list a newly submitted substitute as unacceptable or is changing the status of a substitute from acceptable to unacceptable, EPA has determined that there are other alternatives that pose lower overall risk to human health and the environment. EPA is also proposing that the existing listing decisions for foam blowing agents apply to closed cell foam products and products containing closed cell foam. See section VI.C.3 for the details of this proposal. The emissions that would be avoided from the proposed changes of status in this action are estimated to be approximately 5.5 to 6.6 $MMTCO_2eq$ in 2025 and approximately 9.8 to 11.3 $MMTCO_2eq$ in 2030.[27]

In each listing decision, EPA is considering the intersection between the specific alternative and the particular end-use, per the guiding principles stated above. This action does not propose that any specific alternative is acceptable or unacceptable across all sectors and end-uses. EPA is also not proposing that, for any specific sector, the only acceptable substitutes are non-fluorinated. EPA recognizes that both fluorinated (*e.g.,* HFCs, HFOs) and non-fluorinated (*e.g.,* HCs, CO_2) substitutes may pose lower overall risk to human health and the environment, depending on the particular use.

Change of Listing Status

In determining whether to modify the previous listing decisions for substitutes based on whether other alternatives are available that pose lower risk to human health and the environment, we considered, 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, the regulations and supporting dockets for other EPA rulemakings, presentations and reports presented at domestic and international conferences, and materials from trade associations and professional organizations. The materials on which we have relied may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663). Key references are highlighted in section VIII of today's notice.

Change of Status Dates

Here, as in the July 20, 2015, final rule, the proposed change of status dates are based upon EPA's understanding of the availability of alternatives, considering factors such as commercial availability and supply of alternatives, time required to work through technical challenges with using alternatives, and time required to meet other federal regulatory requirements with redesigned equipment or formulations.

Consideration of Costs and Benefits

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. EPA requires information on cost and availability of substitutes as part of SNAP submissions in order to judge how widely a substitute might be used, and therefore, what its potential environmental and health effects might be. The SNAP criteria do not identify other cost considerations and thus we have not historically used cost information independent of environmental and health effects to determine the acceptability of substitutes under review—that is, we have never determined a substitute under review to be unacceptable or acceptable on the basis of its cost. When considering a change of status for substitutes already listed as acceptable, the SNAP program has not considered the costs of transition away from HFCs, HFC blends, PFCs, and other alternatives affected by the changes of status as part of determining the status of the substitute or the availability of other alternatives for the same uses.

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.

Nevertheless, EPA has estimated the costs of the proposed changes of status in this action in order to provide information to the public and to meet various statutory and executive order requirements. We have estimated costs [28] for applicable NAICS codes in a document titled, ''Preliminary Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression.'' [29] Total annualized compliance costs across affected small businesses are estimated at approximately $11.8–$14.4 million at a 7% discount rate, or $11.5–$14.0 million at a 3% discount rate. The screening analysis finds that the rulemaking can be presumed to have no significant economic impact on a substantial number of small entities (SISNOSE) for the following reasons: roughly 89 small businesses could be subject to the rulemaking, although roughly 76% of small businesses subject to this rulemaking would be expected to incur compliance costs that are estimated to be less than one percent of annual sales; and this analysis indicates that up to 21 of the 89 affected small businesses—or roughly 24%—could incur costs in excess of 1% of annual sales, and that up to 12 small businesses could incur costs in excess of three percent of annual sales.

In addition, we have analyzed costs and impacts on small businesses in a document titled, ''Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression.'' [30] These analyses are available in the docket for this rulemaking (EPA–HQ–OAR–2015–0663). Based upon these analyses, EPA does not expect this proposed rule to have major economic impacts (greater than $100 million per year) or to have a significant impact on a substantial number of small entities, if it is finalized as proposed. In addition, we have analyzed costs and impacts on small businesses in a document titled, ''Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression.[31] Based upon these analyses, EPA does not

[27] EPA, 2016. Draft Climate Benefits of the SNAP Program Status Change Rule. February, 2016.

[28] Using a 7% discount rate, total annualized compliance costs across the roughly 100 affected businesses are estimated to range from $59.2 million–$71.3 million. Using a 3% discount rate, total annualized compliance costs are estimated to range from $58.8 million–$70.6 million. In terms of the percentage of the estimated total annualized costs by sectors: Refrigeration and air conditioning is about 97–98%, foams is about 2–3% and fire suppression is about 0%.

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

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

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

expect this proposed rule to have major economic impacts (greater than $100 million per year) or to have a significant impact on a substantial number of small entities, if it is finalized as proposed. As noted, EPA's consideration of cost in listing decisions is limited to evaluating the cost of the substitute under review pursuant to § 82.180(a)(7)(vii). However, for purposes of ensuring that the cost analysis EPA prepared for purposes of providing information to the public and complying with statutory and executive order requirements is as accurate as possible, EPA requests comment on the preliminary cost analysis and the economic impact screening analysis for purposes of updating the analysis. These analyses are available in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

The refrigeration and air conditioning and fire suppression end-uses that would be affected by this proposed rule were not affected by the changes of status promulgated in the July 20, 2015, final rule. For the foams sector, the rigid PU spray foam end-use was not affected by the changes of status in the July 20, 2015, final rule. For some other foam end uses, we changed the status in the July 20, 2015, final rule with respect to use of the blowing agent and are now proposing to change the status with respect to use of closed cell foam products and products containing closed cell foam that are manufactured or imported using these foam-blowing agents.

Narrowed Use Limits

EPA notes that it may be reasonable for several of the end-uses to be broken down further. Consistent with previous practice and as EPA is proposing in certain instances in this proposal, EPA could consider adopting narrowed use limits. We could also consider adopting temporary narrowed use limits for a specific application within an end-use if the Agency determined that substitutes would be available for all but that specific application as of a particular date. In that case, for applications in that end-use not covered by the narrowed use limit, the proposed rule would list the substitute as unacceptable as of that date. For the specific application at issue, the proposed rule could contain both a temporary narrowed use limit with an expiration date and a listing as unacceptable upon the expiration of the narrowed use limit. Any end user within the covered application would need to comply with the requirement to analyze and document that there are no other alternatives that are technically feasible for their specific end-use in order to use the substitute identified in the narrowed use limit.

Requests for Comment

EPA requests comment on all aspects of this proposal, including proposed decisions to list additional substitutes as acceptable in certain end uses, to list new substitutes as unacceptable in certain end uses and to change the listing status of certain substitutes from acceptable to unacceptable, subject to narrowed use limits or unacceptable, and the dates when the change of status would apply to users of these substitutes. EPA is particularly interested in information concerning whether the supply of substitutes is sufficient to meet the dates proposed in this action or whether there are technical challenges in meeting a proposed change of status date. EPA is also interested in whether EPA should adopt a temporary narrowed use limit for a specific application of an end-use in the final rule. In such a case, the commenter should explain why other alternatives would not be available for the specific application of that end-use and for what period of time. EPA is also requesting comments on the determination that the SNAP listing decisions for foam blowing agents would apply to closed cell foam products and products containing closed cell foam that are manufactured or imported after one year after publication of a final rule. In addition, EPA is requesting comments on its proposed decision regarding the venting prohibition under section 608. More specific requests for comment are included with the discussion of each of the proposed decisions.

A. Retail Food Refrigeration and Stationary AC

1. Proposed Listing of Propane as Acceptable, Subject to Use Conditions, for Commercial Ice Machines, Water Coolers, and Very Low Temperature Refrigeration Equipment

EPA is proposing to list propane (R-290) as acceptable, subject to use conditions, as a refrigerant in new self-contained commercial ice machines, in new water coolers, and in new very low temperature refrigeration equipment. The proposed use conditions include conditions requiring conformity with industry standards, limits on charge size, and requirements for warnings and markings on equipment. The use conditions are detailed below in section VI.A.1.c, ''What are the proposed use conditions?''

a. What are the affected end-uses?

Commercial ice machines are used in commercial establishments to produce ice for consumer use, such as in hotels, restaurants, and convenience stores. Many commercial ice machines are self-contained units, while some have the condenser separated from the portion of the machine making the ice and have refrigerant lines running between the two. The proposed listing applies only to self-contained commercial ice machines.

Water coolers are self-contained units providing chilled water for drinking. They may or may not feature detachable containers of water.

Very low temperature refrigeration equipment is intended to maintain temperatures considerably lower than for refrigeration of food—generally, −80 °C (−170 °F) or lower. In some cases, very low temperature refrigeration equipment may use a refrigeration system with two refrigerant loops containing different refrigerants or with a direct expansion (DX) refrigeration loop coupled with an alternative refrigeration technology (*e.g.,* Stirling cycle).

b. How does propane compare to other refrigerants for these end-uses with respect to SNAP criteria?

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks (*e.g.,* flammability, exposure, and toxicity) are discussed below. In addition, a technical support document [32] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives in the relevant end-uses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

i. Environmental Impacts

The ODP is the ratio of the impact on stratospheric ozone of a substance compared to the impact of an identical mass of CFC-11. Thus, the ODP of CFC-11 is defined to be one. Other ODS have ODPs that range from 0.01 to 10.0.

[32] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

Propane has an ODP of zero.[33] The most commonly used substitutes in the commercial ice machine, water cooler, and very low temperature refrigeration end-uses also have an ODP of zero (*e.g.,* R-404A and R-134a). Some less common alternatives for these end-uses, such as R-401A, R-403B, R-414A and other blends containing HCFC-22 or HCFC-142b,[34] have ODPs ranging from 0.01 to 0.047. Thus, propane has an ODP lower than or identical to the ODPs of other alternatives in these end-uses.[35]

The GWP is a means of quantifying the potential integrated climate forcing of various greenhouse gases relative to a value of one for CO_2. Propane has a relatively low integrated GWP of three.[36] For comparison, some other commonly used acceptable refrigerants in these end-uses are R-134a and R-404A, with GWPs of about 1,430 and 3,920, respectively. As shown in Table 2, the GWPs for acceptable refrigerants in commercial ice machines ranges from zero for ammonia vapor compression, ammonia absorption, and the not-in-kind Stirling cycle technology to approximately 3,990 for R-507A, while for water coolers, acceptable substitutes have GWPs ranging from 31 for THR-02 to approximately 3,990 for R-507A.[37] In very low temperature refrigeration, a common refrigerant is R-508B, with a GWP of 13,400, while the recently listed refrigerant ethane has a GWP of approximately six and CO_2 has a GWP of one; the GWPs for substitutes in this end-use range from one for CO_2 to 14,800 for HFC-23. Propane's GWP is comparable to or significantly lower than those of other alternatives in these end-uses.

TABLE 2—GWP, ODP, AND VOC STATUS OF PROPANE COMPARED TO OTHER REFRIGERANTS IN NEW COMMERCIAL ICE MACHINES, WATER COOLERS, AND VERY LOW TEMPERATURE REFRIGERATION EQUIPMENT [1] [2] [3]

Refrigerants	GWP	ODP	VOC	Proposal
Propane	3	0	Yes	Acceptable, subject to use conditions.
Commercial Ice Machines				
Ammonia, HFC-134a, R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-421A, R-421B, R-424A, R-426A, R-437A, R-448A, R-449A, R-450A, R-507A, R-513A.	0–3,990	0	No	No change.
FOR12A, FOR12B, FRIGC FR-12 (HCFC Blend Beta), IKON A, IKON B, R-125/R-290/R-134a/R-600a (55.0/1.0/42.5/1.5), 417A, R-422A, R-422B, R-422C, R-422D, 428A, R-434A, R-438A, RS-24 (2002 formulation), RS-44 (2003 formulation), THR-02, THR-03.	30–3,610	0–0.009	Yes [3]	No change.
Water Coolers				
HFC-134a, R-404A, R-407A, R-407C, R-410A, R-410B, R-417A, R-421A, R-426A, R-437A, R-450A, R-507A, R-513A.	0–3,990	0	No	No change.
FOR12A, FOR-12B, FRIGC FR-12 (HCFC Blend Beta), IKON B, R-125/R-290/R-134a/R-600a (55.0/1.0/42.5/1.5), R-422B, R-422C, R-422D, R-438A, RS-24 (2002 formulation), SP34E, THR-02, THR-04.	30–3,090	0–0.009	Yes [3]	No change.
Very Low Temperature Refrigeration Equipment				
CO2, HFC-23, HFC-245fa, HFE-7000, HFE-7100, HFE-7200, R-170 (ethane), R-404A, R-407C, R-410A, R-410B, R-507A, R-508A, R-508B.	1–14,800	0	No	No change.
ISCEON 89, R-125/R-290/R-134a/R-600a (55.0/1.0/42.5/1.5), R-422B, R-422C, PFC-1102HC, PFC-662HC, PFC-552HC, and FLC-15.	2,530–8,500	0	Yes [3]	No change.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-use.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] One or more constituents of the blend are VOC.

The overall GHG effects of these refrigerants in various end-uses depend upon the design of the appliances, since the ''indirect'' GHG emissions associated with electricity consumption typically exceed the GHG emissions from the refrigerants over the full lifecycle of refrigerant-containing products.[38] These indirect emissions

[33] We assume that substitutes containing no chlorine, bromine, or iodine have an ODP of zero.

[34] Under EPA's phaseout regulations, virgin HCFC-22, HCFC-142b, and blends containing HCFC-22 or HCFC-142b may only be used to service existing appliances. Consequently, virgin HCFC-22, HCFC-142b and blends containing HCFC-22 or HCFC-142b may not be used to manufacture new pre-charged appliances or appliance components or to charge new appliances assembled onsite.

[35] Propane's ODP is also lower than the ODP of the ozone depleting substances historically used in these end-uses: CFC-12 (ODP = 1.0); HCFC-22 (ODP = 0.055); R-13B1 (ODP = 10) and R-502 (ODP = 0.334).

[36] Unless otherwise stated, GWPs stated in this document are 100-year integrated time horizon values taken from IPCC, 2007. Climate Change 2007: The Physical Science Basis.

[37] The GWPs of the ozone-depleting substances historically used in these end-uses are: CFC-12 (GWP = 10,900); HCFC-22 (GWP = 1,810); R-13B1/halon 1301 (GWP = 7,140) and R-502 (GWP = 4,660).

[38] RTOC, 2015. 2014 Report of the Refrigeration, Air-Conditioning and Heat Pumps Technical

Continued

occur from combustion of fossil fuel at power plants in order to supply electric power for operation of the refrigeration equipment. 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 Department of Energy (DOE) conservation standards) in determining whether alternatives are ''available.'' We recognize that the energy efficiency of any given piece of equipment is in part affected by the choice of refrigerant and the particular thermodynamic and thermophysical properties that refrigerant possesses, as well as other factors. For example, appliances that are optimized for a specific refrigerant will operate more efficiently. 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 in operation. Although we cannot know what energy efficiency will be achieved in future products using propane, or any other specific acceptable refrigerant, we can point to both actual equipment and testing results that suggest that equipment optimized for propane may improve energy efficiency, and is unlikely to negatively impact it.[39] [40] [41] Further, testing data, peer-reviewed journal articles and other information provided by the submitters for propane in the proposed end-uses indicate that equipment using propane is likely to require a smaller refrigerant charge, to have a higher coefficient of performance, and to use less energy than equipment currently being manufactured that uses other refrigerants that currently are listed as acceptable under SNAP in these end-uses. Also see section VI.A.1.f below concerning the role of the DOE energy conservation standards in ensuring that overall energy efficiency of equipment will be maintained or improved over time.

In addition to global impacts on the atmosphere, EPA evaluated potential impacts of propane and other HC refrigerants on local air quality. Propane is a 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 (NAAQS). Potential emissions of VOC from all substitutes for all end-uses in the refrigeration and AC sector are addressed by the venting prohibition under CAA section 608. Under that prohibition, refrigerant substitutes (and thus the VOC they contain) may only be emitted where EPA issues a final determination exempting a refrigerant substitute from the venting prohibition on the basis that venting, releasing or disposing of such substance does not pose a threat to the environment, as proposed elsewhere in this action (see section VI.A.2.a, ''What is EPA's proposal regarding whether venting of propane in the end-uses in this action would pose a threat to the environment?'' below). EPA estimates that potential emissions of HCs, including propane, when used as refrigerant substitutes in all end-uses in the refrigeration and AC sector, have little impact on local air quality, with the exception of unsaturated HCs such as propylene.[42]

EPA analyzed a number of scenarios to consider the potential impacts on local air quality if HC refrigerants were used widely.[43] The analysis considered both worst-case and more realistic scenarios. The worst-case scenario assumed that the most reactive HC listed as acceptable (isobutane) was used in all refrigeration and AC uses even though isobutane has not been listed acceptable for use in all refrigeration and AC uses, and that all refrigerant used was emitted to the atmosphere. In that extreme scenario, the model predicted that the maximum increase in any single 8-hour average ground-level ozone concentration would be 0.72 ppb in Los Angeles, which is the area with the highest level of ozone pollution in the United States. Given the potential sources of uncertainty in the modeling, the conservativeness of the assumptions, and the finding that the incremental VOC emissions from refrigerant emissions would not cause any area that otherwise would meet the 2008 ozone NAAQS to exceed it,[44] we believe that the use of isobutane consistent with the use conditions required in EPA's regulations will not result in significantly greater risk to the environment than other alternatives. Further, propane is less reactive than isobutane and thus we reach a similar conclusion for propane.

In a less conservative analysis potential impacts on ambient ozone levels, EPA looked at a set of end-uses that would be more likely to use HC refrigerants between now and 2030, including end-uses where they previously have been listed as acceptable and where they are proposed to be acceptable under this rule. For example, we assumed use of propane in water coolers and commercial ice machines and in end-uses where it is listed as acceptable, including room air conditioners and household and retail food refrigeration equipment and we assumed the use of other HCs such as isobutane in household and retail food refrigeration equipment and R-441A in room air conditioners and household and retail food refrigeration equipment. For further information on the specific assumptions, see the docket for this rulemaking.[45] Based on this still conservative but more probable assessment of refrigerant use, we found that even if all the refrigerant in appliances in end-uses addressed in this proposed rule and in appliances in end-uses for which HCs are listed as acceptable were to be emitted, there would be a worst-case impact of a 0.15 ppb increase in ozone for a single 8-hour average concentration in the Los Angeles area, which is the area with the highest level of ozone pollution in the United States.[46] In the other cities examined in the analysis, Houston and Atlanta, impacts were smaller (no more than 0.03 and 0.01 ppb for a single 8-hour average concentration, respectively).[47] For areas in the analysis that were not violating the 2008 ozone NAAQS, the impacts did not cause an exceedance of the 2008 ozone NAAQS.

Because of the relatively low air quality impacts of propane if it is

Options Committee. This document is accessible at: *http://ozone.unep.org/sites/ozone/files/documents/RTOC-Assessment-Report-2014.pdf.*

[39] Eppendorf, 2015. SNAP Information Notice for R-170 and R-290 in Very Low Temperature Refrigeration. May, 2015.

[40] Manitowoc, 2015. SNAP Information Notice, September, 2013. EPA SNAP Submittal—Revision to Extend R-290 Use to Commercial Ice Machines, Manitowoc Ice, Inc. October, 2015.

[41] Blupura, 2015. SNAP Information Notice for R-290 in Water Coolers. October, 2015.

[42] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

[43] Ibid.

[44] The analysis described here was conducted prior to finalization of the 2015 ozone NAAQS. EPA has not yet made ozone attainment area designations for the 2015 ozone NAAQS.

[45] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

[46] This less conservative analysis included some use of R-443A in room AC units because that substitute was under evaluation for that end-use. Elsewhere in this proposal, we propose to find R-443A and propylene unacceptable in residential and light-commercial AC and heat pumps, including room AC units. The propylene in R-443A, representing 12 percent of refrigerant emitted, was responsible for about 75 percent of the 0.15 ppb increase in ozone in this scenario, while all uses of propane, representing 83 percent of refrigerant emitted, was responsible for about 21 percent of the increase of ozone in this scenario. Thus, only 0.03 ppb of the o.15 ppb observed in Los Angeles would be due to propane and other acceptable HCs.

[47] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

released to the atmosphere from the proposed end-uses even in a worst-case scenario, we propose that propane does not have a significantly greater overall impact on human health and the environment based on its effects on local air quality than other refrigerants listed as acceptable in commercial ice machines, water coolers, and very low temperature refrigeration equipment.

Propane is highly volatile and typically evaporates or partitions to air, rather than contaminating surface waters. Propane's effects on aquatic life are expected to be small and pose no greater risk of aquatic or ecosystem effects than those of other alternatives for these uses.

ii. Flammability

Propane's flammability risks are of potential concern because commercial ice machines, water coolers, and very low temperature refrigeration equipment have traditionally used refrigerants that are not flammable. Without appropriate use conditions, the flammability risk posed by propane would be higher than non-flammable refrigerants because individuals may not be aware that their actions could potentially cause a fire. In this section, we discuss the flammability risks posed by propane and identify proposed use conditions that would mitigate those risks such that propane would not pose significantly greater risk due to flammability than other substitutes in these end-uses.

Because of its flammability, propane could pose a significant safety concern for workers and consumers in the end-uses addressed in this proposal if it is not handled correctly. In the presence of an ignition source (*e.g.,* static electricity spark resulting from closing a door, use of a torch during service, or a short circuit in wiring that controls the motor of a compressor), an explosion or a fire could occur when the concentration of refrigerant exceeds its lower flammability limit (LFL). Propane's LFL is 21,000 ppm (2.1%). Therefore, to use propane safely, it is important to minimize the presence of potential ignition sources and to reduce the likelihood that the concentration of propane will exceed the LFL. Under the proposed listing decision, propane would be acceptable for use only in new equipment (self-contained commercial ice machines, water coolers, and very low temperature refrigeration equipment) specifically designed for this refrigerant. OSHA and building code requirements generally address flammability risks in the workplace and we presume that the original equipment manufacturers (OEMs), who would be storing large quantities of the refrigerant, are familiar with and use proper safety precautions to minimize the risk of explosion, consistent with those requirements. Therefore, we are not proposing use conditions to address workplace risk, which would be redundant of already existing requirements. We are proposing, however, to include recommendations in the ''Further Information'' section of the SNAP listings that these facilities be equipped with proper ventilation systems and be properly designed to reduce possible ignition sources.

To determine whether flammability would be a concern for service personnel or for consumers, EPA analyzed a plausible worst-case scenario to model a catastrophic release of propane. The worst-case scenario analysis for water coolers and for very low temperature refrigeration equipment revealed that even if the unit's full charge is emitted within one minute, the leaked refrigerant concentration did not reach propane's LFL of 2.1%, provided that the charge sizes were no greater than those specified in the relevant standard from UL.[48] [49] We are proposing the maximum charge size specified in the standard as a use condition; thus, there would not be an unacceptable risk of fire or explosion, even under those worst-case assumptions, so long as the charge does not exceed the use conditions in this proposed rule. In the case of commercial ice machines, the worst-case scenario with use of a charge size of 150 g and assuming stratification of refrigerant into the bottom 0.4 m of the room resulted in attaining 102 percent of the LFL; less conservative, but reasonable, assumptions (*e.g.,* larger room size, greater mixing of the refrigerant in the entire room, same charge size of 150 g) resulted in concentrations at 18 percent or less of the LFL.[50] Thus, we expect there would not be an unacceptable risk of fire or explosion provided that the charge size is limited to 150 g. EPA also reviewed the submitters' detailed assessments of the probability of events that might create a fire and approaches to avoid sparking from the refrigeration equipment. Further information on these analyses and EPA's risk assessments are available in the docket for this rulemaking (EPA–HQ–OAR–2015–0663). Further, service personnel or consumers may not be familiar with refrigeration or AC equipment containing a flammable refrigerant. Therefore, use conditions are necessary to ensure people handling such equipment are aware that equipment contains a flammable refrigerant and to ensure safe handling.

iii. Toxicity

In evaluating potential toxicity impacts of propane on human health in these end-uses, EPA considered both occupational and consumer risks. In general when evaluating non-cancer toxicity risks of a substitute, we use measured exposure concentrations if available, or modeled exposure concentrations using conservative assumptions appropriate to an end-use, and compare these exposure levels to recommended or required exposure limits for a compound that are intended to protect against adverse health effects. Where measured or modeled exposure levels are below relevant exposure limits for a chemical, we consider toxicity risks to be acceptable. Other acceptable substitutes listed for these end-uses have been evaluated for toxicity in this manner, including ethane for very low temperature refrigeration, ammonia for commercial ice machines, and a number of HFC blends for all three end-uses.

EPA investigated the risk of asphyxiation and of exposure to toxic levels of refrigerant for a worst-case scenario and a typical use. In the worst-case scenario of a catastrophic leak, we modeled release of the unit's full charge within one minute into a confined space to estimate concentrations that might result. We considered a conservatively small space appropriate to each end-use, such as a small galley kitchen of 18 m^3 for a water cooler, a kitchen of a fast food restaurant of 22 m^3 for a commercial ice machine or in a laboratory module of 28 m^3 for very low temperature refrigeration equipment.

To evaluate the toxicity of propane, EPA estimated the maximum time weighted average (TWA) exposure both for a short-term exposure scenario, with a 30-minute TWA exposure, and for an 8-hour TWA that would be more typical of occupational exposure for a technician servicing the equipment or a worker disposing of appliances. We compared these short-term and long-term exposure values to relevant industry and government workplace exposure limits for propane. The modeling results indicate that both the

[48] ICF, 2016c. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Water Coolers Substitute: Propane (R-290).

[49] ICF, 2016d. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Very Low Temperature Refrigeration Substitute: Propane (R-290) and Ethane (R-170).

[50] ICF, 2016e. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Commercial Ice Machines Substitute: Propane (R-290).

short-term (30-minute) and long-term (8-hour) worker exposure concentrations would be below the relevant workplace exposure limits, such as the OSHA PEL of 1000 ppm (8-hr TWA), and the National Research Council's Acute Emergency Guideline Limit Level 1 (AEGL–1) [51] of 6,900 ppm over 30 minutes.

A similar analysis of asphyxiation risks considered whether a worst-case release of refrigerant in the same room sizes would result in oxygen concentrations of 12 percent or less. This analysis found that impacts on oxygen concentrations were minimal, with oxygen concentrations remaining at approximately 21 percent.

For equipment with which consumers might come into contact, such as water coolers and commercial ice machines, EPA performed a consumer exposure analysis. In this analysis, we examined potential catastrophic release of the entire charge of the substitute in one minute under a worst-case scenario. We did not examine exposure to consumers in very low temperature refrigeration, as equipment for this end-use would typically be used in the workplace, such as in laboratories, and not in a home or public space. The analysis was undertaken to determine the 30-minute TWA exposure levels for the substitute, which were then compared to the toxicity limit to assess the risk to consumers.

EPA considered toxicity limits for consumer exposure that reflect a short-term exposure such as might occur at home or in a store or other public setting where a member of the general public could be exposed and could then escape. The toxicity limit that we used in our analysis of consumer exposure was an AEGL–1 of 6,900 ppm over 30 minutes. The analysis of consumer exposure assumed that 100 percent of the unit's charge would be released over one minute, at which time the concentration of refrigerant would peak in an enclosed space, and then steadily decline. Refrigerant concentrations were modeled under two air change scenarios, believed to represent the baseline of potential flow rates for a home or public space, assuming flow rates of 2.3 air changes per hour (ACH) in a household kitchen and 20 ACH in a restaurant kitchen.[52] [53] The highest concentrations of the refrigerant occur in the lower stratum of the room when assuming the lower ventilation level of 2.3 ACH. Calculating the TWA exposure using 2.3 ACH results in a higher concentration than calculating the TWA exposure using 20 ACH. Even under the very conservative assumptions used in the consumer exposure modeling, the estimated 30-minute consumer exposures to propane are lower than the relevant toxicity limits.

Based upon our analysis, workplace and consumer exposure to propane when used in these end-uses according to the proposed use conditions is not expected to exceed relevant exposure limits. Thus, propane does not pose significantly greater toxicity risks to other acceptable refrigerants in these end-uses. For further information, including EPA's risk screens and risk assessments as well as information from the submitters of propane as a substitute refrigerant, see docket EPA–HQ–OAR–2015–0663.

c. What are the proposed use conditions?

In order to ensure that use of propane in these three end-uses would not cause greater risk to human health or the environment than use of other alternatives, we have identified and are proposing use conditions to address flammability and toxicity concerns. The proposed use conditions include conditions consistent with industry standards, limits on charge size, and requirements for warnings and markings on equipment.

i. New Equipment Only; Not Intended for Use as a Retrofit Alternative

EPA is proposing that, in the specified end-uses, propane be limited to use only in new equipment [54] that has been designed and manufactured specifically for use with propane. Propane was not submitted under the SNAP program to be used in retrofitted equipment, and no information was provided on how to mitigate hazards of flammable refrigerants when used in equipment that was not designed for flammable refrigerants. If this use condition is finalized as proposed, use of propane in equipment not designed for its use, including existing equipment designed for another refrigerant, would be in violation of CAA section 612(c) and the corresponding SNAP regulations at 40 CFR part 82, subpart G.

ii. Standards

EPA is proposing that propane be used only in equipment that meets all requirements in the relevant supplements for flammable refrigerants in certain applicable UL standards for refrigeration and AC equipment. Specifically, Supplement SA to the 8th edition of UL 563 standard, dated July 31, 2009, applies to self-contained commercial ice machines using flammable refrigerants; [55] the UL standard for water coolers using flammable refrigerants is Supplement SB to the 7th edition of UL 399, dated August 22, 2008; [56] and very low temperature refrigeration equipment is sufficiently similar to stand-alone commercial refrigerators that an appropriate standard is Supplement SB to the 10th edition of UL 471, dated November 24, 2010.[57]

UL has tested equipment for flammability risk in household and retail food refrigeration and for commercial freezers for very low temperature refrigeration. Further, UL has developed acceptable safety standards including requirements for construction, for markings, and for performance tests concerning refrigerant leakage, ignition of switching components, surface temperature of parts, and component strength after being scratched. These standards were developed in an open and consensus-based approach, with the assistance of experts in the AC and refrigeration industry as well as experts involved in assessing the safety of products. While similar standards exist from other bodies such as the International Electrotechnical Commission (IEC), we

[51] The AEGL limit is an emergency guideline for exposures to the general population (including susceptible populations) and is not time-weighted. It also considers the chemical's flammability in addition to its toxicity. EPA develops a set of AEGL values for a substance for five exposure periods (10 and 30 minutes, 1 hour, 4 hours and 8 hours). For each exposure period, three different AEGL values are developed to address different levels of toxicological impacts. Of relevance for the modeled scenario is the AEGL–1, which is defined as: ''the airborne concentration, expressed as parts per million or milligrams per cubic meter (ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.'' While permanent toxicological effects are not expected up to the AEGL–2 value, this limit is not relevant for this analysis because at that level, flammability would be a greater concern.

[52] ICF, 2016c. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Water Coolers Substitute: Propane (R-290).

[53] ICF, 2016e. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Commercial Ice Machines Substitute: Propane (R-290).

[54] This is intended to mean a completely new refrigeration circuit containing a new evaporator, condenser and refrigerant tubing.

[55] UL, 2009. Standard 563—Standard for Ice Makers. A summary of this document is accessible at: *http://ulstandards.ul.com/standard/?id=563.*

[56] UL, 2008. Standard 399—Standard for Drinking-Water Coolers. A summary of this document is accessible at: *http://ulstandards.ul.com/standard/?id=399_7.*

[57] UL, 2010. Standard 471—Standard for Commercial Refrigerators and Freezers. A summary of this document is accessible at: *http://ulstandards.ul.com/standard/?id=471_10.*

are proposing to rely on UL standards as those that are most applicable to and recognized by the U.S. market. This proposed approach is the same as that adopted in our previous rules on flammable refrigerants (76 FR 78832, December 20, 2011; 80 FR 19453, April 10, 2015).

iii. Charge Size

EPA is proposing use conditions that limit the amount of propane allowed in each refrigerant circuit to 150 g.[58] It is necessary to set limits on charge size in order for propane not to pose a risk to human health or the environment that is greater than the risk posed by other substitutes. These limits will reduce the risk to workers and consumers since under scenarios we analyzed, a leak of the proposed charge sizes did not result in concentrations of the refrigerant that met or exceeded the LFL.

EPA is proposing limitations on refrigerant charge size for self-contained commercial ice machines, water coolers, and very low temperature refrigeration equipment that reflect the UL 563, UL 399, and UL 471 standards. As discussed above in paragraph ii of this section, we believe UL standards are appropriate because they are the most applicable to and recognized by the U.S. market and offer requirements developed by a consensus of experts.

UL Standards 563 (ice machines), 399 (water coolers), and 471 (commercial stand-alone refrigeration equipment) limit the amount of refrigerant leaked to 150 grams (5.29 ounces). We note that the charge size limit for propane in the UL standards is in line with the IEC 60335–2–89 standard addressing these end-uses, which also has a charge size limit of 150 grams.

iv. Color-Coded Hoses and Piping

EPA proposes that equipment designed for use with propane must have distinguishing color-coded hoses and piping to indicate use of a flammable refrigerant. This will help technicians immediately identify the use of a flammable refrigerant, thereby reducing the risk of using sparking equipment or otherwise having an ignition source nearby. The AC and refrigeration industry currently uses distinguishing colors as means to identify different refrigerants. Likewise, distinguishing coloring has been used elsewhere to indicate an unusual and potentially dangerous situation, for example in the use of orange-insulated wires in hybrid electric vehicles. Currently, no industry standard exists for color-coded hoses or pipes for propane. EPA is proposing that all such refrigerator tubing be colored red Pantone matching system (PMS) #185 to match the red band displayed on the container of flammable refrigerants under the Air Conditioning, Heating and Refrigeration Institute (AHRI) Guideline ''N'' 2014, ''2014 Guideline for Assignment of Refrigerant Container Colors.'' [59] This proposal mirrors the existing use condition for HCs in residential and commercial refrigerator-freezers, vending machines, very low temperature refrigeration equipment, non-mechanical heat transfer equipment and room air conditioners (76 FR 78832, December 20, 2011; 80 FR 19453, April 10, 2015). EPA wants to ensure that there is adequate notice that a flammable refrigerant is being used within a particular piece of equipment or appliance. One mechanism to distinguish hoses and pipes is to add a colored plastic sleeve or cap to the service tube. The colored plastic sleeve or cap would have to be forcibly removed in order to access the service tube. This would signal to the technician that the refrigeration circuit that she/he was about to access contained a flammable refrigerant, even if all warning labels were somehow removed. This sleeve would be of the same red color (PMS #185) and could also be boldly marked with a graphic to indicate the refrigerant was flammable. This could be a cost-effective alternative to painting or dying the hose or pipe.

EPA is particularly concerned with ensuring adequate and proper notification for servicing and disposal of appliances containing flammable refrigerants. The use of color-coded hoses, as well as the use of warning labels discussed below, is necessary to ensure flammable refrigerants can be used without presenting significantly more risk than other alternatives and would be consistent with other general industry practices. This proposed approach is consistent with the approach adopted in our previous rules on flammable refrigerants (76 FR 78832, December 20, 2011; 80 FR 19453, April 10, 2015).

v. Labeling

As a use condition, EPA is proposing to require labeling of self-contained commercial ice machines, water coolers, and, very low temperature refrigeration equipment. EPA is proposing the warning labels on the equipment contain letters at least ¼ inch high and that they be permanently affixed to the equipment. Warning label language requirements are as follows:

- ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing.'' This marking must be provided on or near any evaporators that can be contacted by the consumer.
- ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.'' This marking must be located near the machine compartment.
- ''CAUTION—Risk of Fire or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.'' This marking must be located near the machine compartment.
- ''CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.'' This marking must be provided on the exterior of the refrigeration equipment.
- CAUTION—Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.'' This marking must be provided near all exposed refrigerant tubing.

The warning label language is similar to or exactly the same as that required in UL standards: For commercial ice machines in UL 563 in section SB6.1, for water coolers in UL 399 in section SA6.1, and for commercial refrigerators and freezers, including very low temperature freezers, in UL 471 in section SB6.1.

It would be difficult to see warning labels with the minimum lettering height requirement of ⅛ inch in these UL standards. Therefore, as in the requirements in our previous HC refrigerants rules for residential and commercial refrigerator-freezers, vending machines, very low temperature refrigeration equipment, non-mechanical heat transfer equipment, and room air conditioners (76 FR 78832, December 20, 2011; 80 FR 19453, April 10, 2015), EPA is proposing the minimum height for lettering must be ¼ inch as opposed to ⅛ inch, which will make it easier for technicians, consumers, retail storeowners, and first responders to view the warning labels.

[58] To place this in context, a 150 g charge is about five times the charge in a disposable lighter (30 g).

[59] AHRI, 2014. Guideline N–2014 for Assignment of Refrigerant Container Colors. This document is accessible online at *http://www.ahrinet.org/App_Content/ahri/files/Guidelines/AHRI_Guideline_N_2014.pdf.*

d. What recommendations does EPA have for the safe use of propane?

In addition to establishing regulatory use conditions, which are binding on end users, EPA may also make recommendations for use of a substitute. EPA is proposing to recommend that only technicians specifically trained in handling flammable refrigerant substitutes dispose of or service refrigeration and AC equipment containing these substances. Trained technicians should know how to minimize the risk of fire and the procedures for using flammable refrigerant substitutes safely. Releases of large quantities of flammable refrigerants during servicing and manufacturing, especially in enclosed, poorly ventilated spaces or in areas where large amounts of refrigerant are stored, could cause an explosion if an ignition source exists nearby. For these reasons, technicians should be properly trained to handle flammable refrigerant substitutes when maintaining, servicing, repairing, or disposing of water coolers, commercial ice machines, and very low temperature freezers. In addition, EPA recommends that if propane would be vented, released, or disposed of (rather than recovered), as is proposed for the specified end-uses in this rule, the release should be in a well-ventilated area, such as outside of a building. Ensuring proper ventilation and avoiding ignition sources are recommended practices, whether venting or recovering a flammable refrigerant.

The Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) provides useful guidance on safety precautions technicians can follow when servicing equipment containing flammable refrigerants or when venting refrigerant. One of those practices is to connect a hose to the appliance to allow for venting the refrigerant outside.[60] This document is included in the docket for this proposed rule (EPA–HQ–OAR–2015–0663).

We are aware that at least two organizations in the United States, Refrigeration Service Engineers Society (RSES) and the ESCO Institute, have developed technician training programs in collaboration with refrigeration equipment manufacturers and users that address safe use of flammable refrigerant substitutes. In addition, EPA has reviewed several training programs provided as part of SNAP submissions from persons interested in flammable refrigerant substitutes. The agency intends to update the test bank for technician certification under CAA section 608 as we have done previously, and will consider including additional questions on flammable refrigerants. By adding such questions to the test bank, EPA would supplement but would not replace technician training programs currently provided by non-government entities. EPA will seek additional information and guidance on how best to incorporate this content through a separate process outside the scope of this final rule.

e. When would the listing apply?

EPA proposes that this listing would apply 30 days after the date of publication of a final rule. This date, the same as the proposed effective date of this regulation, allows for the safe use of this substitute at the earliest opportunity.

f. What is the relationship between this proposed SNAP rule and other federal rules?

i. How would this proposed listing relate to federal energy conservation standards?

For some of the types of equipment covered in this proposal, DOE has established energy conservation standards. For example, DOE energy conservation standards apply to automatic commercial ice machines.[61] Thus, total energy use with propane can be expected to be no higher than that required by the standards for those classes of equipment.[62] DOE does not have an energy conservation standard that would apply to water coolers or to very low temperature refrigeration equipment. EPA considers technical needs for energy efficiency (*e.g.,* to meet DOE energy conservation standards) in determining whether alternatives are ''available.'' Based on available information, we found no evidence that propane would reduce energy efficiency or that equipment using propane would be unable to meet DOE energy efficiency standards in the end-uses proposed in this rule, and we found some evidence that propane may improve energy efficiency.[63] [64] [65]

ii. How would this proposed listing relate to regulations implementing the venting prohibition under CAA section 608?

Below in section VI.A.2 of this document, EPA is proposing to exempt propane from the venting prohibition under CAA section 608 when propane is used as a refrigerant in self-contained commercial ice machines, water coolers, or very low temperature refrigeration equipment.

g. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of the proposed listing of propane as an acceptable refrigerant in self-contained commercial ice machines, water coolers, and very low temperature refrigeration equipment, including the proposed use conditions discussed in section VI.A.1.c. We request comment on our risk screens and the assumptions and exposure and flammability levels EPA used to evaluate risk. We are particularly interested in comment of two of the proposed use conditions: (1) The use of red marking for pipes, hoses and other devices including direct color application on the applicable parts of the system, such as a red plastic sleeve (see section VI.A.1.c.iv, ''Color-coded hoses and piping''); and (2) the UL standards that EPA proposes to incorporate by reference (*i.e.,* Supplement SA to the 8th edition of UL 563, dated July 31, 2009, for self-contained commercial ice machines, Supplement SB to the 7th edition of UL 399, dated August 22, 2008, for water coolers; and Supplement SB to the 10th edition of UL 471, dated November 24, 2010, for very low temperature refrigeration equipment.

[60] AIRAH, 2013. Australian Institute of Refrigeration, Air Conditioning and Heating. Safety Guide: Flammable Refrigerants. 2013. This document is accessible at: *http://www.unep.fr/ozonaction/information/mmcfiles/7681-e-FlammableRefrigerantsGuideAIRAH.pdf.*

[61] See *https://www1.eere.energy.gov/buildings/appliance_standards/standards_test_procedures.html.*

[62] Refrigeration or AC 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 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.

[63] Eppendorf, 2015. SNAP Information Notice for R-170 and R-290 in Very Low Temperature Refrigeration. May, 2015.

[64] Manitowoc, 2015. SNAP Information Notice, September, 2013. EPA SNAP Submittal—Revision to Extend R-290 Use to Commercial Ice Machines, Manitowoc Ice, Inc. October, 2015.

[65] Blupura, 2015. SNAP Information Notice for R-290 in Water Coolers. October, 2015.

2. Proposed Exemption for Propane From the Venting Prohibition Under CAA Section 608 for the End-Uses in the Proposed New SNAP Listing

a. What is EPA's proposal regarding whether venting of propane in the end-uses in this action would pose a threat to the environment?

EPA is proposing to list the refrigerant substitute propane under the SNAP program as acceptable, subject to use conditions, in newly manufactured water coolers, self-contained commercial ice machines, and very low temperature refrigeration equipment. EPA is also proposing to exempt propane in these end-uses from the venting prohibition under CAA section 608(c)(2). For purposes of CAA section 608(c)(2), EPA considers two factors in determining whether or not venting, release, or disposal of a refrigerant substitute during the maintenance, servicing, repairing, or disposing of appliances poses a threat to the environment. See 69 FR 11948, March 12, 2004; 79 FR 29682, May 23, 2014; and 80 FR 19453, April 10, 2015. First, EPA analyzes the threat to the environment due to inherent characteristics of the refrigerant substitute, such as GWP. Second, EPA determines whether and to what extent venting, release, or disposal actually takes place during the maintenance, servicing, repairing, or disposing of appliances, and to what extent such actions are controlled by other authorities, regulations, or practices. To the extent that such releases are adequately controlled by other authorities, EPA defers to those authorities.

i. Potential Environmental Impacts

EPA has evaluated the potential environmental impacts of releasing into the environment propane, the substitute that we are proposing to list under the SNAP program as acceptable, subject to use conditions, in water coolers, self-contained commercial ice machines, and very low temperature refrigeration equipment. In particular, we assessed the potential impact of the release of propane on local air quality and its ability to decompose in the atmosphere, its ODP, its GWP, and its potential impacts on ecosystems.

As explained above in section VI.A.1.b.i, ''Environmental impacts,'' propane's ODP is zero, its GWP is approximately three, and its effects on aquatic life are expected to be small. As to potential effects on local air quality, based on the analysis and modeling results described in section VI.A.1.b.i of this preamble, EPA proposes to conclude that release of propane from the end-uses proposed in this action, in addition to the HCs previously listed as acceptable, subject to use conditions, for their specific end-uses, is expected to have little impact on local air quality. In this regard, EPA finds particularly noteworthy that even assuming 100 percent market penetration of propane and the other acceptable HCs in the proposed and acceptable end-uses, which is a conservative assumption, the highest impact for a single 8-hour average concentration based on this analysis would be 0.03 ppb in Los Angeles.

In addition, when examining all HC substitute refrigerants in those uses for which UL currently has standards in place, for which the SNAP program has already listed the uses as acceptable, subject to use conditions, or for which the SNAP program is reviewing a submission, including those in this rule, we found that even if all the refrigerant in appliances in end-uses proposed as acceptable, subject to use conditions in this proposed rule and listed as acceptable in previous rules were to be emitted, there would be a worst-case impact of less than 0.15 ppb for ground-level ozone in the Los Angeles area.[66] The use conditions established in the SNAP listings limit the total amount of refrigerant in each refrigerant circuit to 150 g or less, depending on the end-use. Because propane is not proposed to be used in all refrigerant uses, the total amount of propane that could be emitted in the end-uses evaluated is estimated at roughly ten percent of total refrigerant emissions, or less than 16,000 metric tons annually.[67] Further, there are other substitute refrigerants that are not VOC that may also be used in these end-uses, so our analysis assuming complete market penetration of HCs is conservative. In light of its evaluation of potential environmental impacts, EPA proposes that propane in the end-uses for which it is proposed to be listed under SNAP as acceptable, subject to use conditions, in this notice is not expected to pose a threat to the environment on the basis of the inherent characteristics of this substance and the limited quantities used in the relevant end-uses. In this regard, EPA finds particularly noteworthy that even assuming 100% market penetration of propane and the other acceptable HCs in the proposed and acceptable end-uses, which is a conservative assumption, the highest impact for a single 8-hour average concentration based on this analysis would be 0.03 ppb in Los Angeles.

ii. Flammability and Toxicity

As discussed above in sections VI.A.1.b.ii, ''Flammability'' and VI.A.1.b.iii, ''Toxicity,'' EPA's SNAP program evaluated the flammability and toxicity risks from propane in the proposed end-uses in this rule. EPA is providing some of that information in this section as well.

Propane is classified as an A3 refrigerant by ASHRAE Standard 34–2010 and subsequent addenda, indicating that it has low toxicity and high flammability. Propane has an LFL of 2.1%. To address flammability risks, this proposal provides recommendations for its safe use (see section VI.A.1.d, ''What recommendations does EPA have for the safe use of propane?'' above). The SNAP program's analysis suggests that the proposed use conditions in this proposed rule will mitigate flammability risks.

Like most refrigerants, at high concentrations HCs can displace oxygen and cause asphyxiation. Various industry and regulatory standards exist to address asphyxiation and toxicity risks. The SNAP program's analysis of asphyxiation and toxicity risks suggests that the proposed use conditions in this proposed rule would mitigate asphyxiation and toxicity risks. Furthermore, it is the Agency's understanding that flammability risks and occupational exposures to HCs are adequately regulated by OSHA and building and fire codes at a local and national level.

iii. Authorities, Controls, or Practices

EPA expects that existing authorities, controls, and/or practices will mitigate environmental risk from the release of propane. Analyses performed for both this proposed rule and the SNAP rules issued in 1994, 2011, and 2015 (59 FR 13044, March 17, 1994; 76 FR 38832, December 20, 2011; and 80 FR 19453, April 10, 2015, respectively)) indicate that existing regulatory requirements and industry practices limit and control the emission of propane. As explained below, EPA proposes that the limits and controls under other authorities, regulations, or practices adequately control the release of and exposure to propane and mitigate risks from any possible release.

As mentioned above, the determination of whether venting, release, or disposal of a substitute refrigerant poses a threat to the environment includes considering

[66] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

[67] Ibid.

whether such venting, release, or disposal is adequately controlled by other authorities, regulations, or practices. This information is another part of EPA's proposal that the venting, release, or disposal of propane, in the specified end-uses and subject to the use conditions in this proposed action, does not pose a threat to the environment.

Industry service practices and OSHA standards and guidelines that address HC refrigeration equipment include monitoring efforts, engineering controls, and operating procedures. OSHA requirements that apply during servicing include continuous monitoring of explosive gas concentrations and oxygen levels. In general, HC emissions from refrigeration systems are likely to be significantly smaller than those emanating from the industrial process and storage systems, which are controlled for safety reasons. In the SNAP listings in section VI.A.1.c, ''What are the proposed use conditions?'' we note that the amount of refrigerant substitute from a refrigerant loop is limited to 150 g in the end-uses proposed in this rule. This indicates that HC emissions from such uses are likely to be relatively small.

The release and/or disposal of many refrigerant substitutes, including propane, are controlled by other authorities including various standards, and state and local building codes. To the extent that release during maintaining, repairing, servicing, or disposing of appliances is controlled by regulations and standards of other authorities, these practices and controls for the use of propane are sufficiently protective. These practices and controls mitigate the risk to the environment that may be posed by the venting, release, or disposal of propane during the maintaining, servicing, repairing, or disposing of appliances.

EPA is aware of equipment that can be used to recover HC refrigerants. While there are no relevant U.S. standards for such recovery equipment currently, to the extent that propane is recovered rather than vented in specific end-uses and equipment, EPA recommends the use of recovery equipment designed specifically for flammable refrigerants in accordance with applicable safe handling practices. See section VI.A.1.d above, ''What recommendations does EPA have for the safe use of propane?''

b. What is EPA's proposal regarding whether venting of propane in the end-uses in this action should be exempted from the venting prohibition under CAA section 608?

Consistent with the proposed listing under SNAP in this action, EPA proposes that venting, releasing or disposing of propane in water coolers, self-contained commercial ice machines, and very low temperature refrigeration equipment is not expected to pose a threat to the environment. As discussed more fully above, we propose this on the basis of the inherent characteristics of this substance, the limited quantities used in the relevant end-uses, and the limits and controls under other authorities, regulations, or practices that adequately control the release of and exposure to propane and mitigate risks from any possible release. Accordingly, EPA is proposing to revise the regulations at § 82.154(a)(1) to add propane in these end-uses to the list of substitute refrigerants that are exempt from the venting prohibition. We also note that EPA has recently proposed to revise the format of the text of this section to include separate paragraphs for each substitute refrigerant, rather than grouping refrigerants in an end-use (80 FR 69457; November 9, 2015). Thus, the final text of § 82.154(a)(1) may reflect revised language related to both the November 2015 proposal and to this proposal.

c. When would the exemption from the venting prohibition apply?

We are proposing that propane would be exempt from the venting prohibition as of 30 days after the publication of a final rule in the **Federal Register**. This would be the same as the date of the SNAP listing of propane in commercial ice machines, water coolers, and very low temperature refrigeration equipment.

d. What is the relationship between this proposed exemption under CAA section 608 and other EPA rules?

If this proposed exemption were to become final as proposed, it would not mean that propane could be vented in all situations. Propane and other HCs being recovered, vented, released, or otherwise disposed of from commercial and industrial appliances are likely to be hazardous waste under RCRA (see 40 CFR parts 261 through 270). As discussed in the final rules addressing the venting of ethane, isobutane, propane, and R-441A as refrigerant substitutes in certain end-uses, incidental releases may occur during the maintenance, service, and repair of appliances subject to CAA section 608 (79 FR 29682, May 23, 2014; 80 FR 19454, April 10, 2015). Such incidental releases would not be subject to RCRA requirements for the disposal of hazardous waste, as such releases would not constitute disposal of the refrigerant charge as a solid waste, *per se.* Disposal or venting of propane from household appliances used in the home, such as a water cooler, is also generally not considered disposal of a hazardous waste under the existing RCRA regulations and could be vented under the household hazardous waste exemption, assuming other state or local requirements do not prohibit venting. See 40 CFR 261.4(b)(1). However, for commercial and industrial appliances such as self-contained commercial ice machines, very low temperature refrigeration equipment, or water coolers used in an industrial or office setting, it is likely that propane and other flammable HC refrigerant substitutes would be classified as hazardous waste and disposal of propane from such appliances would need to be managed as hazardous waste under the RCRA regulations (40 CFR parts 261 through 270), unless it is subject to a limited exception in those regulations if the ignitable refrigerant is to be recycled.

e. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of our proposal to exempt from CAA section 608's venting prohibition the venting or release of propane used as a refrigerant substitute in water coolers, self-contained commercial ice machines, and very low temperature refrigeration equipment, as well as seeking comment on the proposed exemption language at 40 CFR 82.154(a)(1).

3. Proposed Listing of New Refrigerants as Unacceptable

a. Proposed Listing of Certain Flammable Refrigerants as Unacceptable for Retrofits in Unitary Split AC Systems and Heat Pumps

EPA is proposing to list the following flammable refrigerants as unacceptable for use in existing unitary split AC and heat pumps for residential and light commercial AC and heat pumps because they pose significantly more risk to human health or the environment than other available alternatives:

- All refrigerants identified as flammability Class 3 in ANSI/ASHRAE Standard 34–2013.
- All refrigerants meeting the criteria for flammability Class 3 in ANSI/

ASHRAE Standard 34–2013. These include, but are not limited to, refrigerant products sold under the names R-22a, 22a, Blue Sky 22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeeze 22a, EF-22a, Envirosafe 22a, ES-22a, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, Oz-Chill 22a, Priority Cool, and RED TEK 22a.

Existing unitary split AC systems and heat pumps were not designed to use a flammable refrigerant. We are aware of instances in which people or property have been harmed by retrofit or so-called 'drop-in' use of certain of the specified flammable refrigerants in equipment designed to use HCFC-22. For new equipment, we have listed certain flammable refrigerants as acceptable on the basis that flammability risks can be addressed in designing the equipment and mitigated through use conditions. In contrast, existing equipment has not been designed for flammable refrigerants and we have not identified appropriate use conditions that can manage the flammability risk for retrofits such that these flammable refrigerants would pose similar or lower risk than other available refrigerants in this end-use.

i. What is the affected end-use?

The residential and light commercial AC and heat pumps end-use includes equipment for cooling air in individual rooms, in single-family homes, and sometimes in small commercial buildings. This end-use differs from commercial comfort AC, which uses chillers that cool water that is then used to cool air throughout a large commercial building, such as an office building or hotel. This proposal specifically concerns unitary split systems and heat pumps, commonly called central AC. These systems include an outdoor unit with a condenser and a compressor, refrigerant lines, an indoor unit with an evaporator, and ducts to carry cooled air throughout a building. Central heat pumps are similar but offer the choice to either heat or cool the indoor space. We are proposing that certain flammable refrigerants would be listed as unacceptable for retrofit use in this type of equipment.

We are not currently proposing that the unacceptability determination for certain flammable refrigerants applies to other types of residential AC and heat pump equipment, but we may do so in the future. The presence of a proposal for a single type of equipment within this end-use or listings finding certain substitutes acceptable, subject to use conditions, in a specific type of equipment does not imply that other uses are acceptable (*e.g.,* listing as acceptable, subject to use conditions in new equipment does not mean retrofit use is acceptable). Other types of residential AC and heat pump equipment not included in this proposed unacceptability determination include:

- Multi-split air conditioners and heat pumps. These systems include one or more outdoor unit(s) with a condenser and a compressor and multiple indoor units, each of which is connected to the outdoor unit by refrigerant lines. For ductless multi-split systems, the cooled air exits directly from the indoor unit rather than being carried through ducts.
- Mini-split air conditioners and heat pumps. These systems include an outdoor unit with a condenser and a compressor and a single indoor unit that is connected to the outdoor unit by refrigerant lines. Cooled air exits directly from the indoor unit rather than being carried through ducts.
- Packaged outdoor air conditioners and heat pumps. These systems include an outdoor unit with a condenser and a compressor and a heating assembly, often used on top of the roof of a building such as a commercial office building or apartment building. These units carry cool air to the inside of the building through ducts, so they are not completely self-contained units; however, the refrigerant remains within the packaged unit, thus reducing the chance of leaks from refrigerant lines.
- Window air conditioners and heat pumps. These are self-contained units that fit in a window with the condenser extending outside the window.
- Packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHP). These are self-contained units that consist of a separate, un-encased combination of heating and cooling assemblies mounted through a wall.
- Portable room air conditioners and heat pumps. These are self-contained, factory-sealed, single package units that are designed to be moved easily from room to room and are intended to provide supplemental cooling within a room. These units typically have wheels or casters for portability and have a fan which operates continuously when the unit is on. Portable room air conditioners and heat pumps may contain an exhaust hose that can be placed through a window or door to eject heat to the outside.

Compared to self-contained AC equipment such as window air conditioners, PTAC, PTHP, and portable room air conditioners, unitary split AC systems and heat pumps are much more likely to have a refrigerant release due to having larger charge sizes, more locations that are prone to leak, and because they are more likely to require servicing by a technician. A higher risk of refrigerant releases and a potential for larger releases and higher concentration releases results in higher risk that flammable refrigerant could be ignited from unitary split AC systems and heat pumps compared to self-contained equipment.

EPA is aware of a number of situations where companies have sold highly flammable refrigerants for use in residential AC that have not been submitted to SNAP for review. EPA has conducted enforcement actions against companies that have sold such substitutes in violation of EPA's regulations.[68] EPA is aware of multiple cases, where people and property using the ''22a'' refrigerant in a residential AC system were harmed in explosions and fires, in part because the person servicing the AC system was not aware that the system contained a highly flammable refrigerant. Considering this demonstration of the flammability risks of retrofitting residential AC systems as well as the lack of risk mitigation available for existing equipment (*e.g.,* charge limits, design for reduced leakage), EPA is proposing to list R-22a, 22a, and other similar liquified petroleum gases as unacceptable, as well as refrigerants with a flammability classification of 3 in ASHRAE 34–2013.

ii. Which refrigerants is EPA proposing to list as unacceptable?

EPA is proposing that the following flammable refrigerants be listed as unacceptable for retrofits in unitary split AC systems and heat pumps:

- All refrigerants identified as flammability Class 3 in ANSI/ASHRAE Standard 34–2013.
- All refrigerants meeting the criteria for flammability Class 3 in ANSI/ASHRAE Standard 34–2013. These include, but are not limited to, refrigerant products sold under the names R-22a, 22a, Blue Sky 22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeeze 22a, EF-22a, Envirosafe 22a, ES-22a, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, Oz-Chill 22a, Priority Cool, and RED TEK 22a.

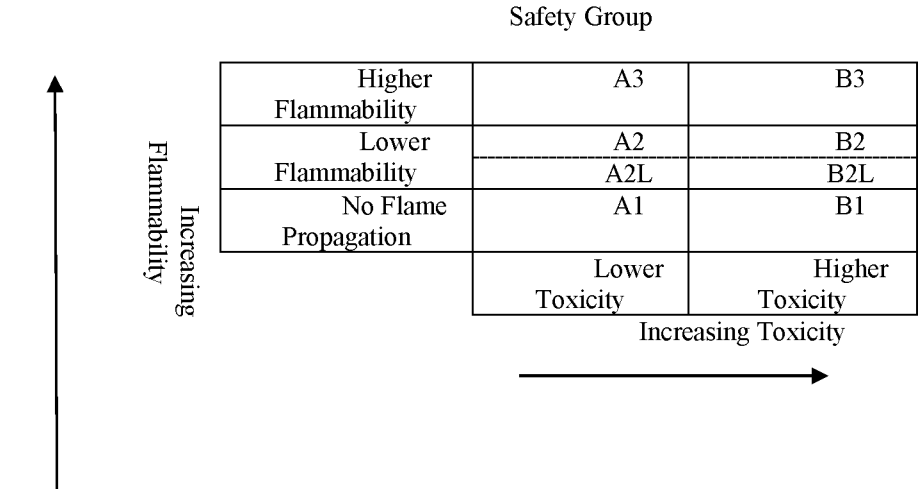
ANSI/ASHRAE Standard 34–2013 assigns a safety group classification for each refrigerant which consists of two

[68] EPA, 2013. Finding of Violation, issued to Enviro-Safe Refrigerants, Inc. June, 2013. This document is accessible at: *http://www2.epa.gov/sites/production/files/2015-07/documents/mailfov_envirosafe_06112013.pdf.*

alphanumeric characters (*e.g.,* A2 or B1). The capital letter indicates the toxicity and the numeral denotes the flammability. ASHRAE classifies Class A refrigerants as refrigerants for which toxicity has not been identified at concentrations less than or equal to 400 parts per million (ppm) by volume, based on data used to determine TLV–TWA or consistent indices. Class B signifies refrigerants for which there is evidence of toxicity at concentrations below 400 ppm by volume, based on data used to determine TLV–TWA or consistent indices. The refrigerants are also assigned a flammability classification of 1, 2, or 3. Tests are conducted in accordance with ASTM E681 using a spark ignition source at 60 °C and 101.3 kPa.[69] Figure 1 in ANSI/ASHRAE Standard 15–2013 uses the same safety group but limits its concentration to 3,400 ppm.[70]

The flammability classification ''1'' is given to refrigerants that, when tested, show no flame propagation. The flammability classification ''2'' is given to refrigerants that, when tested, exhibit flame propagation, have a heat of combustion less than 19,000 kJ/kg (8,174 British thermal units (BTU)/lb), and have a LFL greater than 0.10 kg/m^3. Refrigerants within flammability classification 2 may optionally be designated in the LFL subclass ''2L'' if they have a maximum burning velocity of 10 cm/s or lower when tested at 23.0 °C and 101.3 kPa. The flammability classification ''3'' is given to refrigerants that, when tested, exhibit flame propagation and that either have a heat of combustion of 19,000 kJ/kg (8,174 BTU/lb) or greater or an LFL of 0.10 kg/m^3 or lower. Thus, refrigerants with flammability classification ''3'' are highly flammable while those with flammability classification ''2'' are less flammable and those with flammability classification ''2L'' are mildly flammable. For both toxicity and flammability classifications, refrigerant blends are designated based on the worst-case of fractionation determined for the blend (which may be different when evaluating toxicity than when evaluating flammability).

Figure 1. Refrigerant Safety Group Classification



Refrigerants with a flammability classification of 3 identified by ASHRAE in ASHRAE 34–2013 include the HCs R-1150 (ethylene), R-170 (ethane), R-1270 (propylene), R-290 (propane), R-50 (CH_4), R-600 (n-butane), R-600a (isobutane), R-601 (n-pentane), and R-601a (isopentane); the HC blends R-433A, R-433B, R-433C, R-436A, R-436B, R-441A, and R-443A; and the refrigerant blends R-429A, R-430A, R-431A, R-432A, R-435A, and R-511A. All but one of these refrigerants contain HCs, with some also containing the flammable compounds dimethyl ether and HFC-152a.

In addition to refrigerants specifically identified in the ASHRAE 34–2013 standard as having a flammability classification of 3, EPA is proposing that refrigerants meeting the criteria of that standard are unacceptable. In other words, refrigerants are unacceptable if they exhibit flame propagation and either have a heat of combustion of 19,000 kJ/kg (8,174 BTU/lb) or greater or an LFL of 0.10 kg/m^3 or lower, when tested in accordance with ASTM E681 using a spark ignition source at 60 °C and 101.3 kPa. We are aware of a number of refrigerant products sold over the internet aimed at the market for retrofit usage in refrigeration and AC equipment using HCFC-22 with names containing ''22a,'' such as R-22a, Blue Sky 22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeeze 22a, EF-22a, Envirosafe 22a, ES-22a, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, Oz-Chill 22a, and RED TEK 22a. EPA has analyzed one of these refrigerants and determined that it contained propane mixed with a pine-scented odorant. These refrigerants are also identified as flammable in their Safety Data Sheets and are often identified as ''liquified petroleum gases.'' Although none of these liquified petroleum gas refrigerants have been submitted to SNAP for review, EPA expects that they all are comparable in their flammability to propane and other refrigerants that meet an ASHRAE flammability classification of 3. It is our understanding these refrigerants are all of the same or similar composition, are produced by only one or two facilities using the same process, and then are marketed under different names.

We request comment on whether we should list as unacceptable both any refrigerant that meets the criteria in ASHRAE 34–2013 for a flammability

[69] ASHRAE, 2013. ANSI/ASHRAE Standard 34–2013: Designation and Safety Classification of Refrigerants.

[70] ASHRAE, 2013. ANSI/ASHRAE Standard 15–2013: Designation and Safety Classification of Refrigerants.

classification of 3 and those refrigerants currently identified in the ASHRAE standard with a flammability classification of 3. We also request comment on whether the listing decision should specifically describe the criteria, *i.e.,* ''Any refrigerant that (1) exhibits flame propagation when tested by ASTM E681 at standard temperature and pressure and at 60 °C and (2) that either has a heat of combustion of 19,000 kJ/kg (8,174 BTU/lb) or greater or has an LFL of 0.10 kg/m^3 or lower.''

ii. How do these proposed unacceptable refrigerants compare to other refrigerants for these end-uses with respect to SNAP criteria?

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks (*e.g.,* flammability, exposure, and toxicity) are discussed below. In addition, a technical support document [71] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives in the relevant end-uses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

EPA has listed a number of alternatives as acceptable for retrofit usage in unitary split AC systems and heat pumps. All of the listed alternatives are HFC blends, with some containing small percentages (approximately five percent or less) of HCs. Specific blends include: R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-417A, R-417C, R-421A, R-422B, R-422C, R-422D, R-424A, R-427A, R-434A, R-438A, R-507A, and RS-44 (2003 composition). These blends are all non-ozone-depleting. As shown in Table 3, they have GWPs ranging from approximately 1,770 for R-407C to 3,990 for R-507A. Knowingly venting or releasing these refrigerants is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1). The HFC components of these refrigerant blends are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS, while the HC components are VOC.

TABLE 3—GWP, ODP, AND VOC STATUS OF FLAMMABLE REFRIGERANTS COMPARED TO OTHER REFRIGERANTS FOR RETROFIT IN EXISTING EQUIPMENT FOR RESIDENTIAL AND LIGHT COMMERCIAL AC (UNITARY SPLIT AC SYSTEMS AND HEAT PUMPS) [1] [2] [3] [4]

Refrigerants	GWP	ODP	VOC	Proposal
All refrigerants identified as flammability Class 3 in ANSI/ASHRAE Standard 34–2013.	2–120	0	Yes [3]	Unacceptable.
All refrigerants meeting the criteria for flammability Class 3 in ANSI/ASHRAE Standard 34–2013, including, but not limited [1], to the products named R-22a, 22a, Blue Sky22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeeze EF-22a, EF-22a, Envirosafe 22a, ES-22, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, OZ-Chill 22a, Priority Cool, and RED TEK22a.	2–120	0	Yes [3]	Unacceptable.
R-404A, R-407A, R-407C, R-407F, R-421A, R-427A, R-507A.	1,770–3,990	0	No	No change.
Hot Shot 2, R-125/R-134a/R-600a (28.1/70.0/1.9), R-125/R-290/R-134a/R-600a (55.0/1.0/42.5/1.5), R-417A, R-422B, R-422C, R-422D, R-424A, R-427A, R-434A, R-437A, R-438A, RS-44 (2003 formulation).	1,810–3,390	0	Yes [4]	No change.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-use.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] The entire refrigerant or most of the constituents are VOC.
[4] One or more constituents of the refrigerant are VOC.

Both the currently acceptable refrigerants and those proposed to be unacceptable are non-ozone depleting. The refrigerants proposed to be unacceptable would result in higher VOC emissions than the acceptable refrigerants, with the saturated HCs (*e.g.,* propane, isobutane) having a low impact and unsaturated HCs (*e.g.,* propylene) having a significant impact (see section VI.A.1.b.i above. The refrigerants proposed to be unacceptable have significantly lower GWPs than the refrigerants that would remain acceptable.

(b) Flammability

All refrigerants currently listed as acceptable in this end-use are nonflammable, resulting in no risk of fire or explosion from flammability of the refrigerant. In comparison, ASHRAE Class 3 refrigerants are highly flammable. As discussed further below in section VI.A.3.b.iii.(b), EPA analyzed the flammability impacts of one ASHRAE Class 3 refrigerant, R-443A, and found that a release of the entire refrigerant charge inside a building from a unitary split AC system or heat pump could result in surpassing the LFL.[72] Because of the large charge sizes required for this type of equipment and the similar LFLs for other ASHRAE Class 3 refrigerants, it is likely the LFL would be surpassed for other ASHRAE Class 3 refrigerants. Fires and harm to

[71] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[72] ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

people and property have already occurred in multiple cases due to retrofit or drop-in use of R-22a and similar products in existing unitary split AC systems.

(c) Toxicity

The HFC components of acceptable substitutes in this end-use, as well as the HFC components of the unacceptable refrigerant blends have exposure limits, such as WEELs from the AIHA or manufacturer acceptable exposure limits, of 1,000 ppm on an 8-hr TWA and the HC components of both the acceptable refrigerants and those proposed unacceptable have exposure limits ranging from 500 to 1,000 ppm (8-hr TWA for TLVs from ACGIH and 10-hr TWA for recommended exposure limits (RELs) from NIOSH). Both the acceptable refrigerants and the proposed unacceptable refrigerants are able to be used be used in this end-use in accordance with their respective 8-hr or 10-hr workplace exposure limits. Acute exposure may also be of concern during use in unitary split AC systems and heat pumps because of possible exposure to consumers in the event of a sudden release. The currently acceptable refrigerants typically have high acute exposure limits for their components based upon cardiotoxic effects of halocarbons over 10,000 ppm (*e.g.,* 350,000 cardiotoxic no-observed adverse effect level for HFC-32 over 5 minutes) or have components with STELs or AEGLs (*e.g.,* 8,000 ppm 10-minute AEGL–1 for HFC-134a component). Acute exposure limits for components of the ASHRAE Class 3 refrigerants are comparable or lower, ranging from 1,500 ppm (*e.g.,* excursion limit for propylene) to 6,900 ppm (AEGL–1 over 30 minutes for propane). Because of the large charge sizes required for this type of equipment and somewhat lower acute exposure limits for the hydrocarbon components of ASHRAE Class 3 refrigerants, acute exposure could be a concern for specific refrigerants. For example, as discussed further below in section VI.A.3.b.iii.(c), EPA analyzed the toxicity impacts of the propylene component of R-443A, and found that a catastrophic leak of that refrigerant inside a building from a unitary split AC system or heat pump resulted in estimated exposure levels at least four-fold that of the 1,500 ppm acute exposure limit.[73]

At this time, the potential reduced climate risks from using a highly flammable refrigerant with lower GWP does not outweigh the flammability risks of using these refrigerants in existing equipment that was designed for nonflammable refrigerants. In addition to flammability risk, in at least some cases, acute exposure limits of the proposed unacceptable refrigerants may be more difficult to attain than those for acceptable refrigerants in this end-use. Therefore, EPA proposes that the highly flammable refrigerants proposed to be unacceptable pose greater overall risk to human health and the environment than other substitutes for retrofit in the residential and light commercial AC and heat pumps end-use. However, the Agency may look back at these end-uses for other reasons if we receive information on how risks from the refrigerants proposed for listing as unacceptable can be sufficiently mitigated, we may reconsider any final action listing these refrigerants as unacceptable in this end use.

iv. When would the listings apply?

EPA proposes that these listings would apply 30 days after the date of publication of a final rule. To date, only one of these substitutes have been submitted to EPA for this end-use and this submission is currently incomplete. Thus, under 40 CFR 82.174, manufacturers are prohibited from introducing them into interstate commerce for this end-use. Thus, manufacturers and service technicians should not be currently using these substitutes in the manner that would be prohibited by this proposed listing decision. Further, a date or 30 days after the date of publication of a final rule, the same as the proposed effective date of this regulation, would protect technicians and consumers from the risks of these substitutes at the earliest opportunity.

v. What is the relationship between this proposed SNAP rule and other federal rules?

EPA is not aware of other federal rules that would apply to the use of these flammable refrigerants for retrofits in existing unitary split AC systems and heat pumps.

vi. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on our proposal to list as unacceptable for retrofit use in existing unitary split AC systems and heat pumps all refrigerants identified as flammability Class 3 in ANSI/ASHRAE Standard 34–2013 and all refrigerants meeting the criteria for flammability Class 3 in ANSI/ASHRAE Standard 34–2013, including, but not limited to, refrigerant products sold under the names R-22a, 22a, Blue Sky 22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeeze 22a, EF-22a, Envirosafe 22a, ES-22a, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, Oz-Chill 22a, Priority Cool, and RED TEK 22a. The agency also requests comment on the proposed decision to list these substitutes as unacceptable 30 days after the date of publication of a final rule, and any additional technical information on how risks from the refrigerants proposed for listing as unacceptable can be sufficiently mitigated.

b. Proposed Listing of Propylene and R-443A as Unacceptable for New Residential and Light Commercial AC and Heat Pumps, Cold Storage Warehouses, and Centrifugal and Positive Displacement Chillers

EPA is proposing to list the refrigerants propylene (R-1270) and R-443A as unacceptable in new equipment in residential and light commercial AC and heat pumps, cold storage warehouses, and centrifugal and positive displacement chillers for commercial comfort AC.

i. What are the affected end-uses?

The refrigeration and AC end-uses addressed in this action include:

- Centrifugal and positive displacement chillers;
- residential and light commercial AC and heat pumps, including both self-contained units (*e.g.,* window air conditioners, PTACs and PTHPs, portable AC units) and split systems; and
- cold storage warehouses.

EPA has received a submission for R-443A in new residential and light commercial AC and heat pumps and for new window air conditioners, a subset of that end-use. We have also received a submission for propylene for use in new chillers for commercial comfort AC (centrifugal and positive displacement chillers) and for cold storage warehouses. Because the two refrigerants, R-443A and propylene, have similar properties and risk profiles, we reviewed both refrigerants for all four end-uses.

ii. Which refrigerants is EPA proposing to list as unacceptable?

Propylene, also known as propene or R-1270, is a HC with three carbons, the chemical formula C_3H_6, and the CAS Reg. No. 115–17–1. R-443A is a HC blend[74] consisting of 55 percent

[73] Ibid.

[74] EPA notes that under the SNAP program, we review and list refrigerants with specific compositions (59 FR 13,044; March 18, 1994). To

propylene, 40 percent propane, and five percent isobutane by weight.

iii. How do these proposed unacceptable refrigerants compare to other refrigerants for these end-uses with respect to SNAP criteria?

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks (*e.g.,* flammability, exposure, and toxicity) are discussed below. In addition, a technical support document [75] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives in the relevant end-uses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

Propylene and R-443A have an ODP of zero. Many acceptable substitutes in the refrigeration and AC end-uses addressed in this proposed rule also have an ODP of zero (*e.g.,* HFCs, HFOs, CO_2, ammonia, HCs, and not-in-kind technologies).[76] Of the acceptable refrigerants having an ODP, they have ODPs ranging from 0.00024 to 0.047.[77] [78] Thus, propylene and R-443A have ODPs comparable to or less than the ODPs of other alternatives in the end-uses proposed in this rule.

Propylene and the components of R-443A have relatively low GWPs of less than ten. As shown in Table 4, GWPs of acceptable refrigerants in these end-uses range from zero to 3,990, depending on the specific end-use. (Elsewhere in this proposal, we propose to find unacceptable a number of higher GWP blends for use in new chillers and new cold storage warehouses; if that portion of this proposed rule was finalized as proposed, the highest GWP for any acceptable refrigerant in new chillers would be 630 and in new cold storage warehouses would be approximately 1,830.) The GWPs of propylene and R-443A are comparable to or higher than those of CO_2, propane, isobutane, R-441A, ammonia, HFO-1234ze(E), *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, and not-in-kind technologies such as Stirling cycle, water/lithium bromide absorption, dessicant cooling, or evaporative cooling, each of which is acceptable in new equipment for one or more of the four proposed end-uses. In addition, propylene and R-443A have lower GWPs than those of ODS historically used in these end-uses, CFC-12 (GWP = 10,900); HCFC-22 (GWP = 1,810); and R-502 (GWP = 4,660).[79]

TABLE 4—GWP, ODP, AND VOC STATUS OF PROPYLENE AND R-443A COMPARED TO OTHER REFRIGERANTS IN NEW EQUIPMENT FOR RESIDENTIAL AND LIGHT COMMERCIAL AC AND HEAT PUMPS, COLD STORAGE WAREHOUSES, CENTRIFUGAL CHILLERS AND POSITIVE DISPLACEMENT CHILLERS [1] [2] [3] [4]

Refrigerants	GWP	ODP	VOC	Proposal
Propylene, R-443A	2–3	0	Yes	Unacceptable.
New Residential and Light Commercial AC and Heat Pumps				
HFC-32 [3], HFC-134a, R-404A, R-407A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-507A.	675–3,990	0	No	No change.
R-290 [3], R-441A [3], THR-03 [3], R-125/R-134a/R-600a (28.1/70.0/1.9), R-125/R-290/R-134a/R-600a (55.0/1.0/42.5/1.5), R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, RS-44 (2003 formulation).	3–3,390	0	Yes [4]	No change.
New Cold Storage Warehouses				
CO_2, R-450A, R-513A	1–630	0–0.040	No	No change.
IKON A, IKON B, RS-24 (2002 composition), RS-44, SP34E, THR-02, THR-03, THR-04.	30–1,825	0	Yes [4]	No change.
New Centrifugal Chillers				
Ammonia, HFO-1234ze(E), *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, R-450A, R-513A.	0–630	0–0.00034	No	No change.
IKON A, IKON B, THR-02	30–920	Not public	Yes [4]	No change.
New Positive Displacement Chillers				
Ammonia, HFO-1234ze(E), R-450A, R-513A	0–631	0	No	No change.

the extent possible, we follow ASHRAE's designations for refrigerants. Blends of refrigerants must be reviewed separately. For example, we consider each blend of propane with isobutane to be a different and unique refrigerant, and each would require separate submission, review and listing.

[75] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[76] We assume that substitutes containing no chlorine, bromine, or iodine have an ODP of zero.

[77] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[78] Under EPA's phaseout regulations, virgin HCFC-22, HCFC-142b, and blends containing HCFC-22 or HCFC-142b may only be used to service existing appliances. Consequently, virgin HCFC-22, HCFC-142b and blends containing HCFC-22 or HCFC-142b may not be used to manufacture new pre-charged appliances or appliance components or to charge new appliances assembled onsite. Substitutes containing these HCFCs have ODPs ranging from 0.01 to 0.065. Class I and II ODS historically used as refrigerants in these end-uses have ODPs that range from 0.01 to 1.0.

[79] IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. This document is accessible at: *www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html.*

TABLE 4—GWP, ODP, AND VOC STATUS OF PROPYLENE AND R-443A COMPARED TO OTHER REFRIGERANTS IN NEW EQUIPMENT FOR RESIDENTIAL AND LIGHT COMMERCIAL AC AND HEAT PUMPS, COLD STORAGE WAREHOUSES, CENTRIFUGAL CHILLERS AND POSITIVE DISPLACEMENT CHILLERS [1] [2] [3] [4]—Continued

Refrigerants	GWP	ODP	VOC	Proposal
IKON B, THR-02	0–920	0	Yes [4]	No change.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-use.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] Listed only for use in room AC units.
[4] One or more constituents of the refrigerant are VOC.

In addition to global impacts on the atmosphere, EPA evaluated potential impacts of propylene and the components of R-443A on local air quality. Propylene and the three components of R-443A, propylene, propane and isobutane are not excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. However, there is a significant difference in the photochemical reactivity between propylene and the other two HCs. Propylene, because it has an unsaturated double bond between two carbons, is significantly more reactive in the atmosphere than propane, the saturated HC with the same number of carbon atoms, and isobutane. For example, the Maximum Incremental Reactivity (MIR) of propylene, in gram ozone per gram of the substance, is 11.57 while the MIR of propane is 0.56 g O_3/g and the MIR of isobutane is 1.34 g O_3/g.[80] Thus, propylene is roughly 21 times more reactive than propane and roughly nine times more reactive than isobutane for the same mass. Propylene is also more than 100 times more reactive than HFC-134a (MIR < 0.1) and a number of other HFCs acceptable for these end-uses and is significantly more reactive than unsaturated halogenated substitutes in these end-uses, such as HFO-1234yf (MIR = 0.28), HFO-1234ze(E) (MIR = 0.098), or *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E)) (MIR = 0.040).

Based on analyses described below, EPA estimates that potential emissions of saturated HCs if used as refrigerant substitutes in all end-uses in the refrigeration and AC sector would have little impact on local air quality, while emissions of propylene, including propylene from R-443A, could have a significant negative impact.[81]

EPA analyzed a number of scenarios to consider the potential impacts on local air quality if HC refrigerants were used widely. We used EPA's Vintaging Model to estimate the HC emissions from these scenarios and EPA's Community Multiscale Air Quality (CMAQ) model to assess their potential incremental contributions to ground-level ozone concentrations.[82] The first analysis assumed that all refrigerant used was emitted to the atmosphere, as it could be if refrigerants were exempted from the venting prohibition of CAA section 608. In that highly conservative scenario, the model predicted that the maximum increase in the 8-hour average ground-level ozone concentration would be 0.72 parts per billion (ppb) in Los Angeles if the most reactive saturated HC, isobutane, were the only refrigerant and it was all emitted to the atmosphere. If the unsaturated HC propylene was assumed to be the only refrigerant used in equipment and it was all emitted (if it were to be exempted from the venting prohibition under CAA section 608), the model predicted that the maximum increase in the 8-hour average ground-level ozone concentration would be 6.61 ppb in Los Angeles, which is the area with the highest level of ozone pollution in the United States. For purposes of comparison, the ground-level ozone limit under the NAAQS has been 75 ppb since 2008.[83] We have concerns that widespread emissions of propylene from use as a refrigerant could interfere with the ability of some nonattainment areas to reach attainment, both with the 2008 NAAQS and the new, more stringent standard.

EPA also performed less conservative analyses that considered the end-uses where these refrigerants would more likely be used, based upon submissions received and upon end-uses where there are industry standards addressing the use of flammable refrigerants. Propylene was previously listed as an acceptable substitute in industrial process refrigeration. EPA has received submissions for use of R-443A in residential and light commercial AC and heat pumps and window air conditioners. We have received a SNAP submission for use of propylene in cold storage warehouses and in commercial comfort AC in chillers, and have received inquiries about using propylene in retail food refrigeration. In addition, EPA is aware that UL has developed standards addressing use of flammable refrigerants in stand-alone retail food refrigeration equipment and coolers; vending machines; water coolers; commercial ice machines; household refrigerators and freezers; and room air conditioners; and is currently developing revisions to UL 1995 for residential AC equipment. Thus, we considered scenarios where propylene would be used and emitted (1) in all stationary AC and refrigeration end-uses, but excluding MVAC, (2) in all refrigeration end-uses and all AC end-uses except for MVAC and chillers for commercial comfort AC. For further details on the scenarios and end-uses in the analysis, see the docket for this rulemaking.[84]

Based on this still conservative assessment of refrigerant use, we found that if all the refrigerant in appliances in the end-uses analyzed were to be emitted, there would be a worst-case impact of 4.47 ppb ozone in the Los Angeles area. In the other cities examined in the analysis, Houston and Atlanta, which have also had historically high levels of ambient ozone, impacts were smaller (as much as 0.67 and 0.39 ppb, respectively).[85] Approximately 72–73 percent of the emissions were estimated to come from the residential and light commercial AC and heat pumps end-use in those less conservative analyses, indicating that emissions from this end-use could have a particularly large impact. Both the

[80] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.
[81] Ibid.
[82] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.
[83] The standard has recently been lowered to 70 ppb (80 FR 65292; October 26, 2015).
[84] ICF, 2016g. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Chillers and Cold Storage Warehouses. Substitute: Propylene (R-1270).
[85] Ibid.

most conservative as well as the less conservative but more probable assessments indicated there could be significant air quality impacts of these refrigerants if they are released to the atmosphere.

A more recent analysis specifically examining use of R-443A and propylene in residential and light commercial AC and heat pumps, cold storage warehouses, and commercial comfort AC (centrifugal and positive displacement chillers) found noticeable impacts from these end-uses. If propylene were the only refrigerant in these end-uses and it was emitted from residential and light commercial AC and heat pumps and cold storage warehouses,[86] the analysis indicated there would be a worst-case impact of 4.45 ppb ozone in the Los Angeles area, 1.21 ppb in Houston, and 0.65 in Atlanta, respectively.[87] [88] Assuming that propylene were used in all cold storage warehouses and centrifugal and positive displacement chillers; room air conditioners could use either R-443A or the currently listed VOC refrigerants propane or R-441A; other residential and light commercial AC and heat pumps all used R-443A; and these refrigerants were all emitted from cold storage warehouses and residential and light commercial AC and heat pumps, there would be a worst-case impact of 2.57 ppm ozone in the Los Angeles area, 0.77 ppb in Houston, and 0.44 ppb in Atlanta, respectively.[89] [90]

Propylene and R-443A in the proposed end-uses would be subject to the CAA section 608 venting prohibition unless EPA were to issue a final rule specifically exempting them; EPA is not proposing such an exemption in this rulemaking. While potential air quality impacts of propylene and R-443A would likely be reduced through the CAA section 608 venting prohibition, we do not consider this sufficient to mitigate the risks of these refrigerants in the proposed end-uses, particularly in light of their photochemical reactivity and toxicity. EPA is not aware of commercially available recovery equipment for flammable refrigerants (*e.g.,* built with spark-proof components and other features to reduce flammability risks), and without such equipment, emissions could occur. Further, other emissions could occur that are not subject to the venting prohibition and no equipment is free of refrigerant emissions. Because of the reactivity of these refrigerants, those emissions could interfere with the ability of some nonattainment areas to reach attainment, both with the 2008 NAAQS and the new, more stringent standard.

Ecosystem effects, primarily effects on aquatic life, of the substitutes are expected to be small as are the effects of other acceptable substitutes. Propylene, propane and isobutane are all highly volatile and would evaporate or partition to air, rather than contaminate surface waters. Neither propylene nor R-443A pose a greater risk of aquatic or ecosystem effects than those of other substitutes for these uses.

(b) Flammability

Propylene and R-443A are both designated as A3 refrigerants according to ASHRAE 34–2013 and subsequent addenda. Thus, their flammability is comparable to that of ethane, propane, isobutane, and R-441A, other refrigerants that EPA has listed as acceptable, subject to use conditions, in a number of end-uses (76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015).

Due to their flammable nature, propylene and R-443A could pose a significant safety concern for workers and consumers if they are not properly handled. In the presence of an ignition source (*e.g.,* static electricity spark resulting from closing a door, using a torch during service, or a short circuit in wiring that controls the motor of a compressor), an explosion or a fire could occur when the concentration of refrigerant exceeds its LFL. The LFLs of the substitutes are: 2.03 percent for R-443A [91] and 2.0 percent for propylene.[92]

To determine whether flammability would be a concern for manufacturing and service personnel or for consumers, EPA analyzed a plausible worst-case scenario to model a catastrophic release of the refrigerants. The worst-case scenario analysis for each refrigerant revealed that even if the full charge of a window AC unit is emitted within one minute, neither of these refrigerants reached their respective LFLs. However, for larger residential AC systems, such as for a unitary split AC system, charges are significantly higher, and a catastrophic leak of refrigerant inside a building could result in surpassing the LFL.[93] [94] For chillers, our risk screen found that an instantaneous release of the entire charge of propylene from a small chiller (charge size of around 12 kg) would not exceed the LFL, but release of larger charge sizes (*e.g.,* 315 kg) would result in exceeding the LFL by ten-fold or more.[95] Thus, flammability would be a concern for equipment with large charge sizes.

EPA also reviewed the submitters' detailed assessments of the probability of events that might create a fire and engineering risk and approaches to avoid sparking from the refrigeration equipment. Further information on these analyses and EPA's risk assessments are available in public docket EPA–HQ–OAR–2015–0663. Manufacturing and service personnel or consumers may not be familiar with refrigeration or AC equipment containing a flammable refrigerant. Thus, additional risk mitigation would be appropriate. Use conditions such as those recently finalized for ethane, isobutane, propane, and R-441A could potentially be adopted by regulation as use conditions to mitigate flammability concerns from propylene and R-443A in end-uses for self-contained refrigeration and AC equipment such as stand-alone retail food refrigeration units, household refrigerators and freezers, vending machines, and room air conditioners for residential and light commercial AC and heat pumps. We further note that refrigerant handling equipment designed to be used safely with flammable refrigerants are not commercially available in the United States nor are standards to test and certify such equipment in place. Assuming these substitutes would not be exempted from the venting prohibition under CAA section 608 due to potential local air quality impacts, the lack of such equipment and standards for refrigerant recovery calls into

[86] The analysis assumed that local and state safety regulations required recovery of refrigerant from commercial comfort air conditioning equipment.

[87] ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

[88] ICF, 2016g. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Chillers and Cold Storage Warehouses. Substitute: Propylene (R-1270).

[89] ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

[90] ICF, 2016g. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Chillers and Cold Storage Warehouses. Substitute: Propylene (R-1270).

[91] A.S. Trust & Holdings, 2014. Response to Incompleteness Letter from A.S. Trust & Holdings to EPA—Sent March 7, 2014.

[92] Airgas, 2015. Safety Data Sheet for Propylene.

[93] ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

[94] ICF, 2016g. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Chillers and Cold Storage Warehouses. Substitute: Propylene (R-1270).

[95] Ibid.

question whether flammability risks could be adequately addressed through use conditions at this time.

(c) Toxicity

In evaluating potential toxicity impacts of propylene and R-443A on human health, EPA considered both occupational risk, and for end-uses in the household or in retail establishments, also consumer risks. EPA investigated the risk of asphyxiation and of exposure to toxic levels of refrigerant for a plausible worst-case scenario and a typical use scenario for each refrigerant. In the worst-case scenario of a catastrophic leak, we modeled release of the unit's full charge within one minute into a confined space to estimate concentrations that might result. We considered a conservatively small space appropriate to each end-use, such as a small utility room of 18 m^3 for a unitary split AC system, or a small bedroom of 41 m^3 for a room air conditioner. EPA used the same assumptions when evaluating other substitutes, such as CO_2, HFC-32, propane and R-441A.

To evaluate toxicity of both refrigerants, EPA estimated the maximum TWA exposure both for a short-term exposure scenario, with a 30-minute TWA exposure, and for an 8-hour TWA that would be more typical of occupational exposure for a technician servicing the equipment. We compared these short-term and long-term exposure values to relevant industry and government workplace exposure limits for propylene and the components of R-443A (including potential impurities). The modeling results indicate that both the short-term (30-minute) and long-term (8-hour) worker exposure concentrations would be below the relevant workplace exposure limits, such as the OSHA PEL, the NIOSH REL, or the ACGIH's TLV in cold storage warehouses, commercial comfort AC equipment, and residential and light commercial AC and heat pumps.[96] Because there is not an established short-term exposure limit (STEL) for propylene, propane, or isobutane, we considered information on short-term exposure such as a short-term excursion limit based on the TLV or the National Research Council's AEGL. The respective workplace exposure limits we considered for the various compounds, including components of the refrigerant blend R-443A, are as follows:

- Isobutane: 800 ppm REL on 10-hr TWA; 6,900 ppm over 30 minutes
- Propane: 1,000 ppm PEL/TLV on 8-hr TWA; 6,900 ppm AEGL–1 over 30 minutes
- Propylene: 500 ppm TLV on 8-hr TWA; 1,500 ppm excursion limit over 30 minutes

In comparison, HFCs and the HFC components of acceptable substitutes in these end-uses, have exposure limits, such as WEELs from the AIHA or manufacturer acceptable exposure limits, of 1,000 ppm on an 8-hr TWA and the HC components of both the acceptable refrigerants and those proposed unacceptable have exposure limits ranging from 500 to 1,000 ppm (8-hr TWA for TLVs from ACGIH and 10-hr TWA for recommended exposure limits (RELs) from NIOSH). HFOs acceptable in centrifugal and positive displacement chillers have WEELs of 800 ppm. Both the acceptable refrigerants and the proposed unacceptable refrigerants are able to be used in these end-uses in accordance with their respective workplace exposure limits.

For equipment with which consumers might come into contact, such as residential air conditioners and heat pumps, EPA also performed a consumer exposure analysis. In this analysis, we examined potential catastrophic release of the entire charge of the substitute in one minute under a worst-case scenario. We did not examine exposure to consumers in cold storage warehouses and commercial comfort AC (chillers), since such equipment is typically used in workplaces where access is controlled and not in homes or public spaces. The analysis was undertaken to determine the 30-minute TWA exposure levels for the substitute, which were then compared to the toxicity limits to assess the risk to consumers.

EPA considered toxicity limits for consumer exposure that reflect a short-term exposure such as might occur at home or in a store or other public setting where a member of the general public could be exposed and could then escape. Specific toxicity limits that we used in our analysis of consumer exposure include:

- Isobutane: 6,900 ppm over 30 minutes[97]
- Propane: 6,900 ppm AEGL–1 over 30 minutes[98]
- Propylene: 1,500 ppm excursion limit[99] over 30 minutes

The analysis of consumer exposure assumed that 100 percent of the unit's charge would be released over one minute, at which time the concentration of refrigerant would peak in an enclosed space, and then steadily decline. Refrigerant concentrations were modeled under two air change scenarios, believed to represent the baseline of potential flow rates for a home or other public space, assuming flow rates of 0.11 and 0.67 ACH.[100] Under the conservative assumptions used in the consumer exposure modeling, the estimated 30-minute consumer exposures to the refrigerants exceed the toxicity limits for the propylene component of R-443A in all cases but the least conservative. The least conservative scenario assumed the highest ventilation rate and the lowest charge size (160 g) evaluated, as well as assuming complete mixing of the refrigerant rather than stratification (*i.e.,* refrigerant pooling near the floor). All of the other estimates of exposure exceeded the 1,500 ppm excursion limit for propylene, with estimates ranging from approximately 1,520 ppm to 9,700 ppm. This occurred for lower or higher charge sizes ranging from 160 g to 1,500 g; lower or higher ventilation levels of 0.11 or 0.67 ACH; and, except for the smallest charge size, whether stratification was assumed to occur or not. In comparison, EPA previously found that a charge of 180 g of propane

[96] Ibid.

[97] EPA selected this value as analogous to the AEGL–1 of 6,900 ppm over 30 minutes for propane, another saturated hydrocarbon with similar chemical properties.

[98] The Acute Emergency Guideline Limit (AEGL) is an emergency guideline for exposures to the general population (including susceptible populations) and is not time-weighted. It also considers the chemical's flammability in addition to its toxicity. EPA develops a set of AEGL values for a substance for five exposure periods (10 and 30 minutes, 1 hour, 4 hours and 8 hours). For each exposure period, three different AEGL values are developed to address different levels of toxicological impacts. Of relevance for the modeled scenario is the AEGL–1, which is defined as: ''the airborne concentration, expressed as parts per million or milligrams per cubic meter (ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.'' While permanent toxicological effects are not expected up to the AEGL–2 value, this limit is not relevant for this analysis because at that level, flammability would be a greater concern.

[99] There are no short term exposure limits available for propylene (*e.g.,* AEGL–1, NIOSH STEL, ACGIH STEL). This compound is sufficiently different chemically from propane (*e.g.,* contains a double bond) that we could not select an analogous AEGL. Therefore, EPA developed a short-term excursion limit based upon ACGIH recommendations. The ACGIH recommends that short-term exposures of chemicals not surpass three times the 8-hr TWA TLV over 15 minutes and at no time surpass five times the 8-hr TWA TLV. For propylene, this equates to 1,500 to 2,500 ppm.

[100] ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

in a room air conditioner could meet its AEGL–1 and a charge of 195 g of R-441A in a room air conditioner could meet the various short-term exposure limits for its components under the same assumptions of ventilation, stratification, and room size.[101] [102] Thus, EPA has concern about the exposure levels and toxicity of propylene and R-443A in residential and light commercial AC and heat pumps.

In comparison, the currently acceptable refrigerants typically have high acute exposure limits for their components based upon cardiotoxic effects of halocarbons over 10,000 ppm (*e.g.,* 350,000 cardiotoxic no-observed adverse effect level for HFC-32 over 5 minutes) or have components with STELs or AEGLs (*e.g.,* 8,000 ppm 10-minute AEGL–1 for HFC-134a component). Acute exposure limits for propylene and R-443A's components range from 1,500 ppm for propylene to 6,900 ppm (AEGL–1 over 30 minutes for propane). Because of the relatively low acute exposure limit for propylene, acute exposure is a greater concern than for other acceptable refrigerants in residential and light commercial AC systems and heat pumps.

In summary, EPA's concerns about propylene and R-443A encompass both toxicity and exposure and impacts of these refrigerants on local air quality.[103] Other acceptable refrigerants are available in the same end-uses that offer lower toxicity and air quality impacts, and similar flammability, GWP, and ODP when compared to R-443A and propylene. Thus, we are proposing to list propylene and R-443A as unacceptable in these end-uses because they pose significantly more risk than other available refrigerants. For further information, including EPA's risk screens and risk assessments as well as information from the submitters of the substitutes, see docket EPA–HQ–OAR–2015–0663.

iv. When would the listings apply?

EPA proposes that this listing would apply 30 days after the date of publication of a final rule. To our knowledge, manufacturers and service technicians are not currently using these substitutes in the proposed end-uses. We note that EPA has only recently found submissions complete for these substitutes, and under the SNAP program regulations, a substitute may not be introduced into interstate commerce prior to 90 days after EPA receives a complete submission. Further, a date of 30 days after the date of publication of a final rule, the same as the proposed effective date of this regulation, would protect against the risks of these substitutes at the earliest opportunity.

v. What is the relationship between this proposed SNAP rule and other federal rules?

DOE has indicated its intent to issue a proposed energy conservation standard for portable air conditioners, a subset of the residential and light commercial air conditioning and heat pumps end-use. For information on DOE's 2015 Fall Regulatory Agenda, see *http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201510&RIN=1904-AD02*. Information on other federal rules that may apply to centrifugal chillers, positive displacement chillers, and cold storage warehouses is available in sections VI.A.4.a.vi, VI.A.4.b.vi, and VI.A.4.c.v below. We note that since these two refrigerants are currently not being used in these types of equipment in the United States, we expect this regulation, if finalized as proposed, would have no impact on compliance with federal energy conservation standards.

vi. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on our proposal to list the refrigerants propylene (R-1270) and R-443A as unacceptable in new equipment in residential and light commercial AC and heat pumps, cold storage warehouses, and centrifugal and positive displacement chillers for commercial comfort AC. EPA specifically requests comment on the proposed decision to list these refrigerants as unacceptable 30 days after the date of publication of a final rule, and the end-uses proposed here.

4. Proposed Changes in Listing Status

a. Proposed Change of Status for Certain HFC Refrigerants for New Centrifugal Chillers

As provided in the following table, EPA is proposing to change the status of numerous refrigerants from acceptable to unacceptable for new centrifugal chillers:

TABLE 5—PROPOSED CHANGE OF STATUS DECISIONS FOR NEW CENTRIFUGAL CHILLERS

End-use	Substitutes	Proposed decision
Centrifugal chillers (new only).	FOR12A, FOR12B, HFC-134a, HFC-227ea, HFC-236fa, HFC-245fa, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R-438A, R-507A, RS-44 (2003 composition), and THR-03.	Unacceptable as of January 1, 2024, except where allowed under a narrowed use limit.
Centrifugal Chillers (new only).	HFC-134a	Acceptable, subject to narrowed use limits, for military marine vessels, as of January 1, 2024.
Centrifugal Chillers (new only).	HFC-134a and R-404A	Acceptable, subject to narrowed use limits, for human-rated spacecraft and related support equipment, as of January 1, 2024.

i. What is the affected end-use?

(a) Overview of Equipment Covered

In the initial rule establishing the SNAP program (59 FR 13044; March 18, 1994), EPA included within the refrigeration and AC sector the end-use ''commercial comfort air conditioning'' and then elaborated on that end-use saying that ''CFCs are used in several different types of mechanical commercial comfort AC systems, known as chillers.'' EPA indicated ''that over time, existing cooling capacity [from chillers] will be either retrofitted or replaced by systems using non-CFC refrigerants in a vapor compression cycle or by alternative technologies.''

[101] ICF, 2014b. Risk Screen on Substitutes for HCFC-22 in Residential and Light Commercial Air Conditioning and Heat Pumps; Substitute: Propane (R-290).

[102] ICF, 2014c. Risk Screen on Substitutes for HCFC-22 in Residential and Light Commercial Air Conditioning and Heat Pumps; Substitute: R-441A.

We also explained in that rule that vapor compression chillers can be categorized by the types of compressor used, including centrifugal, rotary, screw, scroll and reciprocating compressors. These compressor types are also divided into centrifugal and positive displacement chillers, the latter of which includes those with reciprocating, screw, scroll or rotary compressors. This section of the proposed rule covers centrifugal chillers.

Centrifugal chillers are equipment that utilize a centrifugal compressor in a vapor-compression refrigeration cycle. Centrifugal chillers are typically used for commercial comfort AC although other uses do exist. Centrifugal chillers can be found in office buildings, hotels, arenas, convention halls, airport terminals and other buildings. Centrifugal chillers tend to be used in larger buildings.

For commercial comfort and some other applications, centrifugal chillers typically cool water that is then pumped to fan coil units or other air handlers to cool the air that is supplied to the occupied spaces transferring the heat to the water. The heat absorbed by the water can then be used for heating purposes, and/or can be transferred directly to the air (''air-cooled''), to a cooling tower or body of water (''water-cooled'') or through evaporative coolers (''evaporative-cooled''). A centrifugal chiller or a group of centrifugal chillers could similarly be used for district cooling where the chiller plant cools water or another fluid that is then pumped to multiple locations being served such as several different buildings within the same complex. All such centrifugal chillers are covered by this section of the proposed rule.

Centrifugal chillers are used for other applications besides commercial comfort AC and are covered under this section of the proposed rule. For instance, centrifugal chillers used to cool equipment, such as in data centers, are covered under this section of the proposed rule.

(b) What other types of equipment are used for similar applications but are not covered by this section of the proposed rule?

Other equipment including packaged rooftop units and split system air conditioners, both of which fall under the SNAP end-use ''household and light commercial air conditioning,'' can also be used for commercial comfort AC, typically for smaller capacity needs. These equipment types are not centrifugal chillers and hence are not covered under this section of the proposed rule.

(c) What refrigerants are used in centrifugal chillers?

Centrifugal chillers historically employed either CFC-11 (called ''low pressure chillers'') or CFC-12 (''high pressure chillers''), although other CFCs have been used, including CFC-114 and R-500 (a blend of CFC-12 and HFC-152a). When the production and consumption of CFCs were phased out in the United States in the 1990s, centrifugal chillers was one of the first end-uses to be redesigned for alternative refrigerants and HCFC-123 and HFC-134a became the primary refrigerants used in centrifugal chillers. HCFC-123 was used in low pressure chillers while HFC-134a was used in high pressure chillers. Both of these alternatives continue to be used today. HCFC-22 was also used in some centrifugal chillers, primarily only in equipment produced before approximately the year 2000. HFC-245fa was also identified as a possible refrigerant for low pressure centrifugal chillers, but has found only limited use.

More recently, centrifugal chillers that use alternatives listed as acceptable have been demonstrated or announced. For instance, one manufacturer has introduced centrifugal chillers using *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, a nonflammable low-GWP refrigerant.[104]

ii. Which refrigerants is EPA proposing to list as unacceptable?

For new centrifugal chillers, EPA is proposing to change the status of the following refrigerants from acceptable to unacceptable: FOR12A, FOR12B, HFC-134a, HFC-227ea, HFC-236fa, HFC-245fa, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R-438A, R-507A, RS-44 (2003 composition), and THR-03.

iii. How do these proposed unacceptable refrigerants compare to other refrigerants for this end-use with respect to SNAP criteria?

For new centrifugal chillers, acceptable refrigerants for which we are not proposing a change of status in this end-use include: HFO-1234ze(E), IKON A, IKON B, R-450A, R-513A, R-717 (ammonia), THR-02, and trans-1-chloro-3,3,3-trifluoroprop-1-ene.

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document [105] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives for new centrifugal chillers may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

The refrigerants for which we are proposing a change of status have an ODP of zero. Other alternatives also with an ODP of zero that we are not proposing a change of status for new centrifugal chillers include HFO-1234ze(E), IKON A, IKON B, R-450A, R-513A, R-717, and THR-02. Also, the alternative refrigerant *trans*-1-chloro-3,3,3-trifluoroprop-1-ene has an ODP of 0.00024 to 0.00034.[106] [107] Estimates of this compound's potential to deplete the ozone layer indicate that even with worst-case estimates of emissions, which assume that this compound would substitute for all compounds it could replace, the impact on global atmospheric ozone abundance would be statistically insignificant.[108] Thus, the acceptable alternatives not subject to the proposed status change have ODPs lower than or of the same practical effect to the ODPs of other alternatives for which EPA is proposing a change of status, and lower than the ODPs of ODS historically used in this end-use. The refrigerants we are proposing to find unacceptable through this action have GWPs ranging from about 920 to 9,810. As shown in Table 6, other alternatives

[104] Cooling Post, 2014. Trane first with 1233zd chiller, June 30, 2014. This document is accessible at *www.coolingpost.com/world-news/trane-first-with-1233zd-chiller/.*

[105] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[106] 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.

[107] 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.

[108] 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.

acceptable for this end-use have GWPs ranging from zero to 630.

TABLE 6—GWP, ODP, AND VOC STATUS OF REFRIGERANTS IN NEW CENTRIFUGAL CHILLERS [1] [2] [3]

Refrigerants	GWP	ODP	VOC	Proposal
Ammonia, HCFC-123, HCFC-124, HFO-1234ze(E), R-450A, R-513A, *trans*-1-chloro-3,3,3-trifluoroprop-1-ene.	0–630	0-0.022	No	No change.
IKON A, IKON B, THR-02	30–560	0	Yes [3]	No change.
HFC-134a, HFC-245fa	1,030–1,430	0	No	Unacceptable.
FOR12A, FOR12B, THR-03	920–1,220	0	Yes [3]	Unacceptable.
R-407C, R-410A, R-410B, R-421A, R-423A, HFC-227ea	1,770 –3,220	0	No	Unacceptable.
R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55/1/42.5/1.5), R-417A, R-422B, R-422C, R-422D, R-424A, R-434A, R-438A, RS-44 (2003 composition).	1,770 –3,250	0	Yes [3]	Unacceptable.
HFC-236fa, R-404A, R-507A	3,920–9,810	0	No	Unacceptable.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-use.
[2] HCFC-22, HCFC-123, HCFC-124, and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] One or more constituents of the refrigerant are VOC.

One of the refrigerant blends not subject to the proposed status change (THR-02), as well as several of the substitutes subject to the proposed status change, include small amounts of R-290 (propane), R-600 (butane) or other substances that are VOCs. These amounts are small and for this end-use are not expected to contribute significantly to ground level ozone formation.[109] In the actions where EPA listed these refrigerants as acceptable, EPA concluded none of these refrigerants in this end-use pose significantly greater risk to ground-level ozone formation than other alternative refrigerants that are not VOCs or that are specifically excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

The refrigerants not subject to the proposed status change are highly volatile and typically evaporate or partition to air, rather than contaminating surface waters. Their effects on aquatic life are expected to be small and pose no greater risk of aquatic or ecosystem effects than those of other refrigerants that are subject to the proposed status change for this end-use.

(b) Flammability

For the centrifugal chillers end-use, with the exceptions of HFO-1234ze(E) and R-717, all other refrigerants listed as acceptable, including those for which we are proposing to change the status to unacceptable, are not flammable. HFO-1234ze(E) is non-flammable at standard temperature and pressure using the standard test method ASTM E681; however, at higher temperatures it is mildly flammable. It is classified as a Class 2L (lower flammability, low burning velocity) refrigerant under the standard ASHRAE 34 (2013). Our assessment and listing decision (77 FR 47768; August 10, 2012) found that the overall risk, including the risk due to this mild flammability at elevated temperature, is not significantly greater than for other refrigerants or for the refrigerants we are proposing to list as unacceptable.

R-717 is slightly flammable with a low flame speed; it is classified as a 2L refrigerant under ASHRAE 34 (2013). R-717 has a long history of use in cold storage warehouses and other applications, but it is not believed to be used extensively in centrifugal chillers. In the original SNAP rule, EPA noted ''[a]mmonia has been used as a medium to low temperature refrigerant in vapor compression cycles for more than 100 years. Ammonia has excellent refrigerant properties, a characteristic pungent odor, no long-term atmospheric risks, and low cost. It is, however, slightly flammable and toxic, although it is not a cumulative poison. OSHA standards specify a 15 minute short-term exposure limit of 35 ppm for ammonia.'' (53 FR 13072; March 18, 1994). We further noted its use in various food and beverage processing and storage applications as well as other industrial applications. In that rule, we found R-717 acceptable for use in new centrifugal chillers, concluding that its overall risk to human health and the environment was not significantly greater than the other alternatives found acceptable. This conclusion was based on the assumption that the regulated community adheres to OSHA regulations on such use as well as standard refrigeration practices, such as the adherence to ASHRAE Standard 15, which is often utilized by local authorities when setting their own building and safety requirements.

For further information, including EPA's risk screens and risk assessments as well as information from the submitters of the substitutes, see docket EPA–HQ–OAR–2015–0663.

(c) Toxicity

The toxicity of the refrigerants we are proposing to list as unacceptable is comparable to that of other alternatives that are acceptable in this end-use, with the exception of R-717. R-717, for which we are not proposing a change of status, is of a higher toxicity than some other refrigerants and is classified as a B refrigerant under ASHRAE 34 (2013). See section VI.A.4.a.iii.(b) for a discussion on the long history of use of R-717 and our original decision finding it acceptable in new centrifugal chillers. The other acceptable alternatives listed above that are included in ASHRAE 34 (2013) are classified as A (lower toxicity) refrigerants.

For all refrigerants, the relatively large charge sizes employed in centrifugal chillers, and the fact that some such chillers are placed in an enclosed mechanical room, raise a concern regarding oxygen displacement. This concern has been addressed over the long history of the use of centrifugal chillers, including the use of HCFC-123, another B refrigerant as classified by ASHRAE 34 (2013), by providing adequate ventilation, reducing leaks to small levels, and other techniques such as employing refrigerant sensors and automatic air movement. Commonly followed standards and practices have reduced toxicity concerns equally for historically used ODS, the alternatives for which we are proposing a status

[109] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

change, and the alternatives for which we are not proposing a status change.

(d) Summary

EPA has listed as acceptable several alternatives that pose lower overall risk to human health and the environment than the refrigerants whose status we are proposing to change to unacceptable. The risks other than GWP are not significantly different for the alternatives than for the refrigerants we are proposing to list as unacceptable, and the GWPs for the refrigerants we are proposing to list as unacceptable are significantly higher and thus pose significantly greater risk.

iv. What narrowed use limits for military marine vessels and human-rated spacecraft and related support equipment is EPA proposing?

EPA is proposing a narrowed use limit that would allow continued use of HFC-134a in centrifugal compressor chillers for military marine vessels after the change of status date where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements. Under the narrowed use limit, the end user for this military application would need to ascertain that other alternatives are not technically feasible and document the results of their analysis. See 40 CFR 82.180(b)(3). For the military, there are several unique performance requirements related to marine vessel air conditioning systems that require extensive testing prior to qualifying alternatives for HFC-134a. The lower-GWP alternatives available or potentially available for use in commercial chillers either do not meet the military-unique requirements or will require longer testing, based on available program funding for testing, for military suitability. It will also then take additional time to redesign, qualify, and procure new chillers for military shipbuilding programs.

We anticipate that most centrifugal compressor chillers in military applications will be able to transition to acceptable alternatives by the proposed January 1, 2024 date. However, HFC-134a chillers are mission-critical equipment on ships and submarines, primarily in cooling of electronics, sensors, and weapon systems, but also cooling of ship spaces for personnel. Failure of the chillers would disable the ship. The equipment is not the same as commercial equipment and it is located in confined engineering spaces near other critical equipment, including conventional and nuclear propulsion plants. All major components are designed, tested and certified for military use (including the compressor, motor, evaporator, condenser, and electronic controls) and must meet military-unique requirements: Weapons effect shock resistance, stringent electromagnetic interference resistance, ship vibration resistance, all weather pitch and roll operation, low acoustic signature, arctic to tropical operations (at temperatures from 28 °F to 105 °F), compact to fit in confined warship spaces, 40 to 50 year service life, and very high reliability due to extended at-sea missions. Further challenges include installation on submarines with the inherent risk of refrigerant leakage and need for the refrigerant to be compatible with the submarine life support systems. Production for these equipment for naval ships and submarines is low volume with only one certified manufacturer, limited test facilities, and prototype hardware and designs shared among platforms for affordability and commonality. Another significant challenge lies in the fact that the testing program for the use of alternatives for ships has not yet been funded. Once funding is in place, the completion timeline to fund, test, qualify, and begin procurement on all Navy-unique surface ship chiller designs is estimated to be about ten years. Due to the unique challenges associated with submarines, including potential refrigerant incompatibility with life support systems, it may not be feasible to implement currently available alternatives being evaluated for surface ships. Given the limited population of submarine chillers, the resulting greenhouse gas emissions from refrigerant leakage in this application is not expected to be significant.

EPA is proposing a narrowed use limit that would allow continued use of HFC-134a and R-404A in centrifugal compressor chillers for human-rated spacecraft and related support equipment applications after the change of status date where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements. Under the narrowed use limit, the end user for this human-rated spacecraft and related support equipment application would need to ascertain that other alternatives are not technically feasible and document the results of their analysis. See 40 CFR 82.180(b)(3). HFC-134a and R-404A chillers are used to provide cooling to human-rated spacecraft and related support equipment during ground-based assembly, integration and test operations, and launch. The cooling of sensitive human-rated electrical equipment is critical to the spacecraft technical performance and crew safety. EPA understands that such programs use specialized ground coolant systems to provide heat transfer during certain ground operations. These coolant circulation systems use HFC-134a and R-404A chillers to meet the program's stringent performance and material compatibility requirements. Other alternatives currently listed as acceptable under the SNAP program have not yet been proven to provide appropriate heat transfer, material compatibility, stability in the test environment, and other critical properties necessary for use in human-rated spacecraft and related support equipment applications. Considering that identification, testing, and implementation of materials to be used in human-rated-spacecraft programs routinely take several years due to the challenging operational environment, lengthy qualification process associated with human rating, and the federal budgetary cycle, it may not be feasible to deploy centrifugal chillers using other alternatives in the proposed timeframe. Given the limited population of chillers used in human-rated spacecraft and related support equipment applications, the resulting greenhouse gas emissions from refrigerant leakage in this application is not expected to be significant.

Users of a restricted agent within the narrowed use limits category must make a reasonable effort to ascertain that other substitutes or alternatives are not technically feasible. Users are expected to undertake a thorough technical investigation of alternatives to the otherwise restricted substitute. Although users are not required to report the results of their investigations to EPA, users must document these results, and retain them in their files for the purpose of demonstrating compliance. This information includes 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.

v. When would the status change?

The Agency understands that relevant building standards and codes are likely to change in 2021. These include ASHRAE 15, UL 1995, UL 60335–2–40, and the International Building Code. The Agency believes some amount of

time will be needed to meet the technical challenges for a safe and smooth transition to alternatives particularly considering the complexity of chiller designs and the need to ensure energy efficiency levels are met. EPA is considering a range of dates from January 1, 2022, through January 1, 2025, as the change of status date for new centrifugal chillers. Our lead proposal is a status change date of January 1, 2024, which we believe would allow development of designs of new centrifugal chillers using an acceptable alternative. We are aware that some equipment has been introduced with acceptable alternatives and that additional research and development is underway with these and other possible alternatives.

In addition, EPA has received communication from representatives of AHRI and NRDC requesting a change of status date of January 1, 2025, for HFC-134a, R-407C and R-410A, in all types of chillers.[110] We are encouraged that the major trade organization representing manufacturers of chillers worked with the environmental non-governmental group to develop this consensus agreement that all chillers could transition to lower-GWP alternatives by or before this date and that during this time period more and more models of such equipment would be released from individual manufacturers. While the letter did not provide detailed technical analysis or timelines of why this date but not an earlier date was offered, it did indicate that their recommendation ''allows eight years from the publication of the final rule for industry to finish designing and bringing to market chillers using alternative refrigerants.'' The authors pointed out that ''this conversion [in all types of chillers] is anticipated to involve use of new 2L flammable refrigerants, which are severely restricted by current safety and building codes'' and added that a 2025 date ''provides time to amend model building codes to accommodate these new refrigerants and for adoption by state and local jurisdictions.'' AHRI and NRDC held that a January 1, 2025 change of status date ''provides adequate time for industry to launch products that have been tested and certified by the existing laboratories and certification agencies . . . globally'' and emphasized that time was required to complete revisions to ASHRAE Standard 15, recertify the chillers with safety standards, and qualify materials and components to ensure low-leak, high-reliability products. They also said their recommended schedule provides time for manufacturers to optimize the energy efficiency of their products.

vi. What is the relationship between this proposed SNAP rule and other federal rules?

DOE has established efficiency requirements, based on ANSI/ASHRAE/IES Standard 90.1–2010, for chillers used in federal buildings.[111] EPA is not aware of any DOE energy efficiency requirements for chillers used in non-federal buildings. Although EPA is not aware of any federal standards that apply, EPA recognizes, however, that state and local building codes may place certain requirements that affect the desired efficiency of chillers. Many state and local codes reference ASHRAE Standard 90.1. EPA's understanding of ASHRAE Standard 90.1 is that it provides both a prescriptive and performance-based measures to achieve compliance. Under the prescriptive approach, depending on the version of the standard, one or two ''paths'' exist setting specific energy efficiency requirements based on the type and capacity of the chiller. Under a performance-based approach, the energy consumption of the chiller may exceed the prescriptive requirements provided that the building as a whole meets or exceeds the applicable reference building.

vii. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on a range of dates from January 1, 2022, through January 1, 2025, for the change of status of the identified substitutes. EPA requests comment and information on any potential environmental or other impacts of EPA adopting a date other than January 1, 2024, which is our lead option. In particular, EPA requests comment on whether other alternatives that reduce overall risk would be available prior to January 1, 2024 and for comment on any technical or other reasons that NRDC and AHRI proposed January 1, 2025 in their joint letter. EPA requests comment on the specific steps that must be undertaken to commercialize centrifugal chillers with alternative refrigerants, including the time each such step would take, which steps must occur in sequence, and which steps could occur in parallel. EPA requests comments on if and how this timing might vary based on the characteristics of the chiller, such as but not limited to, compressor type, capacity range, evaporator design, condenser design (*e.g.,* air cooled or water cooled), and refrigerant currently used and potentially used.

EPA requests comment on the current use of four refrigerants not subject to the proposed change of status, *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, HFO-1234ze(E), R-450A and R-513A, in centrifugal chillers, including the status of product availability and the capacity range covered by such products. We also request comment on the on-going research, development, deployment and expected increased market penetration of centrifugal chillers using refrigerants such as *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, HFO-1234ze(E), R-290, R-450A, R-513A, DR-55,[112] R-718 and R-744.

Additionally, EPA requests comment on any energy efficiency performance impacts of using the refrigerants not subject to the change of status proposed today that could affect the ability of manufacturers to meet current energy efficiency requirements or standards for centrifugal chillers in the United States. Also, EPA requests comment on the ability of centrifugal chillers using refrigerants other than those for which we are proposing a status change to meet those energy efficiency requirements or standards. In particular, we request comment on the specific steps and timing of such steps required to design and develop centrifugal chillers to meet applicable federal energy efficiency requirements.

EPA is also requesting comment on the proposed narrowed use limitation for chillers on military marine vessels and human-rated spacecraft and related support equipment where the unique requirements would limit the availability and feasible use of alternatives not subject to the proposed status change.

b. Proposed Change of Status for Certain HFC Refrigerants for New Positive Displacement Chillers

As provided in the following table, EPA is proposing to change the status of numerous refrigerants from acceptable to unacceptable for new positive displacement chillers:

[110] Doniger, David (NRDC) and Stephen Yurek (AHRI), February 1, 2016. AHRI/NRDC Letter Regarding Chiller Actions Under SNAP.

[111] DOE, 2014. Building Energy Codes Program. Energy Efficiency Standards for Federal Buildings. Available at: *https://www.energycodes.gov/regulations/federal-building-standards.* Last updated February 13, 2014.

[112] DR-55 is a temporary name identifying a specific HFC/HFO blend.

TABLE 7—PROPOSED CHANGE OF STATUS DECISIONS FOR NEW POSITIVE DISPLACEMENT CHILLERS

End-use	Substitutes	Proposed decision
Positive Displacement Chillers (new only).	FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 composition), SP34E, and THR-03.	Unacceptable as of January 1, 2024 except where allowed under a narrowed use limit.
Positive Displacement Chillers (new only).	HFC-134a	Acceptable, subject to narrowed use limits, for military marine vessels, as of January 1, 2024.
Positive Displacement Chillers (new only).	HFC-134a and R-404A	Acceptable, subject to narrowed use limits, for human-rated spacecraft and related support equipment, as of January 1, 2024.

i. What is the affected end-use?

(a) Overview of Equipment Covered

As discussed in section VI.A.4.a.i, vapor compression cycle chillers are divided into centrifugal chillers and positive displacement chillers. This section deals with positive displacement chillers, which are those that utilize positive displacement compressors such as reciprocating, screw, scroll or rotary types. Positive displacement chillers are applied in similar situations as centrifugal chillers, again primarily for commercial comfort AC, except that positive displacement chillers tend to be used for smaller capacity needs such as in mid- and low-rise buildings.

For commercial comfort and some other applications, positive displacement chillers typically cool water that is then pumped to fan coil units or other air handlers to cool the air that is supplied to the occupied spaces transferring the heat to the water. The heat absorbed by the water can then be used for heating purposes, and/or can be transferred directly to the air (''air-cooled''), to a cooling tower or body of water (''water-cooled'') or through evaporative coolers (''evaporative-cooled'').

Positive displacement chillers are used for other applications besides commercial comfort AC and are covered under this section of the proposed rule. For instance, positive displacement chillers used to cool equipment, such as in data centers, are covered under this section of the proposed rule.

(b) What other types of equipment are used for similar applications but are not covered by this section of the proposed rule?

Other equipment including packaged rooftop units and split system air conditioners, both of which fall under the SNAP end-use ''household and light commercial air conditioning,'' can also be used for commercial comfort AC, typically for even smaller capacity needs than positive displacement chillers. These equipment types are not positive displacement chillers and hence are not covered under this section of the proposed rule.

(c) What refrigerants are used in positive displacement chillers?

Positive displacement chillers historically used CFC-12, although HCFC-22 was also used and became more common after the production and consumption of CFC-12 were phased out. In accordance with CAA 605(a) and the implementing regulations codified at 40 CFR part 82, subpart A, in the United States, the use of newly manufactured HCFC-22 for new positive displacement chillers (and other new equipment) ceased as of January 1, 2010. Both R-407C and to a larger extent R-410A are used in new positive displacement chillers primarily in lower capacity ranges previously served by HCFC-22 chillers. HFC-134a is also used for new positive-displacement chillers, including some mid-level capacity water-cooled screw chillers.

More recently, positive displacement chillers that use alternatives listed as acceptable including HFO-1234ze(E) and R-513A (a blend of HFC-134a and HFO-1234yf) have been demonstrated or announced. EPA is aware of air-cooled rotary chillers in the 115 to 500 refrigeration ton (400 to 1,750 kW) range using R-513A.[113] Other chiller models using low-GWP refrigerants have also been introduced; for instance an air-cooled chiller using DR-55 at the IIR International Conference of Refrigeration.[114] EPA also notes that a water-cooled screw chiller using HFO-1234ze [115] has been installed in Europe.[116]

ii. Which refrigerants is EPA proposing to list as unacceptable?

For new positive displacement chillers, EPA is proposing to change the status of the following refrigerants from acceptable to unacceptable: FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 composition), SP34E, and THR-03.

iii. How do these proposed unacceptable refrigerants compare to other refrigerants for this end-use with respect to SNAP criteria?

For new positive displacement chillers, acceptable refrigerants for which we are not proposing a change of status in this end-use include: HFO-1234ze(E), IKON B, R-450A, R-513A, R-717, and THR-02.

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document [117] that provides the **Federal Register** citations concerning data on the SNAP criteria

[113] Trane, 2015. Trane® SintesisTM Air-cooled Chillers. This document is accessible at: *http://www.trane.com/content/dam/Trane/Commercial/global/products-systems/equipment/chillers/air-cooled/TRANE_Sintesis_Brochure.pdf.*

[114] Trane Exhibits First Air-cooled Chiller with Climate-friendly Refrigerant DR-55, September 21, 2015. Available at: *www.ejarn.com/news.aspx?ID=36282.*

[115] EPA assumes the refrigerant used is the stereoisomer HFO-1234ze(E) but requests comment on this assumption.

[116] First Carrier AquaForce Chillers using HFO-1234ze, August 2, 2015. *www.ejarn.com/news.aspx?ID=35619.*

[117] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes Under the Significant New Alternatives Policy Program. March, 2016.

(*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives for new positive displacement chillers may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

The refrigerants for which we are proposing to change the status to unacceptable have zero ODP and GWPs ranging from about 920 to 3,990. As shown in Table 8, other alternatives for which we are not proposing a change of status in this end-use have GWPs ranging from zero to 630.

TABLE 8—GWP, ODP, AND VOC STATUS OF REFRIGERANTS IN NEW POSITIVE DISPLACEMENT CHILLERS [1] [2] [3]

Refrigerants	GWP	ODP	VOC	Proposal
Ammonia, HFO-1234ze(E), R-450A, R-513A	0–630	0	No	No change.
IKON B, THR-02	30–560	0	Yes [3]	No change.
HFC-134a	1,430	0	No	Unacceptable.
FOR12A, FOR12B, SP34E, THR-03	920–1,410	0	Yes [3]	Unacceptable.
HFC-227ea, R-407C, R-410A, R-410B, R-421A	1,770–3,220	0	No	Unacceptable.
KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55/1/42.5/1.5), R-417A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, RS-44 (2003 composition).	1,810–3,250	0	Yes [3]	Unacceptable.
R-404A, R-507A	3,920–3,990	0	No	Unacceptable.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-uses.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] One or more constituents of the refrigerant are VOC.

One of the refrigerant blends not subject to the proposed status change (THR-02), as well as several of the substitutes subject to the proposed status change, include small amounts of R-290 (propane), R-600 (butane), or other substances that are VOCs. These amounts are small and for this end-use are not expected to contribute significantly to ground level ozone formation.[118] In the actions where EPA listed these refrigerants as acceptable, EPA concluded none of these refrigerants in this end-use pose significantly greater risk to ground-level ozone formation than other alternative refrigerants that are not VOCs or that are specifically excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

The refrigerants not subject to the proposed status change are highly volatile and typically evaporate or partition to air, rather than contaminating surface waters. Their effects on aquatic life are expected to be small and pose no greater risk of aquatic or ecosystem effects than those of other refrigerants that are subject to the proposed status change for this end-use.

(b) Flammability

For the positive displacement chillers end-use, with the exception of HFO-1234ze(E) and R-717, all other refrigerants listed as acceptable, including those for which we are proposing to change the status to unacceptable, are not flammable. HFO-1234ze(E) is non-flammable at standard temperature and pressure using the standard test method ASTM E681; however, at higher temperatures it is mildly flammable. It is classified as a Class 2L (lower flammability, low burning velocity) refrigerant under the standard ASHRAE 34 (2013). Our assessment and listing decision (77 FR 47768; August 10, 2012) found that the overall risk, including the risk due to this mild flammability at elevated temperature, is not significantly greater than for other refrigerants or for the refrigerants we are proposing to list as unacceptable. As noted above, a positive displacement chiller using this refrigerant has already been installed.

R-717 is slightly flammable with a low flame speed; it is classified as a 2L refrigerant under ASHRAE 34 (2013). R-717 has a long history of use as a refrigerant in positive displacement chillers, especially in water-cooled screw chillers, and other applications. In our evaluation finding R-717 acceptable in this end-use, EPA noted ''Ammonia has been used as a medium to low temperature refrigerant in vapor compression cycles for more than 100 years. Ammonia has excellent refrigerant properties, a characteristic pungent odor, no long-term atmospheric risks, and low cost. It is, however, slightly flammable and toxic, although it is not a cumulative poison. Ammonia may be used safely if existing OSHA and ASHRAE standards are followed'' (61 FR 47015).

(c) Toxicity

With the exception of R-717, the toxicity of the refrigerants we are proposing to list as unacceptable is comparable to that of other alternatives that are acceptable in this end-use. R-717, for which we are not proposing a change of status, is of a higher toxicity than some other refrigerants and is classified as a B refrigerant under ASHRAE 34 (2013). See section VI.A.4.b.iii.(b) for a discussion on the long history of use of R-717 and our original decision finding it acceptable in new positive displacement chillers.

For all refrigerants, the possible relatively large charge sizes of some positive displacement chillers, and the fact that some such chillers are place in an enclosed mechanical room, raise a concern regarding oxygen displacement. This concern has been addressed over the long history of the use of positive displacement chillers by providing adequate ventilation, reducing leaks to small levels, and other techniques such as employing refrigerant sensors and automatic air movement. Commonly followed standards and practices have reduced toxicity concerns equally for historically used ODS, the alternatives subject to the proposed status change, and the alternatives not subject to the proposed status change.

(d) Summary

EPA has listed as acceptable several alternatives that pose lower overall risk to human health and the environment than the refrigerants whose status we are proposing to change to unacceptable. The risks other than GWP are not significantly different for the

[118] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

alternatives than for the refrigerants we are proposing to list as unacceptable, and the GWPs for the refrigerants we are proposing to list as unacceptable are significantly higher and thus pose significantly greater risk.

iv. What narrowed use limits for military marine vessels and human-rated spacecraft and related support equipment is EPA proposing?

EPA is proposing a narrowed use limit that would allow continued use of HFC-134a in positive displacement compressor chillers for military marine vessels after the change of status date where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements. Under the narrowed use limit, the end user for this military application would need to ascertain that other alternatives are not technically feasible and document the results of their analysis. See 40 CFR 82.180(b)(3). For the military, there are several unique performance requirements related to marine vessel air conditioning systems that require extensive testing prior to qualifying alternatives for HFC-134a. The lower-GWP alternatives available or potentially available for use in commercial chillers either do not meet the military-unique requirements or will require longer timeframes to test, based on available program funding for testing, for military suitability. It will also then take additional time to redesign, qualify, and procure new chillers for military shipbuilding programs. See additional information in section VI.A.4.a.iv above on centrifugal chillers.

EPA is proposing a narrowed use limit that would allow continued use of HFC-134a and R-404A in positive displacement compressor chillers for human-rated spacecraft and related support equipment applications after the change of status date where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements. Under the narrowed use limit, the end user for this human-rated spacecraft and related support equipment application would need to ascertain that other alternatives are not technically feasible and document the results of their analysis. See 40 CFR 82.180(b)(3). HFC-134a and R-404A chillers are used to provide cooling to human-rated spacecraft and related support equipment during ground-based assembly, integration and test operations, and launch. The cooling of sensitive human-rated electrical equipment is critical to the spacecraft technical performance and crew safety. EPA understands that such programs use specialized ground coolant systems to provide heat transfer during certain ground operations. These coolant circulation systems use HFC-134a and R-404A chillers to meet the program's stringent performance and material compatibility requirements. Other alternatives currently listed as acceptable under the SNAP program have not yet been proven to provide appropriate heat transfer, material compatibility, stability in the test environment, and other critical properties necessary for use in human-rated spacecraft and related support equipment applications. Considering that identification, testing, and implementation of materials to be used in human-rated spacecraft programs routinely take several years due to the challenging operational environment, lengthy qualification process associated with human rating, and the federal budgetary cycle, it may not be feasible to deploy positive displacement chillers using other alternatives in the proposed timeframe. Given the limited population of chillers used in human-rated spacecraft and related support equipment applications, the resulting greenhouse gas emissions from refrigerant leakage in this application is not expected to be significant.

Users of a restricted agent within the narrowed use limits category must make a reasonable effort to ascertain that other substitutes or alternatives are not technically feasible. Users are expected to undertake a thorough technical investigation of alternatives to the otherwise restricted substitute. Although users are not required to report the results of their investigations to EPA, users must document these results, and retain them in their files for the purpose of demonstrating compliance. This information includes 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.

v. When would the status change?

The Agency understands that relevant building standards and codes are likely to change in 2021. These include ASHRAE 15, UL 1995, UL 60335–2–40, and the International Building Code. The Agency believes some amount of time will be needed to meet the technical challenges for a safe and smooth transition to alternatives particularly considering the complexity of chiller designs and the need to ensure energy efficiency levels are met. EPA is considering a range of dates from January 1, 2022, through January 1, 2025, as the change of status date for new positive displacement chillers. Our lead proposal is a status change date of January 1, 2024, which we believe would allow development of designs of new positive displacement chillers using an acceptable alternative. We are aware that some equipment has been introduced with acceptable alternatives and that additional research and development is underway with these and other possible alternatives.

In addition, EPA has received communication from representatives of AHRI and NRDC requesting a change of status date of January 1, 2025, for HFC-134a, R-407C and R-410A, in all types of chillers. See section VI.A.4.a.v.

vi. What is the relationship between this proposed SNAP rule and other federal rules?

DOE has established efficiency requirements, based on ANSI/ASHRAE/IES Standard 90.1–2010, for chillers used in federal buildings.[119] See section VI.A.4.a.vi for more information.

vii. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on a range of dates from January 1, 2022, through January 1, 2025, for the change of status of the identified substitutes. EPA requests comment and information on any potential environmental or other impacts of EPA adopting a date other than January 1, 2024, which is our lead option. In particular, EPA requests comment on whether other alternatives that reduce overall risk would be available prior to January 1, 2024 and for comment on any technical or other reasons that NRDC and AHRI proposed January 1, 2025 in their joint letter. EPA requests comment on the specific steps that must be undertaken to commercialize positive displacement chillers with alternative refrigerants, including the time each such step would take, which steps must occur in sequence, and which steps could occur in parallel. EPA requests comments on if and how this timing might vary based on the characteristics of the chiller, such as but not limited to, compressor type,

[119] DOE, 2014. Building Energy Codes Program. Energy Efficiency Standards for Federal Buildings. Available at: *https://www.energycodes.gov/regulations/federal-building-standards.* Last updated February 13, 2014.

capacity range, evaporator design, condenser design (*e.g.,* air cooled or water cooled), and refrigerant currently used and potentially used. EPA requests comment on the current use of three refrigerants, HFO-1234ze(E), R-450A and R-513A, in positive displacement chillers, including the status of product availability and the capacity range covered by such products. We also request comment on the on-going research, development, deployment and expected increased market penetration of positive displacement chillers using refrigerants such as HFO-1234ze(E), R-290, R-450A, R-513A, DR-55, R-718 and R-744.

Additionally, EPA requests comment on any energy efficiency performance impacts of using the refrigerants not subject to the change of status proposed today that could affect the ability of manufacturers to meet current energy efficiency requirements or standards for positive displacement chillers in the United States. Also, EPA requests comment on the ability of positive displacement chillers using refrigerants other than those for which we are proposing a status change to meet those energy efficiency requirements or standards. In particular, we request comment on the specific steps and timing of such steps required to design and develop positive displacement chillers to meet federal energy efficiency requirements.

EPA is also requesting comment on the proposed narrowed use limitation for chillers on military marine vessels and human-rated spacecraft and related support equipment where the unique requirements would limit the availability and feasible use of alternatives not subject to the proposed status change.

c. Proposed Change of Status for Certain HFC Refrigerants for New Cold Storage Warehouses

As provided in the following table, EPA is proposing to change the status of numerous refrigerants from acceptable to unacceptable for new cold storage warehouses.

TABLE 9—PROPOSED CHANGE OF STATUS DECISIONS FOR COLD STORAGE WAREHOUSES

End-use	Substitutes	Proposed decision
Cold Storage Warehouses (new)	HFC-227ea, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-438A, R-507A, and RS-44 (2003 composition).	Unacceptable as of January 1, 2023.

i. What is the affected end-use?

Cold storage warehouses are temperature-controlled facilities used to store meat, produce, dairy and other products that are delivered to other locations for sale to the ultimate consumer. This end-use within the SNAP program describes an application of refrigeration equipment for an intended purpose, and hence the listings of acceptable and unacceptable refrigerants for this end-use apply regardless of the type of refrigeration system used. In addition to traditional vapor-compression cycle systems, EPA has found several not-in-kind systems acceptable for this end-use, including ammonia absorption, evaporative cooling, desiccant cooling, and Stirling cycle systems, which are not subject to the proposed status change.

Cold storage warehouses are usually deemed ''private'' or ''public,'' describing the relationship between the owner or operator of the cold storage warehouse and the owner of the products stored within. Private cold storage warehouses are ones owned by a company for the purpose of storing its products; for instance, a food producer, processor or shipper may own and operate a facility as a distribution point for its products. Likewise, a supermarket chain may own and operate a facility to control the distribution of a variety of products to multiple stores in a given region. A public cold storage warehouse provides storage for lease and hence may receive and hold products from multiple producers and for multiple supermarkets or other vendors. Some cold storage warehouses may be both public and private, with one part dedicated to the owner's products and another part available for lease. All such types of cold storage warehouses are included within the SNAP end-use.

Cold storage warehouses are also often divided into two general uses: Those storing products at temperatures above 32 °F (0 °C) and those storing products below this temperature. The former is referred to as a ''cooler'' while the term ''freezer'' is used for the latter. The 2014 ASHRAE Handbook of Refrigeration provides an additional cooler application called ''controlled atmosphere for long-term fruit and vegetable storage'' and three subdivisions of freezers: ''high-temperature freezers'' storing goods at 27 to 28 °F (−2.8 to −2.2 °C), ''low-temperature storage rooms for general frozen products, usually maintained at −5 to −20 °F'' (−21 to −29 °C), and low-temperature storage at the same temperature range as before but ''with a surplus of refrigeration for freezing products received at above 0 °F'' (−18 °C).

Several other end-uses under the SNAP program cover other parts of the food (and product) cold chain, and are distinct from the cold storage warehouse end-use. These are discussed here as examples of what EPA considers to be part of or separate from the ''cold storage warehouse'' end-use for which we are proposing changes of status.

Many food products require refrigeration during the production process. The application of refrigerating equipment used during the production of food and beverages falls within the SNAP end-use ''industrial process refrigeration.'' The industrial process refrigeration end-use would include all equipment and operations (that use a refrigerant) used to make and prepare food that is not immediately available for sale to the ultimate consumer and would require shipping it, possibly through intermediate points, to the point where such sale would occur. The industrial process refrigeration end-use could be applied at facilities where food is processed and packaged by the food producer. An example could be a meat processor that prepares and packages individual cuts of meat within a single facility or building while maintaining the required temperatures within that facility or building. Although such facilities may be designed in a fashion similar to a cold storage warehouse, the fact that items are being processed by the food producer indicates that the application falls in the industrial process refrigeration end-use. However, if a food producer operates a refrigerated storage area solely for the holding of already packaged products, and possibly packing such products in larger containers or bundles for shipment, that application would fall under the cold-storage warehouse end-use. In the

example above, such a cold storage warehouse might be a facility, separate from the industrial process refrigeration system in a different facility, where the individually-packaged cuts of meat are packed in a larger container that is placed on a pallet and then shipped.

Another example of an industrial process refrigeration system is a ''blast cooler'' or ''blast freezer.'' As described previously in a separate SNAP rulemaking ''[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.'' (80 FR 42901; July 20, 2015). Such devices might be used as part of a food production line in an industrial setting. They also can be placed separately at public facilities including hospitals, schools, restaurants and supermarkets. These public facilities might use the blast chiller on products that they will store for later use after they receive products from a vendor or that they cook or prepare as part of their operations. Such units might also be placed near entranceways to cold storage warehouses, for instance to receive food shipped refrigerated at one temperature and bring it down to a lower temperature for storage. EPA does not consider a separate blast chiller or blast freezer (*i.e.,* one with its own refrigerant-containing circuit, including the compressor, evaporator and the condenser or heat exchanger) to be part of a cold storage warehouse. Another design, however, could consist of a refrigeration system that is used to provide refrigerant (or a secondary fluid in an indirect system) to the evaporators extracting heat from the cold storage warehouse as well as to the evaporators used by a blast chiller or blast freezer that is installed at the facility. In this situation, EPA expects that the majority of the load and intended use of the combination system is for the cold storage of products, including those that undergo the blast cooling or freezing, and hence we consider the system to be a cold storage warehouse. For such systems, certain refrigerants would be subject to the proposed change of status as explained below.

As discussed in section VI.A.4.d, because products from refrigerated food processing and dispensing equipment are generally available for sale to the ultimate consumer, that end-use category, part of the retail food refrigeration end-use, is distinct from industrial process refrigeration.

Another application in the food cold chain is the use of a ''cold room'' at a retail facility where refrigerated food is kept generally for short periods of time. In the July 20, 2015, final rule (80 FR 42870), EPA changed the status of certain refrigerants used in ''remote condensing units'' and ''stand-alone systems,'' two categories within the ''retail food refrigeration'' end-use that include equipment that can be used for such cold rooms. Remote condensing units may include a dedicated one- or two-compressor system with condensers located on a roof or the side of a building providing cooling through unit coolers to an insulated room, for instance in a restaurant or supermarket, that are built and charged with refrigerant at the site. Also, some cold rooms are stand-alone systems that are pre-charged at the factory and ready to use once placed at the retailer's facility and provided with electrical and possibly plumbing connections, and are accessed via a door to store refrigerated products. In general, both types of applications are often called ''walk-in coolers'' or ''walk-in freezers,'' depending on the design temperature.

Such cold rooms are used to store products at required temperatures until sale to the ultimate consumer, such as a shopper in a supermarket or a diner in a restaurant. In some cases, one side of the room is fitted with glass doors and racks where the owner stacks products on the racks and the consumer obtains the product from the rack. In other cases, the cold room is only accessible by employees of the retail food establishment. For these applications, even if this equipment is not accessible to the public—for instance, it is in the back of a supermarket and holds products that are later brought to display cases from which customers obtain the products; or in the back of a restaurant where a cook takes and prepares the food that is brought to the diner by a waiter—it is considered part of the retail establishment and hence is part of the ''retail food refrigeration'' end-use and is not included in the ''cold storage warehouse'' end-use. The changes of status proposed in this action would not apply to such ''cold rooms,'' ''walk-in coolers,'' or ''walk-in freezers;'' however, EPA refers the reader to a previous rulemaking that does apply (80 FR 42870; July 20, 2015).

R-717 is believed to be the most common refrigerant used in cold storage warehouses. While R-717 is not used extensively in many other types of refrigeration and air-conditioning equipment, certain characteristics of cold storage warehouses have facilitated the widespread use of that refrigerant in this end-use. For example, because cold storage warehouses are often large in size for economies of scale reason and require a large amount of land use—as opposed to other systems that might be located on a building roof or a small slab next to the building—they are typically located away from population centers where land costs and taxes may be higher. Also, because they often service multiple retail locations and may receive goods from multiple producers, cold storage warehouses are often sited where major transportation services (*i.e.,* highways and rail lines) are available and are less prone to high traffic delays and similar disruptions that are more common in population centers. In addition, the transportation of goods is typically done in large volumes—by truck or train—to reduce costs, which in turn reduces the workforce needed and the number of people at the warehouse and in particular near the refrigeration equipment. These factors allow for more consideration of the use of refrigerants that do pose toxicity and flammability risks, such as R-717, than in other applications where more people might be at risk, such as an office building.

Limitations on the use of R-717 do exist. For example, it is reported that charge sizes exceeding 10,000 pounds of R-717 ''may require government-mandated process safety management (PSM) and [a] risk management plan (RMP)''.[120] Various state and local building codes could also apply and adherence to such codes might hinder or even eliminate the use of R-717 in some cold storage warehouses. Likewise, regulations may require employing operators with special levels of expertise, reporting of use or accidental releases, and other actions not typically required for other alternatives, increasing the operating cost compared to facilities using other refrigerants. These increased costs however are often offset given the high energy efficiencies typically achieved with ammonia systems.

Some of the limitations on the use of R-717 in cold storage warehouses may be overcome with system designs that have been introduced or have been more fully explored recently. These include low charge packaged R-717 systems, R-717/R-744 cascade systems, and indirect secondary-loop systems using R-717 as the primary refrigerant in a machine room separated from the cooled interior. These systems are described in market characterizations found in the docket to

[120] ASHRAE, 2014. 2014 Handbook—Refrigeration. The American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc. Atlanta, Georgia, USA. ISBN 978–1–936504–71–8; ISSN 1930–7195.

this proposed rule (EPA–HQ–OAR–2015–0663).[121]

Where R-717 was not used, cold storage warehouses traditionally used CFC-12, R-502 and HCFC-22. With the 1996 CFC phaseout, and the restriction on the use of newly manufactured HCFC-22 in new equipment that took effect January 1, 2010, R-404A or R-507A are generally used when R-717 is not chosen. Two nonflammable HFC/HFO blends, R-448A and R-449A, are designed to perform similarly to R-404A and R-507A and are under investigation for this use. EPA also notes that a major retailer recently announced progress on implementing HFC-free food distribution centers.[122]

ii. Which refrigerants is EPA proposing to list as unacceptable?

For new cold storage warehouses, EPA is proposing to change the status of the following refrigerants from acceptable to unacceptable: HFC-227ea, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-438A, R-507A, and RS-44 (2003 composition).

EPA understands that existing cold storage warehouses may undergo expansion to handle needs such as increased production, consolidation of distribution points, or increased population or other reasons for increased demands of the products stored. Such expansions could include a physical expansion of the storage space or using racking techniques to increase the amount of product within a given facility. The owner of cold storage warehouses undergoing such expansions (or the owner's designer) may determine that a new system needs to be added. That new system could be a complete newly manufactured system separate from the existing system, or it could be equipment and refrigerant added to the existing system increasing the capacity of the existing system. In both cases, EPA considers these actions as the manufacturing of a new system and hence that equipment could be affected by the proposed changes of status, as explained further below.

EPA addressed the difference between a ''new'' and ''retrofit'' system as used in the SNAP program in a previous rule (80 FR 42902–42903; July 20, 2015). As used in the SNAP program, ''new'' refers to the manufacture and often installation of a refrigeration system, which may occur on a newly manufactured or an existing cold storage warehouse. This proposed action would apply to expansion of the refrigeration system in an existing cold storage warehouse as being designated a ''new'' system if the capacity of that existing refrigeration system is increased to handle the expansion. On the other hand, if an existing refrigeration system is extended (for instance, by adding additional refrigerant lines and evaporators to a newly manufactured or newly commissioned building, to a portion of the existing facility previously not used for cold storage, or to an extension of the previous building), without requiring an increase in capacity, the system is not considered ''new'' and hence may continue its operations with the existing refrigerant. Likewise, a facility may increase the amount of products it handles while at the same time providing better sealing around infiltration points and/or increasing the insulation on walls and roofs, and thereby avoid the need to increase the refrigeration capacity of the equipment serving the cold storage warehouse. EPA requests comment on the definition of ''new'' and how it applies to cold storage warehouses. In particular, EPA requests comments on the likelihood and frequency that existing cold storage warehouses are expanded and whether it is typical to utilize or expand the existing refrigeration system to address the increased load from the facility expansion or whether it is typical to install a new system specifically to handle that expansion.

iii. How do these proposed unacceptable refrigerants compare to other refrigerants for this end-use with respect to SNAP criteria?

For new cold storage warehouses, acceptable refrigerants for which we are not proposing a change of status in this end-use include: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, KDD6, R-407C, R-407F, R-437A, R-450A, R-513A, R-717, R-744, RS-24 (2002 composition), SP34E, THR-02, and THR-03.

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document [123] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives for new cold storage warehouses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

The refrigerants we are proposing to find unacceptable through this action have zero ODPs, but they have GWPs ranging from 2,090 to 3,990. As shown in Table 10, acceptable alternatives have GWPs ranging from zero to 1,820.

TABLE 10—GWP, ODP, AND VOC STATUS OF REFRIGERANTS IN NEW COLD STORAGE WAREHOUSES [1 2 3]

Refrigerants	GWP	ODP	VOC	Proposal
Ammonia, CO_2, R-450A, R-513A	0–630	0	No	No change.
IKON A, IKON B, THR-02	30–560	0	Yes [3]	No change.
HFC-134a, R-407C, R-407F	1,430–1,820	0	No	No change.
FOR12A, FOR12B, KDD6, R-437A, RS-24 (2002 composition), SP34E, THR-03	920–1,810	0	Yes [3]	No change.
R-407A, R-407B, R-410A, R-410B, R-421A, R-423A	2,090–2,800	0	No	Unacceptable.
R-125/290/134a/600a (55/1/42.5/1.5), R-417A, R-422B, R-422D, R-424A, R-438A, RS-44 (2003 composition).	2,260–2,730	0	Yes [3]	Unacceptable.
HFC-227ea, R-421B, R-404A, R-507A	3,190–3,990	0	No	Unacceptable.

[121] ICF, 2016h. Market Characterization for Fire Suppression, Comfort Cooling, Cold Storage, and Household Refrigeration Industries in the United States. Prepared for the U.S. Environmental Protection Agency. October 2015.

[122] The White House, 2015. FACT SHEET: Obama Administration and Private-Sector Leaders Announce Ambitious Commitments and Robust Progress to Address Potent Greenhouse Gases, October 15, 2015. Accessible at *https://www.whitehouse.gov/the-press-office/2015/10/15/fact-sheet-obama-administration-and-private-sector-leaders-announce.*

[123] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

TABLE 10—GWP, ODP, AND VOC STATUS OF REFRIGERANTS IN NEW COLD STORAGE WAREHOUSES [1] [2] [3]—Continued

Refrigerants	GWP	ODP	VOC	Proposal
R-422A, R-422C, R-428A, R-434A	3,080–3,610	0	Yes [3]	Unacceptable.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-uses.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] One or more constituents of the refrigerant are VOC.

Some of the refrigerant blends not subject to the proposed status change, as well as several of the substitutes subject to the proposed status change, include small amounts of R-290, R-600, or other substances that are VOCs. These amounts are small and for this end-use, are not expected to contribute significantly to ground level ozone formation.[124] In the actions where EPA listed these refrigerants as acceptable or acceptable subject to use conditions, EPA concluded none of these refrigerants in this end-use pose significantly greater risk to ground-level ozone formation than other alternative refrigerants that are not VOCs or that are specifically excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

The refrigerants not subject to the proposed status change are highly volatile and typically evaporate or partition to air, rather than contaminating surface waters. Their effects on aquatic life are expected to be small and pose no greater risk of aquatic or ecosystem effects than those of other refrigerants that are subject to the proposed status change for this end-use.

(b) Flammability

For the cold storage warehouse end-use, with the exception of R-717, the acceptable refrigerants not subject to proposed changes of status, as well as those that are subject to proposed changes of status, are not flammable. R-717 is slightly flammable with a low flame speed; it is classified as a 2L refrigerant under ASHRAE 34 (2013). R-717 has a long history of use as a refrigerant in cold storage warehouses and other applications. In the original SNAP rule, EPA noted ''[a]mmonia has been used as a medium to low temperature refrigerant in vapor compression cycles for more than 100 years. Ammonia has excellent refrigerant properties, a characteristic pungent odor, no long-term atmospheric risks, and low cost. It is, however, slightly flammable and toxic, although it is not a cumulative poison. OSHA standards specify a 15 minute short-term exposure limit of 35 ppm for ammonia.'' (53 FR 13072; March 18, 1994). We further noted its use in various food and beverage processing and storage applications as well as other industrial applications. In that rule, we found R-717 acceptable for use in new cold storage warehouses, concluding that its overall risk to human health and the environment was not significantly greater than the other alternatives found acceptable. This conclusion was based on the assumption that the regulated community adheres to OSHA regulations on such use as well as standard refrigeration practices, such as the adherence to ASHRAE Standard 15, which is often utilized by local authorities when setting their own building and safety requirements.

(c) Toxicity

For the cold storage warehouse end-use, with the exception of R-717, the acceptable refrigerants not subject to the proposed status change, as well as those that are subject to the proposed status change, are of low toxicity (*e.g.,* those listed under ASHRAE Standard 34–2013 are class A toxicity). R-717, for which we are not proposing a change of status, is of a higher toxicity than some other refrigerants and is classified as a B refrigerant under ASHRAE 34 (2013). See section VI.A.4.c.iii.(b) for a discussion on the long history of use of R-717 and our original decision finding it acceptable in new cold storage warehouses.

(d) Summary

EPA has listed as acceptable several alternatives that pose lower overall risk to human health and the environment than the refrigerants whose status we are proposing to change to unacceptable. The risks other than GWP are not significantly different for the alternatives than for the refrigerants we are proposing to list as unacceptable, and the GWPs for the refrigerants we are proposing to list as unacceptable are significantly higher and thus pose significantly greater risk.

iv. When would the status change?

EPA is proposing a change of status date for new cold storage warehouses of January 1, 2023, which the Agency believes is the earliest date by which the technical challenges can be met for a safe and smooth transition to alternatives, particularly considering the various equipment types that could be employed to provide the cooling necessary for new cold storage warehouses and the requirement for many of these equipment types to meet energy conservation standards while undergoing such a transition. Given the widespread use of other acceptable alternatives, particularly R-717, EPA expects that only a limited number of new cold storage warehouses, including expansions at existing facilities, would otherwise have been designed to use one of the alternatives for which we are proposing a change of status. Nonetheless, because of the restrictions that may apply on the use of ammonia at the local level, and the variety of equipment that could be applied at a cold storage warehouse, EPA expects that this period of time is necessary until acceptable alternatives will become available for cold storage warehouses. HFC blends, primarily R-404A and R-507A, like CFCs and HCFCs in the past, may have been used where R-717 was deemed by the owner as impractical, costly, onerous and/or too risky to use, given the restrictions that might exist in certain locations or for certain applications. For such locations and applications, the cold storage warehouse industry may need the time proposed to develop equipment with other alternative refrigerants or address the issues that exist with R-717 and the other alternatives that are not subject to the proposed change in status. As explained below, certain types of equipment potentially applied in cold storage warehouses are subject to energy conservation standards, and hence time will be required to design, test and certify equipment for those standards, while at the same time using acceptable alternatives.

[124] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

v. What is the relationship between this proposed SNAP rule and other federal rules?

EPA is not aware of other federal rules applying to efficiency of cold storage warehouses (*i.e.,* the buildings), but we find that some federal rules apply to equipment that could be used in this specified end-use. Specifically, EPA notes that air-cooled commercial unitary air conditioners and heat pumps (''CUACs'' and ''CUHPs'') might be applied at cold storage warehouses, and such equipment is subject to DOE energy conservation standards.

DOE recently issued a pre-publication version of a direct final rule affecting CUACs and CUHPs (see docket numbers EERE–2013–BT–STD–0007 and EERE–2013–BT–STD–0021). DOE's standards require that minimum energy efficiency levels be met by January 1, 2018 and that a second phase of minimum energy efficiency levels be met by January 1, 2023. The 2023 date was chosen by the Appliance Standards and Rulemaking Federal Advisory Committee Working Group as a time when alternative refrigerants could be adopted during design modifications for the second phase of DOE's minimum energy efficiency levels. In adopting a 2023 date, DOE stated ''In recognition of the issues related to alternative refrigerants, members of the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) Working Group agreed as part of the Term Sheet to delay implementation of the second phase of increased energy conservation standard levels until January 1, 2023, in part to align dates with potential refrigerant phase-outs and to provide sufficient development lead time after safety requirements for acceptable alternatives have been established.'' (*http://energy.gov/sites/prod/files/2015/12/f27/CUAC-CUHP%20CWAF%20Direct%20Final%20Rule.pdf*). Further, DOE indicated that ''Delaying the implementation of the second phase of standards in the manner recommended and agreed to by the Working Group will provide manufacturers with flexibility and additional time to comply with both energy conservation standards and potential refrigerant changes, allowing manufacturers to better coordinate equipment redesign to reduce the cumulative [regulatory] burden.''

DOE issued a final rulemaking on June 3, 2014 (79 FR 32049) that set nineteen energy conservation standards for walk-in coolers and walk-in freezers with a compliance date of June 5, 2017. Due to litigation regarding this rulemaking, DOE vacated six of those standards for refrigeration systems and is currently engaged in a negotiated rulemaking to address the standards as referenced in the agency's technical amendments final rulemaking (80 FR 69837, November 12, 2015). For purposes of the DOE regulations, the Energy Conservation Act 42 U.S.C. 6311(20) defines walk-in coolers and walk-in freezers as having a total chilled storage area of less than 3,000 square feet. EPA considers the vast majority of such equipment to fit within the retail food refrigeration end-use, rather than the cold storage warehouse end-use. As described in the July 20, 2015 SNAP final rule, walk-in coolers and walk-in freezers as pertaining to DOE regulations could fall in the SNAP retail food refrigeration end-use category ''supermarket system'' (*i.e.,* where refrigerant from a multi-compressor rack was supplied to the evaporator(s) in the walk-in enclosed storage space), ''remote condensing unit'' (where a dedicated one- or two-compressor system installed in the field supplied the refrigerant to the walk-in enclosed storage space) or ''stand-alone equipment'' (where the enclosed storage space is manufactured and delivered with all components including the refrigerant). Thus, we consider there to be no regulatory overlap between the vast majority of equipment to provide cooling to cold storage warehouses, which is addressed by this proposed rule and the DOE energy conservation standards for walk-in coolers and freezers. One exception might be where a refrigeration system (that does not otherwise fit into the SNAP end-use categories of supermarket system or remote condensing units) supplied refrigerant to an enclosed storage space with an area less than 3,000 square foot. This enclosed storage space would be required to meet both this proposed rule and the DOE requirements. On the other hand, if this refrigeration system supplied refrigerant to two enclosed storage spaces, one with an area greater than 3,000 square foot and one with an area less than that amount, both spaces would be covered by this proposed rule as cold storage warehouses while only the smaller room is covered by the DOE requirements.

vi. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on the types and subdivisions of cold storage warehouses explained here and whether other subdivisions of the end-use should be considered for this action. In particular, EPA requests comments on whether different alternatives are used or are otherwise available for different types of cold storage warehouses, why such differences exist, and whether the proposed change of status decisions, including the date such changes occur, might be affected considering such differences.

EPA requests comment on the proposed decision to change the status of the identified substitutes to unacceptable on January 1, 2023, and on the specific steps that must be undertaken to commercialize cold storage warehouse refrigeration equipment with alternative refrigerants, including the time each such step would take, which steps must occur in sequence, and which steps could occur in parallel. EPA requests comments on if and how this timing might vary based on the characteristics of the cold storage warehouse and application of the equipment. Such characteristics could include but are not limited to the equipment and system design (*i.e.,* direct or indirect, central or unitary/packaged equipment), the required temperatures, jurisdictional limitations (*e.g.,* at State or local levels), and considerations of risk and safety (*e.g.,* to workers, those transporting goods to/from the facility, and the local public depending on the location). EPA requests comment on how these different distinctions may affect any federal rules that apply to the equipment or subsets thereof, for instance DOE energy conservation standards for walk-in coolers and walk-in freezers.

Additionally, EPA requests comment on any energy efficiency performance impacts of using the refrigerants not subject to the change of status proposed today that could affect the ability of manufacturers to meet current energy efficiency requirements or standards for cold storage warehouses in the United States. Also, EPA requests comment on the ability of cold storage warehouses using refrigerants other than those for which we are proposing a status change to meet those energy efficiency requirements or standards. In particular, we request comment on the specific steps and timing of such steps required to design and develop cold storage warehouses to meet applicable federal energy efficiency requirements.

EPA requests comment on the distinctions made here between cold storage warehouses and other SNAP end-uses. In particular, EPA requests comments on whether such distinctions are clear and if not, comments on how to make such distinctions clear so that they are understood by the regulated community.

EPA requests comment on the definition of ''new'' and how it applies to cold storage warehouses. In particular, EPA requests comments on the likelihood and frequency that existing cold storage warehouses are expanded and whether it is typical to utilize or expand the existing refrigeration system to address the increased load from the facility expansion or whether it is typical to install a new system specifically to handle that expansion.

EPA also requests comment on the current and expected use of refrigerants in cold storage warehouses. In particular, we request comment on the continued use of ODS and on the use of the HFCs for which we propose a change of status. We request comment on the factors that led to the decision to use those refrigerants as opposed to other refrigerants for which we are not proposing a change of status, including especially R-717, which as explained above has been used widely in this end-use. We request comment on the use of other alternatives, including the ones for which we are not proposing a change of status and others that may be in development, and the expected availability and penetration into the cold storage warehouse market for such alternatives. Two nonflammable HFC/HFO blends, R-448A and R-449A, are designed to perform similarly to R-404A and R-507A and are under investigation for this use. EPA requests comment on the status of such investigations and results seen to date.

We request comment on our interpretation that there may be some overlap between EPA's proposed status change in cold storage warehouses and DOE's regulatory activity on walk-in coolers and walk-in freezers, as discussed in section VI.A.4.c.v above.

d. Proposed Change of Status for Certain HFC Refrigerants for New Retail Food Refrigeration (Refrigerated Food Processing and Dispensing Equipment)

As provided in the following table, EPA is proposing to change the status of numerous refrigerants from acceptable to unacceptable for new retail food refrigeration (refrigerated food processing and dispensing equipment):

TABLE 11—PROPOSED CHANGE OF STATUS DECISIONS FOR RETAIL FOOD REFRIGERATION

[Refrigerated food processing and dispensing equipment]

End-use	Substitutes	Proposed decision
Retail food refrigeration (refrigerated food processing and dispensing equipment) (new only).	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, 2021.

i. What is the affected end-use?

In the SNAP July 20, 2015, final rule (80 FR 42870), EPA clarified in the response to comments that ''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'' was not included as part of the retail food refrigeration end-use categories specifically identified in that final rule. In the July 20, 2015, final rule, EPA clarified that this equipment is part of a separate end-use category within the retail food refrigeration end-use—''refrigerated food processing and dispensing equipment.'' A variety of food and beverage products are dispensed and often processed by equipment within this end-use category, including but not limited to: Chilled and frozen beverages (carbonated and uncarbonated, alcoholic and nonalcoholic); frozen custards, gelato, ice cream, Italian ice, sorbets and yogurts; milkshakes, ''slushies'' and smoothies, and whipped cream. For instance, some such equipment will process the product by combining ingredients, mixing and preparing it at the proper temperature, while others function mainly as a holding tank to deliver the product at the desired temperature or to deliver chilled ingredients for the processing, mixing and preparation. Some may use a refrigerant in a heat pump, or utilize waste heat from the cooling system, to provide hot beverages. Some may also provide heating functions to melt or dislodge ice or for sanitation purposes.

We noted in the July 20, 2015, final rule that refrigerated food processing and dispensing equipment ''can be self-contained or can be connected via piping to a dedicated condensing unit located elsewhere'' (80 FR 42902) and clarify here that both types fall within this end-use category. The equipment can be air-cooled although in some cases where multiple units are together and/or other space constraints exist (and hence air movement to the condenser would be compromised), a separate water line could be used to remove heat.

This end-use category does not include certain types of refrigeration equipment. For example, units designed solely to cool and dispense water, including those that feature detachable containers of water as well as those that are supplied directly from a shared water supply, fall under the separate ''Water Coolers'' end-use within the SNAP program. In addition, this end-use category does not include the preparation of chilled products in factory situations; such equipment falls under the SNAP end-use ''Industrial Process Refrigeration'' and are characterized as being those that do not provide products to the ultimate consumer for immediate or near-immediate consumption. Also included in the industrial process refrigeration end-use are blast chillers and freezers, including those that may be used at consumer settings such as schools, hotels, supermarkets, hospitals, restaurants, etc. Further, this end-use category does not include the equipment used to transport food products between distinct points of production and storage, such as refrigerated trucks that may transport products from a factory to a cold storage warehouse or from that warehouse to a supermarket or restaurant. That type of equipment falls under the SNAP end-use ''Refrigerated Transport.''

As part of the retail food refrigeration end-use, any alternative that has been listed broadly acceptable for the retail food refrigeration end-use, as opposed to being listed for only an individual end-use category within the retail food end-use, is likewise acceptable for this end-use category. For example, because R-744 was found acceptable for the retail food refrigeration end-use (74 FR 50129; September 30, 2009), it is acceptable for the refrigerated food processing and dispensing equipment category within the retail food refrigeration end-use. Those alternatives that have been found broadly

unacceptable for this end-use, or those that have been found acceptable only for other specific end-use categories in this end-use, would not be acceptable alternatives under current regulations. For example, propane has been listed specifically for certain end-use categories such as standalone reach in coolers indicating it is not necessarily acceptable for all other end-use categories within the retail food end-use. Hence, the following alternatives are currently acceptable for new refrigerated food process and dispensing equipment: FOR12A, FOR12B, HFC-134a, HFC-227ea, IKON A, IKON B, 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-450A, R-507A, R-744, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-02, and THR-03. On the other hand, because in our December 2011 and April 2015 final rules we found R-290, R-600a and R-441A acceptable only for stand-alone units, those alternatives are not currently acceptable for equipment in this end-use category.

ii. Which refrigerants is EPA proposing to list as unacceptable?

For new refrigerated food processing and dispensing equipment, EPA is proposing to change the status of the following refrigerants from acceptable to unacceptable: HFC-227ea, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 formulation).

iii. How do these proposed unacceptable refrigerants compare to other refrigerants for this end-use with respect to SNAP criteria?

For new retail food refrigeration (refrigerated food processing and dispensing equipment), acceptable refrigerants for which we are not proposing a change of status in this end-use category include: FOR12A, FOR12B, HFC-134a, IKON A, IKON B, R-426A, RS-24 (2002 formulation), R-450A, R-744, SP34E, THR-02 and THR-03.

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document [125] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives for new refrigerated food processing and dispensing equipment may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

The refrigerants for which we are proposing a change of status through this action have zero ODP, but they have GWPs ranging from 1,770 to 3,990. As shown in Table 12, acceptable alternatives have GWPs ranging from one to 1,510.

TABLE 12—GWP, ODP, AND VOC STATUS OF REFRIGERANTS IN NEW RETAIL FOOD REFRIGERATION

[Refrigerated food processing and dispensing equipment] [1] [2] [3]

Refrigerants	GWP	ODP	VOC	Proposal
CO_2, HFC-134a, R-450A	1–1,430	0	No	No change.
FOR12A, FOR12B, IKON A, IKON B, R-426A, RS-24 (2002 composition), SP34E, THR-02, THR-03.	30–1,510	0	Yes [3]	No change.
R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-421A	1,770–2,800	0	No	Unacceptable.
KDD6, R-125/290/134a/600a (55/1/42.5/1.5), R-417A, R-422B, R-422D, R-424A, R-437A, R-438A, RS-44 (2003 composition).	1,810–2,730	0	Yes [3]	Unacceptable.
HFC-227ea, R-404A, R-421B, R-507A	3,190–3,990	0	No	Unacceptable.
R-422A, R-422C, R-428A, R-434A	3,080–3,610	0	Yes [3]	Unacceptable.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-uses.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] One or more constituents of the refrigerant are VOC.

Some of the refrigerant blends not subject to the proposed status change, as well as several of the substitutes subject to the proposed status change, include small amounts of VOC such as R-290 (propane) and R-600 (butane). These amounts are small, and for this end-use are not expected to contribute significantly to ground level ozone formation.[126] In the actions where EPA listed these refrigerants as acceptable, EPA concluded none of these refrigerants in this end-use pose significantly greater risk to ground-level ozone formation than other alternative refrigerants that are not VOCs or that are specifically excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

The refrigerants not subject to the proposed status change are highly volatile and typically evaporate or partition to air, rather than contaminating surface waters. Their effects on aquatic life are expected to be small and pose no greater risk of aquatic or ecosystem effects than those of other refrigerants that are subject to the proposed status change for this end-use.

(b) Flammability

For the retail food refrigeration (refrigerated food processing and dispensing equipment) end-use category, all other refrigerants, including those for which we are proposing to change the status to unacceptable, are not flammable (*e.g.,* those listed under ASHRAE Standard 34–2013 are class 1 flammability).

[125] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[126] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

(c) Toxicity

Toxicity is not a significant concern for the refrigerants we are proposing to list as unacceptable. Their toxicity is comparable to that of other alternatives that are acceptable in this end-use. For the retail food refrigeration (refrigerated food processing and dispensing equipment) end-use category, all other refrigerants, including those for which we are proposing to change the status to unacceptable, are of lower toxicity (*e.g.,* those listed under ASHRAE Standard 34–2013 are class A toxicity).

(d) Summary

EPA has listed as acceptable several alternatives that pose lower overall risk to human health and the environment than the refrigerants whose status we are proposing to change to unacceptable. The risks other than GWP are not significantly different for the alternatives than for the refrigerants we are proposing to list as unacceptable, and the GWPs for the refrigerants we are proposing to list as unacceptable are significantly higher and thus pose significantly greater risk.

iv. When would the status change?

EPA is proposing a change of status date for new retail food refrigeration (refrigerated food processing and dispensing equipment) of January 1, 2021, which the Agency believes is the earliest date by which the technical challenges can be met for a safe and smooth transition to alternatives particularly considering the need for equipment to comply with any sanitation, safety and energy conservation standards while continuing to maintain the properties, characteristics and quality of the food or beverage provided by the equipment. EPA recognizes that some manufacturers will need time to test alternative refrigerants and develop equipment to use them while meeting other standards that may apply. We find however that components for some refrigerants, such as HFC-134a, are in wide supply. Further, as noted in our July 2015 rule, at least one major beverage retailer has chosen R-744 as its alternative refrigerant for stand-alone equipment and vending machines. Given the change of status dates established for such products in that rule (from January 1, 2018 to January 1, 2020) precede the change of status date we are proposing here, we expect an increasing supply of R-744 components that could be utilized in refrigerated food processing and dispensing equipment. We note that two substitutes are currently awaiting SNAP review for this end-use. These two substitutes, R-448A and R-449A, are designed to mimic R-404A and could be readily adapted to those refrigerants if they are listed as acceptable in the future. As discussed below, there are other relevant requirements that mean that newly designed equipment will need to be certified as complying with sanitation and safety standards, and some may be required to meet energy conservation standards issued by DOE. These standards apply to similar equipment that falls within other end-use categories of the retail food refrigeration end-use, and changes of status for those end-use categories take effect January 1, 2020, or before. Those requirements will provide additional incentive for refrigerant producers to increase low-GWP refrigerant supply, for component manufacturers to test and qualify components for such low-GWP refrigerants, and for manufacturers to gain the technical knowledge necessary to successfully implement those refrigerants. Hence, we foresee that additional equipment using similar low-GWP refrigerants, and using components that are expected to become available, could be similarly transitioned in a similar amount of time as finalized for those other end-use categories.

v. What is the relationship between this proposed SNAP rule and other federal rules?

EPA is not aware of any energy conservation standards issued by DOE that apply to refrigerated food processing and dispensing equipment. EPA also understands that food safety and sanitation standards, such as those from the U.S. Food and Drug Administration and the National Sanitation Foundation (NSF), as well as product safety standards, such as those from UL, apply.

vi. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on the refrigerant(s) used for equipment in this end-use category, and detailed descriptions of the functions and why a particular refrigerant is used. We also seek comment on the applicability, technical feasibility, research, development and use of HCs, HFC/HFO blends, R-744 or other low-GWP alternatives for equipment within this end-use category. Additionally, we request comment on applicable standards for equipment used in the United States as well as those that apply to products that are pre-charged with refrigerant and exported to other countries and specifically request comment on how those standards may affect when equipment can be transitioned away from the alternatives we are proposing to list as unacceptable. Likewise, we request comment on DOE energy conservation standards and other federal requirements that apply to this equipment.

Additionally, EPA requests comment on any energy efficiency performance impacts of using the refrigerants not subject to the change of status proposed today that could affect the ability of manufacturers to meet current energy efficiency requirements or standards for refrigerated food processing and dispensing equipment in the United States. Also, EPA requests comment on the ability of refrigerated food processing and dispensing equipment using refrigerants other than those for which we are proposing a status change to meet those energy efficiency requirements or standards. In particular, we request comment on the specific steps and timing of such steps required to design and develop refrigerated food processing and dispensing equipment to meet applicable federal energy efficiency requirements.

EPA requests detailed comment on the proposed decision to change the status of the identified substitutes to unacceptable on January 1, 2021, and on the specific steps that must be undertaken for refrigerated food processing and dispensing equipment with alternative refrigerants to be available, including the time each such step would take, which steps must occur in sequence, and which steps could occur in parallel. EPA requests comments on if and how this timing might vary based on the characteristics of the equipment. Such characteristics could include, but are not limited to, compressor type, condenser design (*e.g.,* air cooled or water cooled), refrigeration capacity, intended dispensing rate (*e.g.,* short-term rush dispensing or steady dispensing over longer time), and refrigerant currently used and potentially used.

Additionally, EPA requests comment on our description of this end-use category to ensure it is sufficiently understood particularly by those in the equipment manufacturing and equipment servicing industry. For example, are there other technical factors that should be used to describe this end-use category? In particular, do such factors describe equipment types that are sufficiently distinct such that they are better described as two separate end-use categories (*e.g.,* processing/dispensing and dispensing-only)?

e. Proposed Change of Status for Certain HFC Refrigerants for New Household Refrigerators and Freezers

As provided in the following table, EPA is proposing to change the status of numerous refrigerants from acceptable to unacceptable for new household refrigerators and freezers:

TABLE 13—PROPOSED CHANGE OF STATUS DECISIONS FOR HOUSEHOLD REFRIGERATORS AND FREEZERS

End-use	Substitutes	Proposed decision
Household refrigerators and freezers (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-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.	Unacceptable as of January 1, 2021.

i. What is the affected end-use?

Household refrigerators, freezers and combination refrigerator/freezers are intended primarily for residential use, although they may be used outside the home. The designs and refrigeration capacities of equipment vary widely. Household refrigerators and freezers are composed of three main categories of equipment. Household freezers only offer storage space at freezing temperatures, while household refrigerators only offer storage space at non-freezing temperatures. Products with both a refrigerator and freezer in a single unit are most common. In addition to the most common types, other small refrigerated household appliances exist (*i.e.,* chilled kitchen drawers, wine coolers, and mini-fridges). Household refrigerators and freezers have all refrigeration components integrated, and for the smallest types, the refrigeration circuit is entirely brazed or welded. These systems are charged with refrigerant at the factory and typically require only an electricity supply to begin operation.

The 2014 ASHRAE Handbook of Refrigeration provides an overview of food preservation in regards to household refrigerators and freezers. Generally, a storage temperature between 32 and 39 °F (0 to 3.9 °C) is desirable for preserving fresh food. Humidity and higher or lower temperatures are more suitable for certain foods and beverages. Wine chillers, for example, are frequently used for storing wine, and have slightly higher optimal temperatures from 45 to 65 °F (7.2 to 18.3 °C). Freezers and combination refrigerator-freezers that are designed to store food for long durations have temperatures below 8 °F (−13.3 °C) and are designed to hold temperatures near 0 to 5 °F (−17.7 to −15 °C). In single-door refrigerators, the optimum conditions for food preservation are typically warmer than this due to the fact that food storage is not intended for long-term storage.

The following alternatives are currently acceptable for new household refrigerators and freezers: FOR12A, FOR12B, HFC-134a, HFC-152a, IKON A, IKON B, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-290, R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-427A, R-428A, R-434A, R-437A, R-438A, R-441A, R-450A, R-513A, R-507A, R-600a, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-02 and THR-03. Of those, R-290, R-441A and R-600a are acceptable subject to use conditions.

Currently, the most commonly used refrigerant in the United States for household refrigerators and freezers is R-134a, a HFC with a GWP of 1,430. However, throughout many parts of the world, R-600a with a GWP of 8 is the most commonly used refrigerant and there are ongoing efforts to help facilitate the adoption and continued use of R-600a in this industry.[127] The European Union (EU) banned the use of HFCs with a GWP greater than 150 (which includes R-134a) for household refrigerators and freezers as of January 1, 2015.[128] R-600a has been used in Europe for approximately two decades. Throughout parts of Asia, Africa, and South America, R-600a is the dominant refrigerant for this end-use. In its 2014 assessment report,[129] the TEAP's RTOC projects that by 2020 about 75 percent of new household refrigerators globally will use R-600a, a small percentage will use HFOs, and the rest will use HFC-134a. There are other alternatives that can be considered too. EPA also listed R-450A and R-513A as acceptable for use in this end-use (79 FR 62863, October 21, 2014; 80 FR 42053, July 16, 2015, respectively). As noted in the preamble to those Notices of Acceptability, both R-450A and R-513A were designed to match the characteristics and performance of HFC-134a and therefore we conclude that they may be under consideration by manufacturers as well.

EPA previously found a number of flammable HC refrigerants including R-290, R-441A and R-600a as acceptable, subject to use conditions in household refrigerators and freezers (76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015). Hydrocarbon refrigerants have been in use for over 20 years in countries such as Germany, the United Kingdom, Australia, and Japan.[130]

ii. Which refrigerants is EPA proposing to list as unacceptable?

For new household refrigerators and freezers, EPA is proposing to change the status of the following refrigerants from acceptable to unacceptable: FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03.

[127] ORNL, 2015. ORNL's JUMP Challenge: JUMP in to Advance Tech Innovation! Presented by Brian Fricke, Oak Ridge National Laboratory. November 17, 2015.

[128] EU, 2014. Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006. Available online at: *http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.150.01.0195.01.ENG.*

[129] RTOC, 2015. 2014 Report of the Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee. Available at: *http://conf.montreal-protocol.org/meeting/mop/mop-27/presession/Background%20Documents%20are%20available%20in%20English%20only/RTOC-Assessment-Report-2014.pdf.*

[130] Ecomall, 2015. Greenfreeze: A Revolution in Domestic Refrigeration. Accessible at: *http://www.ecomall.com/greenshopping/greenfreeze.htm.*

iii. How do these proposed unacceptable refrigerants compare to other refrigerants for this end-use with respect to SNAP criteria?

For new household refrigerators and freezers, acceptable refrigerants for which we are not proposing a change of status in this end-use include: HFC-152a, IKON A, IKON B, and THR-02; two HFC/HFO blends R-513A and R-450A; and HC refrigerants R-290, R-441A and R-600a.

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document [131] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives for new household refrigerators and freezers may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

The refrigerants we are finding unacceptable through this action also have zero ODP, but they have GWPs ranging from 920 to 3,990. As shown in Table 14, other alternatives, some of which are acceptable subject to use conditions, have GWP ranging from three to 630.

TABLE 14—GWP, ODP, AND VOC STATUS OF REFRIGERANTS IN NEW HOUSEHOLD REFRIGERATORS AND FREEZERS [1] [2] [3]

Refrigerants	GWP	ODP	VOC	Proposal
IKON A, IKON B, R-290, R-441A, R-600a, THR-02	3–560	0	Yes [3]	No change.
HFC-152a	124	0	No	No change.
R-450A, R-513A	600–630	0	No	No change.
HFC-134a	1,430	0	No	Unacceptable.
FOR12A, FOR12B, R-426A, RS-24 (2002 composition), SP34E, THR-03	920–1,510	0	Yes [3]	Unacceptable.
R-407C, R-407F, R-410A, R-410B, R-421A	1,770–2,630	0	No	Unacceptable.
KDD6, R-125/290/134a/600a (55/1/42.5/1.5), R-417A, R-422B, R-422D, R-424A, R-437A, R-438A, RS-44 (2003 composition).	1,810–2,730	0	Yes [3]	Unacceptable.
R-404A, R-421B, R-507A	3,190–3,990	0	No	Unacceptable.
R-422A, R-422C, R-428A, R-434A	3,080–3,610	0	Yes [3]	Unacceptable.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-uses.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] One or more constituents of the refrigerant are VOC.

Three substitutes that remain acceptable subject to use conditions, 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.[132] In the actions where EPA listed these refrigerants as acceptable subject to use conditions, EPA concluded none of these refrigerants in this end-use pose significantly greater risk to ground-level ozone formation than other alternative refrigerants that are not VOCs or that are specifically excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

The refrigerants not subject to the proposed status change are highly volatile and typically evaporate or partition to air, rather than contaminating surface waters. Their effects on aquatic life are expected to be small and pose no greater risk of aquatic or ecosystem effects than those of other refrigerants that are subject to the proposed status change for this end-use.

(b) Flammability

For household refrigerators and freezers, with the exception of HFC-152a, R-290, R-600a and R-441A, all other refrigerants listed as acceptable, including those for which we are proposing to change the status to unacceptable, are not flammable. The HCs R-290 and R-600a are classified as Class A3 (lower toxicity, higher flammability) refrigerants under the standard ASHRAE 34 (2013) while HFC-152a is classified as Class A2 (lower toxicity, lower flammability). To address flammability, EPA listed these HCs as acceptable, subject to use conditions. The use conditions include conditions consistent with industry standards, limits on charge size, and requirements for warnings and markings on equipment to inform consumers and technicians of potential flammability hazards. Our assessment and listing decisions (76 FR 78832; December 20, 2011 and FR 80 1954; April 10, 2015) found that the overall risk, including the risk due to flammability with the use conditions, is not significantly greater than for other refrigerants at that time and likewise are not significantly greater than for the refrigerants we are proposing to list as unacceptable. EPA found HFC-152a acceptable for new household refrigerators and freezers in the original SNAP rule indicating ''[a]lthough HFC-152a is flammable, a risk assessment demonstrated it could be used safely in this end-use'' (59 FR 13081; March 18, 1994).

(c) Toxicity

Toxicity is not a significant concern for the refrigerants we are proposing to list as unacceptable. Their toxicity is comparable to that of other alternatives that are acceptable in this end-use. The refrigerants subject to the proposed status change and the refrigerants not subject to the proposed status change, if listed under ASHRAE 34 (2013), are classified as A refrigerants (lower toxicity).

(d) Summary

EPA has listed as acceptable several alternatives that pose lower overall risk to human health and the environment than the refrigerants whose status we are proposing to change to unacceptable. The risks other than GWP are not significantly different for the alternatives than for the refrigerants we

[131] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[132] ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

are proposing to list as unacceptable, and the GWPs for the refrigerants we are proposing to list as unacceptable are significantly higher and thus pose significantly greater risk.

iv. When would the status change?

EPA is proposing a change of status date for new household refrigerators and freezers of January 1, 2021, by this date the Agency believes the technical challenges can be met for a safe and smooth transition to alternatives, particularly considering the likely use of alternatives that are acceptable subject to use conditions such as isobutane or propane. As noted above, most experts, including the TEAP, anticipate the majority of the household refrigeration market will use HC refrigerants globally and EPA does not have information suggesting anything different for the United States. Although some models may be able to transition in compliance with use conditions required for alternatives earlier, the Agency believes that most can transition by 2021.

EPA recognizes that manufacturers will need time to continue product design work for alternative refrigerants, drawing from current models used both in the United States and elsewhere. Household refrigerators are subject to DOE energy conservation standards and will need to be tested to demonstrate compliance with those standards. We understand that there may be limitations with regards to the availability of testing facilities. If the proposed change of status date was exceedingly ahead of the next anticipated DOE energy conservation standard date, it could affect the availability of testing facilities. DOE's previous energy conservation rulemaking for this end-use was finalized in 2011 with a compliance date of September 15, 2014 (76 FR 57516; September 15, 2011). EPA anticipates that any amended standard set by DOE for these products in an upcoming rulemaking will, consistent with prior rulemakings, have a compliance date several years following issuance of the standard and thus we expect that the compliance date would be no earlier than 2020. As a result, EPA's proposed change of status in 2021 likely would occur at approximately the same time as a compliance date for the next future DOE energy conservation standard for these products.

v. What is the relationship between this proposed SNAP rule and other federal rules?

DOE energy conservation standards apply to household refrigerators and freezers, as discussed in section VI.A.4.e.iv.

vi. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on the proposed change of status date of January 1, 2021. In particular, EPA requests comments on the specific steps that must be undertaken to commercialize household refrigerators and freezers with alternative refrigerants in the United States, including the time each step would take, which steps must occur in sequence, and which steps could occur in parallel. EPA requests comments on how and if this timing might vary based on the characteristics of the household refrigerator and freezer. Such characteristics could include, but are not limited to, capacity range, internal volume, design (*e.g.,* refrigerator-only, freezer-only, or both) and refrigerant currently used and potentially used. EPA also requests comment on the expected availability of alternatives for such equipment, including when products using such alternatives would be available. EPA requests comments on how such timing is expected to be affected by other federal rules in the future, including the availability of testing laboratories to analyze the performance of products with alternatives while meeting any applicable federal rules. Additionally, EPA requests comment on any energy efficiency performance impacts of using the refrigerants not subject to the change of status proposed today that could affect the ability of manufacturers to meet current energy efficiency requirements or standards for household refrigerators and freezers in the United States. Also, EPA requests comment on the ability of household refrigerators and freezers using refrigerants other than those for which we are proposing a status change to meet those energy efficiency requirements or standards. In particular, we request comment on the specific steps and timing of such steps required to design and develop household refrigerators and freezers to meet applicable federal energy efficiency requirements.

B. Motor Vehicle Air Conditioning

1. Proposed Listing of HFO-1234yf as Acceptable, Subject to Use Conditions, for Newly Manufactured MVAC Systems

EPA is proposing to list HFO-1234yf as acceptable, subject to use conditions, in MVAC systems for newly manufactured MDPVs, HD pickup trucks, and complete HD vans. EPA is proposing to list HFO-1234yf as acceptable, subject to use conditions, for use in complete HD vans; we also are requesting comment and information on listing HFO-1234yf as acceptable subject, to use conditions for some incomplete HD vans. At this time, our proposal only includes complete HD vans because we do not have sufficient information on the potential for modifications to OEM-installed MVAC systems of incomplete HD vans by secondary and tertiary manufacturers and the impact of those modifications on safe use of HFO-1234yf. The use conditions are detailed below in section V.B.1.c, ''What are the proposed use conditions?''

2. What is the affected end-use?

The vehicle types within the MVAC end-use that are addressed in today's proposal include limited types of heavy-duty (HD) vehicles, specifically, MDPVs,[133] HD trucks, and complete HD vans.[134] EPA has previously listed HFO-1234yf as acceptable subject to use conditions in light-duty (LD) motor vehicles and trucks (76 FR 17490; March 29, 2011).

HD vehicles are often subdivided by vehicle weight classifications, as defined by the vehicle's gross vehicle weight rating (GVWR), which is a measure of the combined curb (empty) weight and cargo carrying capacity of the truck. HD vehicles have GVWRs above 8,500. Table 15 outlines the HD vehicle weight classifications commonly used. MDPVs,[135] HD pickup trucks, and HD vans are Class 2b and 3 vehicles with GVWRs between 8,501 and 14,000 pounds.

[133] Defined at 40 CFR 86.1801–03.

[134] MVAC systems provide passenger comfort cooling for light-duty cars and trucks, heavy-duty vehicles (large pick-ups, delivery trucks, recreational vehicles, and semi-trucks), off-road vehicles, buses, and rail vehicles. EPA is not addressing other types of HD vehicles, off-road vehicles, buses, or trains in the proposed listing decision.

[135] MDPVs are classified as HD vehicles based on their GVWR, but due to their similarities to LD vehicles they are subject to the GHG emissions standards established for LD trucks.

TABLE 15—VEHICLE WEIGHT CLASSIFICATION

Class	2b	3	4	5	6	7	8
GVWR (lb)	8,501–10,000	10,001–14,000	14,001–16,000	16,001–19,500	19,501–26,000	26,001–33,000	>33,000

The types of HD vehicles for which EPA is proposing to list HFO-1234yf as acceptable, subject to use conditions, are in many ways more similar to LD vehicles, for which HFO-1234yf has already been approved under SNAP,[136] than they are to the HD vehicles with a higher GVWR classification. These vehicle types are similar to LD vehicles technologically and most are manufactured by companies with major light-duty markets in the United States and in a similar manner to LD vehicles.[137] Ford, General Motors, and Fiat Chrysler Automobiles (FCA) produce approximately 100 percent of HD pickup trucks and approximately 95 percent of HD vans, with Daimler and Nissan producing the remaining approximately five percent of HD vans.[138] In many cases, these types of HD vehicles are versions of their LD counterparts.[139] For example, the Silverado 1500, Ram 1500, and Ford F–150 are the LD counterparts of the HD Silverado 2500/3500, Ram 2500/3500, and Ford F–250/F–350/F–450 pickup trucks.[140] The primary difference between HD pickup trucks and vans and their LD counterpart vehicles is that HD pickups and vans are occupational or work vehicles that are designed for much higher towing and payload capabilities than are LD pickups and vans.

All types of HD vehicles can be sold as ''complete'' or ''incomplete'' vehicles (76 FR 57259–60; September 15, 2011). Complete vehicles are sold by vehicle manufacturers to end-users with no secondary manufacturer making substantial modifications prior to registration and use. Incomplete vehicles are sold by vehicle manufacturers to secondary manufacturers without the primary load-carrying device or container attached. With regard to HD pickup trucks and vans, 90 percent are sold as complete vehicles while only 10 percent are sold as incomplete (80 FR 40331; July 13, 2015). Of the 10 percent of HD pickups and vans that are sold as incomplete vehicles to secondary manufacturers, about half are HD pickup trucks and half are HD vans.

Examples of modifications by secondary manufacturers to HD pickup trucks are installing a flatbed platform or tool storage bins. EPA is not aware of any equipment added by a secondary manufacturer to an incomplete HD pickup truck that would result in a secondary manufacturer modifying or adjusting the already installed MVAC system to provide cooling capacity.

Incomplete vans are typically sold with no enclosed cabin area behind the driver's seat, and secondary manufacturer modifications could include applications such as conversion to ambulances, shuttle vans, and motor homes. Incomplete vans may include OEM MVAC systems that are identical to those installed in the complete van on which the incomplete model is based. In some cases these systems are designed solely for cooling the front driver area, while other systems are manufactured by the OEM with additional capability to provide cooling behind the driver area to the cabin. Some, but not all, secondary manufacturers use the OEM MVAC system with no modification to the contained refrigerant system (hoses, connections, heat exchangers, compressor, etc.).

3. How does HFO-1234yf compare to other refrigerants for these MVAC applications with respect to SNAP criteria?

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document[141] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives in the relevant end-uses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

Available refrigerants in the end-uses subject to this proposal include HFC-134a, HFC-152a,[142] and CO_2.[143] There are also several blend refrigerants that are listed as acceptable for new HD MVAC systems, subject to use conditions, including the HFC blends SP34E and R-426A (also known as RS-24) 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). EPA is not aware of the use or development of any of these blend refrigerants in newly manufactured MDPVs, HD pickup trucks, or HD vans. HFC-134a is the refrigerant most widely used today in HD MVAC systems. All MVAC refrigerants are subject to use conditions requiring labeling and the use of unique fittings, and the two lower-GWP alternatives (HFC-152a, CO_2) currently approved for use in HD vehicles are subject to additional use conditions mitigating flammability and toxicity as appropriate to the alternative.

As explained more fully below, to evaluate environmental, flammability, and toxicity risks resulting from the use of HFO-1234yf in new MDPVs, HD pickup trucks, and complete HD vans, the Agency is relying on EPA's analysis conducted in support of the 2011 listing decision for HFO-1234yf for LD

[136] HFO-1234yf is listed as acceptable, subject to use conditions for newly manufactured passenger cars and light-duty trucks only (40 CFR part 82 subpart G).

[137] This is more broadly true for heavy-duty pickup trucks than vans because every manufacturer of heavy-duty pickup trucks also makes light-duty pickup trucks, while only some heavy-duty van manufacturers also make light-duty vans (80 FR 40148; July 13, 2015).

[138] EPA, 2015. Draft Regulatory Impact Analysis: Proposed Rulemaking for Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2. EPA–420–D–15–900. June 2015. Available at *http://www3.epa.gov/otaq/climate/documents/420d15900.pdf.*

[139] ICCT, 2015. International Council on Clean Transportation: Regulatory Considerations for Advancing Commercial Pickup and Van Efficiency Technology in the United States. Available online at: *http://www.theicct.org/us-commercial-pickups-vans-efficiency-technology.*

[140] ICF, 2015. 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.

[141] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[142] HFC-152a is listed as acceptable, subject to use conditions, for new vehicles only at 40 CFR part 82 subpart G; final rule published June 12, 2008 (73 FR 33304).

[143] CO_2 is listed as acceptable, subject to use conditions, for new vehicles only at 40 CFR part 82 subpart G; final rule published June 6, 2012 (77 FR 33315).

vehicles. In addition, we considered risk assessments performed by OEMs and independent consultants on the use of HFO-1234yf in LD vehicles through SAE Cooperative Research Programs (CRPs) and found these were consistent with our analysis. Based on that analysis, in 2011 EPA concluded that for LD vehicles HFO-1234yf did not pose significantly greater risk to human health and the environment than the other alternatives when used in accordance with use conditions established as part of the listing decision. The refrigerants to which HFO-1234yf was compared in the 2011 action for LD vehicles are the same refrigerants available for use in the vehicle types included in today's proposal.

EPA is able to rely on the 2011 analysis of HFO-1234yf in LD vehicles in support of this proposal because the MVAC systems, vehicle designs, and the potential for exposure for the HD vehicle types for which EPA is proposing to list HFO-1234yf as acceptable, subject to use conditions, in today's action are identical or very similar to those of LD vehicles. As discussed in more detail below, EPA has determined that the analyses conducted on HFO-1234yf in LD vehicles are sufficiently conservative to support today's proposal, and, in turn, that the use of HFO-1234yf in the MVAC systems of MDPVs, HD pickup trucks, and complete HD vans does not pose greater risk to human health or the environment than other alternatives, when used in accordance with use conditions.

a. Environmental Impacts

HFO-1234yf has a GWP of one to four. HFO-1234yf has a GWP similar to or lower than the GWP of other alternatives for the HD vehicle types addressed in today's proposal. For example, its GWP is significantly lower than that of HFC-134a, the refrigerant most widely used in these vehicles today, which has a GWP of 1,430. As shown in Table 16, two other alternatives, HFC-152a,[144] and CO_2 [145] have GWPs of 1,430, 124, and one, respectively. Other acceptable refrigerants for the HD vehicle types addressed in today's proposal have GWPs ranging from 1 to 2,340.

TABLE 16—GWP, ODP, AND VOC STATUS OF HFO-1234YF COMPARED TO OTHER REFRIGERANTS IN MVAC SYSTEMS OF NEWLY MANUFACTURED MDPVS, HD PICKUP TRUCKS, AND COMPLETE HD VANS [1 2 3]

Refrigerants	GWP	ODP	VOC status	Proposal
HFO-1234yf	1–4	0	No	Acceptable, subject to use conditions.
CO_2, HFC-152a, HFC-134a	1–1,430	0	No	No change.
IKON A, R-416A, R-426A, SP34E	30–1,510	0–0.009	Yes [3]	No change.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-use.
[2] HCFC-22 and several blends containing HCFCs are also listed as acceptable but their use is severely restricted by the phasedown in HCFC production and consumption.
[3] One or more constituents of the blend are VOC.

HFO-1234yf does not deplete the ozone layer. Like HFO-1234yf, HFC-134a, HFC-152a, CO_2 and the HFC blends SP34E and R-426 Ado not deplete the ozone layer; however, the HCFC blends have ODPs ranging from 0.012 to 0.056.

HFO-1234yf, HFC-134a, HFC-152a, and CO_2 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 NAAQS. The HFC blends and some of the HCFC blends have one or more components that are VOCs.

Another potential environmental impact of HFO-1234yf is its atmospheric decomposition to trifluoroacetic acid (TFA, CF_3COOH). TFA is a strong acid that may accumulate on soil, on plants, and in aquatic ecosystems over time and that may have the potential to adversely impact plants, animals, and ecosystems.[146] Simulations have found that the amount of TFA in rainfall produced from a transition of all mobile air conditioners in the continental United States to HFO-1234yf has been estimated to be double or more the values observed in the United States in 2009 from all sources, natural and artificial (*i.e.,* HFC-134a) sources.[147] In comparison, the amount of TFA produced from HFO-1234yf is expected to be higher than that of other fluorinated refrigerants in this end-use.

In support of the 2011 listing decision for HFO-1234yf in LD vehicles, EPA analyzed potential TFA concentrations from a full transition to HFO-1234yf in all MVAC applications, not limited to LD vehicles.[148] [149] [150] [151] [152] The analysis found a maximum projected concentration of TFA in rainwater of approximately 1,700 ng/L. This maximum projected concentration identified in EPA's analysis, 1700 ng/L,[153] was roughly 34 percent higher than that projected in a 2009 peer reviewed article.[154] The differences in projected TFA concentrations in water

[144] HFC-152a is listed as acceptable, subject to use conditions, for new vehicles only at 40 CFR part 82 subpart G; final rule published June 12, 2008 (73 FR 33304).

[145] CO_2 is listed as acceptable, subject to use conditions, for new vehicles only at 40 CFR part 82 subpart G; final rule published June 6, 2012 (77 FR 33315).

[146] Other fluorinated compounds also decompose into TFA, including HFC-134a.

[147] Luecken et al., 2009. Ozone and TFA impacts in North America from degradation of 2, 3, 3, 3-tetrafluoropropene (HFO-1234yf), a potential greenhouse gas replacement. Environmental Science & Technology 2009. The document is accessible at: *http://www.researchgate.net/profile/Robert_Waterland/publication/40481734_Ozone_and_TFA_impacts_in_North_America_from_degradation_of_2333-Tetrafluoropropene_(HFO-1234yf)_a_potential_greenhouse_gas_replacement/links/00b7d514ca9595bf5e000000.pdf.*

[148] ICF, 2009a. Revised Final Draft Assessment of the Potential Impacts of HFO-1234yf and the Associated Production of TFA on Aquatic Communities and Local Air Quality.

[149] ICF, 2010a. Summary of HFO-1234yf Emissions Assumptions.

[150] ICF, 2010b. Summary of Updates to the Vintaging Model that Impacted HFO-1234yf Emissions Estimates.

[151] ICF, 2010c. Revised Assessment of the Potential Impacts of HFO-1234yf and the Associated Production of TFA on Aquatic Communities, Soil and Plants, and Local Air Quality.

[152] ICF, 2010d. Sensitivity Analysis CMAQ results on projected maximum TFA rainwater concentrations and maximum 8-hr ozone concentrations.

[153] ICF, 2010d. Sensitivity Analysis CMAQ results on projected maximum TFA rainwater concentrations and maximum 8-hr ozone concentrations.

[154] Luecken et al., 2009. Ozone and TFA impacts in North America from degradation of 2, 3, 3, 3-tetrafluoropropene (HFO-1234yf), a potential greenhouse gas replacement. Environmental Science & Technology 2009. The document is accessible at: *http://www.researchgate.net/profile/Robert_Waterland/publication/40481734_Ozone_and_TFA_impacts_in_North_America_from_degradation_of_2333-Tetrafluoropropene_(HFO-1234yf)_a_potential_greenhouse_gas_replacement/links/00b7d514ca9595bf5e000000.pdf.*

is a reflection of EPA's reliance on higher emission estimates.[155] Even when relying on more conservative emission estimates, a concentration of 1700 ng/L corresponds to roughly 1/600th of the No-Observed-Adverse-Effect-Level (NOAEL) for the most sensitive algae species, which is also well below the NOAEL for the most sensitive aquatic animal species.[156]

Since the 2011 final rule listing HFO-1234yf as acceptable for LD vehicles, additional research on TFA has been conducted. The UNEP Ozone Secretariat provided a summary of key information pertaining to TFA based on the 2014 Assessment Reports of the Environmental Effects Assessment Panel (EEAP) and the Scientific Assessment Panel (SAP) of the Montreal Protocol. The brief states, ''While it is well established that TFA is a ubiquitous natural component in rivers, lakes, and other surface water bodies, uncertainties remain regarding anthropogenic sources, long-term fate and abundances as these are linked to current and future use and emissions of HFCs, HCFCs, and HFOs. Based on estimates to 2040, increases are predicted to remain relatively low and are therefore not expected to be a significant risk to human health or detrimental to the environment. Projected future increased loadings of TFA to playas, land-locked lakes, and the oceans due to continued use of HCFCs, HFCs, and replacement products such as HFOs are still judged to present negligible risks for aquatic organisms and humans.'' The UNEP background document also states that TFA and its salts ''do not bioconcentrate in aquatic organisms, and do not biomagnify in the food chain. Thus they present negligible risk to organisms higher on the food chain, including humans.''

A 2014 study by Kazil, *et al.*[157] analyzed TFA deposition in the United States assuming 100 percent of all MVAC systems use HFO-1234yf. The results indicated that rainwater TFA concentrations, while varying strongly geographically, will on average be low compared to the levels at which toxic effects are observed in aquatic systems. The additional information available since our 2011 listing decision shows no greater risk than our earlier analysis.

Taking into consideration the analysis conducted in support of the 2011 listing decision, which was based on conservative emissions assumptions and a transition from HFC-134a to HFO-1234yf for all MVAC systems (not limited to LD vehicles), and the research that has been conducted since, EPA concludes that the use of HFO-1234yf in the HD vehicle types addressed in this action will not pose a significant risk to the environment from atmospheric decomposition to TFA.

Based on the consideration of all of these environmental impacts, EPA concludes that HFO-1234yf does not pose significantly greater risk to the environment than the other alternatives for use in newly manufactured MDPVs, HD pickup trucks, and complete HD vans, and it poses significantly less risk than several of the alternatives with high-GWPs and ODPs.

b. Flammability

HFO-1234yf is a flammable refrigerant classified as A2L under ASHRAE 34-2013. HFC-134a and CO_2 are nonflammable refrigerants, while HFC-152a is slightly more flammable than HFO-1234yf with an ASHRAE classification of A2.

To evaluate human health and safety impacts, including flammability risks, of the use of HFO-1234yf in MDPVs, HD pickup trucks, and complete HD vans, the Agency is relying on EPA's analysis conducted in support of the 2011 listing decision for HFO-1234yf for LD vehicles and information submitted during the public comment period of the proposal for the 2011 final decision (October 19, 2009; 74 FR 53445), including the SAE CRP risk assessments. With regards to occupational exposure, EPA's risk screen on the use of HFO-1234yf in LD vehicles evaluated flammability risks (*e.g.,* potential for a fire from release and ignition) in workplace situations, such as during equipment manufacture and disposal or recycling of vehicle end-of-life. Modeling of concentrations of HFO-1234yf in the workplace scenarios found short-term, 15-minute concentrations of 28 ppm or less—far below the lower LFL of 6.2 percent by volume (62,000 ppm).[158]

The SAE CRP's risk assessments also evaluated flammability risks to technicians. The SAE CRP conducted Computational Fluid Dynamics (CFD) modeling of exposure levels in case of a leak in a system in a service shop. The SAE CRP found that a leaked concentration of HFO-1234yf could exceed the LFL of 6.2%, but only within ten centimeters or less of the leak. The SAE CRP risk assessment concluded that the risk of this occupational exposure scenario is ''inconsequential'' because ignition sources would not be located within ten centimeters of the MVAC system given technicians' familiarity with precautions necessary to avoid flammability risks due to the presence of other flammable materials in the engine compartment.[159] EPA notes that HFO-1234yf is less flammable and results in a less energetic flame than a number of fluids that motor vehicle service technicians and recyclers or disposers deal with on a regular basis, such as oil, anti-freeze, transmission fluid, and gasoline. The results of the CRP indicate that HFO-1234yf does not pose a greater risk in occupational settings than nonflammable alternatives, or HFC-152a, which is more flammable than HFO-1234yf and already approved for use in the HD vehicle types being addressed in this action.

Regarding the flammability risks of HF-1234yf to passengers inside a LD vehicle, in support of the 2011 listing decision, EPA determined the following (76 FR 17490; March 29, 2011):

> Depending on the charge size of an HFO-1234yf MVAC system, which may range from as little as 400 grams to as much as 1600 grams,[160] it is possible in a worst case scenario to reach a flammable concentration of HFO-1234yf inside the passenger compartment. This could occur in the case of a collision that ruptures the evaporator in the absence of a switch or other engineering mitigation device to prevent flow of high concentrations of the refrigerant into the passenger compartment, provided that the windows and windshield remain intact. As stated in the SAE CRP, ignition of the refrigerant once in the passenger cabin is unlikely (probability on the order of 10^{-14} occurrences per operating hour) because the only causes of ignition within the passenger cabin with sufficient energy to ignite the refrigerant would be use of a butane lighter (EPA–OAR–2008–0664–0056.2). If a passenger were in a collision, or in an emergency situation, it is unlikely that they would choose to operate a butane lighter in the passenger cabin. Additionally, it is unlikely ignition would occur from a flame from another part of the vehicle because

[155] ICF, 2010d. Sensitivity Analysis CMAQ results on projected maximum TFA rainwater concentrations and maximum 8-hr ozone concentrations.

[156] ICF, 2009a. Revised Final Draft Assessment of the Potential Impacts of HFO-1234yf and the Associated Production of TFA on Aquatic Communities and Local Air Quality.

[157] Kazil et al., 2014. Deposition and rainwater concentrations of trifluoroacetic acid in the United States from the use of HFO-1234yf. JGR-Atmospheres, 2014.

[158] ICF, 2008. Air-Conditioning Refrigerant Charge Size to Passenger Compartment Volume Ratio Analysis. Confidential Memorandum Prepared for the U.S. Environmental Protection Agency. 2008.

[159] SAE, 2013. SAE International Cooperative Research Project CRP1234–4 on R-1234yf Safety, Finishes Work and Presents Conclusions. This document is accessible at: *http://www.sae.org/servlets/pressRoom?OBJECT_TYPE=PressReleases&PAGE=showRelease&RELEASE_ID=2146.*

[160] ICF, 2008. Air-Conditioning Refrigerant Charge Size to Passenger Compartment Volume Ratio Analysis. Confidential Memorandum Prepared for the U.S. Environmental Protection Agency. 2008.

automobiles are constructed to seal off the passenger compartment with a firewall. If a collision breached the passenger compartment such that a flame from another part of the vehicle could reach it, that breach would also create ventilation that would lower the refrigerant concentration below the lower flammability limit. Similarly, if either a window or the windshield were broken in the collision, the ventilation created would lower the refrigerant concentration below the lower flammability limit. Therefore, EPA finds that flammability risks of HFO-1234yf to passengers inside a vehicle will be low. Further, these risks are likely to be less than those from HFC-152a, another flammable refrigerant that EPA has previously found acceptable subject to use conditions, because HFC-152a has a lower LFL and a lower minimum ignition energy than HFO-1234yf (EPA–HQ–OAR–2008–0664–0008, –0013.4, –0056.2).

Since that time additional analysis has been conducted under more recent SAE CRPs.

The fourth and most recent SAE CRP, SAE CRP1234–4, was established in October 2012 in response to a press release issued by the German OEM Daimler ''suggesting that new testing conducted by the company had shown R-1234yf to pose greater risk of vehicle fire than was estimated by the prior CRP1234 analysis.'' The final report for SAE CRP1234–4 was released on July 24, 2013, and concluded that the ''refrigerant release testing completed by Daimler was unrealistic.'' And, ''their testing created extreme conditions that favored ignition while ignoring many mitigating factors that would be present in an actual real-world collision.'' [161] The OEM members of CRP1234–4 included FCA, Ford, General Motors, Honda, Hyundai, Jaguar Land Rover, Mazda, PSA, Renault, and Toyota.

To fully assess the newly raised concerns, CRP1234–4 completed two new fault tree scenarios as refinements to the original fault tree analysis (FTA). ''The two new fault tree scenarios consider the possibility of an individual being unable to exit the vehicle due to a collision or a non-collision event that involves a refrigerant/oil release, the refrigerant/oil being ignited and the fire propagating. The FTA examined average risks across the entire global fleet of light-duty vehicles and used a number of conservative assumptions to ensure that the final risk estimate would be more likely to overestimate rather than underestimate actual risks.'' SAE CRP1234–4 concluded that:

Based on the updated analysis, the estimated overall risk of vehicle fire exposure attributed to use of R-1234yf is conservatively estimated at 3×10^{-12} events per vehicle operating hour. This is nearly six orders of magnitude less than the current risk of vehicle fires due to all causes (approximately 1×10^{-6} per vehicle operating hour) and also well below other risks accepted by the general public. The current overall risk of occupant exposure to adverse events based on R-1234yf usage is on the same order of magnitude as that estimated in the prior work of CRP1234. Therefore, the conclusions of the former CRP risk assessment are still valid: Risks are still very small compared to the risks of a vehicle fire from all causes and well below risks that are commonly viewed as acceptable by the general public.[162]

The findings of CRP1234–4 provide additional support for the conclusions of prior CRPs, and the EPA's analysis for its 2011 rule listing HFO-1234yf as acceptable, subject to use conditions, for use in LD vehicles. These findings in conjunction with EPA's earlier evaluation for LD vehicles support this proposal to list HFO-1234yf as acceptable, subject to use conditions, for the identified HD vehicle types.

To determine the appropriateness of relying on the conclusions of the extensive risk assessments conducted on flammability risks to passengers from HFO-1234yf in LD vehicles to support today's proposed SNAP listing of the same alternative in MDPVs, HD pickup trucks, and complete HD vans, we conducted an analysis of refrigerant charge size as compared to vehicle cabin size.[163] Specifically, we evaluated whether the charge size and vehicle cabin size used for the worst case scenario for LD vehicles would be sufficiently conservative to also represent a worst case scenario for the HD vehicle types addressed in this proposal. EPA analyzed the charge to vehicle cabin size ratios for 38 vehicle models of MDPVs, HD pickup trucks, and HD vans and found that the highest ratio of charge size to compartment area, which represents the most conservative exposure scenario (smallest passenger compartment with largest refrigerant charge), for the types of HD vehicles included in this proposal, is 410 g/m^3. This ratio is significantly lower than the highest ratio identified for LD vehicles, 641 g/m^3, which was identified as the most conservative value and used to conduct the risk screen supporting for LD listing.[164] Thus, the assessment used for the LD vehicles is sufficiently conservative to also represent a worst case scenario for the HD vehicle types subject to this proposal.

EPA considered the results of our examination of the ratio of charge size to compartment area and our understanding of these vehicle types and their MVAC systems being very similar to LD vehicles in determining it was appropriate to rely on the currently available analyses on light-duty vehicles. In addition, EPA has considered the characteristics of MDPVs, HD pickup trucks, and HD vans that could be different from LD vehicles, such as differences in the engine compartment size, passenger cabins, and operating conditions, and how those might impact EPA's reliance on the LD analyses. CRP1234–4 considered the temperature and condition of a hot surface that would be necessary to ignite HFO-1234yf released into the engine compartment as part of the FTA. The risk assessment conservatively analyzed a refrigerant and oil mixture contacting a hot surface, at or above 700 degrees Fahrenheit, in a stagnant zone condition such as might occur if the hot surface were covered with a heat shield with limited ventilation. EPA considered whether the engine temperatures and configurations of MDPVs, and HD pickup trucks and vans would reach higher temperatures (above 700 degrees) more regularly due to workload and towing capabilities, and if this would increase the likelihood of a fire under the hood of the vehicle. EPA does not believe this is the case. Despite their use as occupational vehicles and their towing capabilities, EPA does not expect any engine compartment surfaces to reach temperatures above those conservatively assumed for LD vehicles. The engine materials in these vehicles are the same as their LD counterparts, or in some cases a different material may be used to ensure consistent operating conditions. Also, in many cases the engine compartments for these vehicle types are larger than a LD engine compartment, allowing for additional space between hot parts and refrigeration lines, as well as increased airflow in the engine, decreasing the likelihood that refrigerant would be released onto a hot surface and that

[161] Gradient, 2013. Executive Summary for Additional Risk Assessment of Alternative Refrigerant R-1234yf, Prepared by Gradient for SAE International CRP–1234–4. July 24, 2013. Available online at: *http://www.sae.org/standardsdev/tsb/cooperative/executivesummary.pdf.*

[162] Gradient, 2013. Executive Summary for Additional Risk Assessment of Alternative Refrigerant R-1234yf, Prepared by Gradient for SAE International CRP–1234–4. July 24, 2013. Available online at: *http://www.sae.org/standardsdev/tsb/cooperative/executivesummary.pdf.*

[163] ICF, 2016i. Technical Support Document for Acceptability Listing of HFO-1234yf for Motor Vehicle Air Conditioning in Limited Heavy-Duty Applications.

[164] ICF, 2008. Air-Conditioning Refrigerant Charge Size to Passenger Compartment Volume Ratio Analysis. Confidential Memorandum Prepared for the U.S. Environmental Protection Agency. 2008.

contact, if it occurs, would occur in a stagnant zone condition.

EPA also considered whether the MVAC systems in diesel vehicles require additional analysis, since only gasoline vehicles have been used in the existing risk assessments. Unlike the LD fleet, where few vehicles have diesel engines, about half of HD pickup trucks and vans use diesel engines (July 13, 2015; 80 FR 40137). Based on EPA's understanding that MVAC systems and passenger compartments will be the same in gasoline and diesel engines, and surface temperatures within a diesel engine are typically lower than those in a gasoline vehicle because of the lean combustion and more complete utilization of thermal energy inherent to diesel engines, EPA has determined that additional analysis on vehicles with diesel engines is not necessary.

For these reasons, EPA concludes that the currently available assessments on the use of HFO-1234yf in LD vehicles are sufficiently conservative to account for all possible flammability risks from the use of HFO-1234yf in MDPVs, HD pickup trucks, and complete HD vans. Relying on the same analysis considered in support of the 2011 SNAP listing of HFO-1234yf as acceptable, subject to use conditions, for MVAC in new LD vehicles, verifying that more recent information is consistent with that analysis, and considering unique factors for these vehicle types, EPA concludes that the use of HFO-1234yf in new MVAC systems for MDPVs, HD pickup trucks, and complete HD vans does not pose greater flammability risk than the other alternatives when used in accordance with the proposed use conditions.

c. Toxicity

To evaluate human health and safety impacts, including toxicity risks, from the use of HFO-1234yf in MDPVs, HD pickup trucks, and complete HD vans, the Agency is relying on EPA's analysis conducted in support of the 2011 listing decision for HFO-1234yf for LD vehicles and information submitted during the public comment period of the proposal (October 19, 2009; 74 FR 53445) for the 2011 final decision, including the SAE CRP risk assessments.

In our analysis supporting the 2011 final decision, EPA compared worker exposures to a workplace exposure limit of 250 ppm [165] over an 8-hour time-weighted average for long-term occupational exposure to HFO-1234yf, For short-term occupational exposure to HFO-1234yf, we compared worker exposure to an acute exposure limit of 98,211 ppm, divided by a margin of exposure of 30, for a value of 3,270 ppm over 30 minutes.[166] [167]

Concerning workplace exposure, we expect that professional technicians have proper training and certification and have the proper equipment and knowledge to minimize their risks due to exposure to refrigerant from an MVAC system. Thus, worker exposure to HFO-1234yf is expected to be low. If workers service MVAC systems using certified refrigerant recovery equipment after receiving training and testing, exposure levels to HFO-1234yf are estimated to be on the order of 4 to 8.5 ppm on an 8-hour time-weighted average (as compared with a 250 ppm workplace exposure limit) [168] and 122 ppm on a 30-minute average (as compared with a short-term exposure level of 98,211 ppm divided by a [margin of exposure of 30, for a value of 3270 ppm over 30 minutes [169] [170]).[171] [172] We also analyzed exposure levels during manufacture and final disposition at vehicle end-of-life, and found that they would be no higher than 28 ppm on a 15-minute average or 8.5 ppm on an 8-hour time-weighted average.[173] The manufacture, use, and disposal or recycling of HFO-1234yf MVAC systems are not expected to present a toxicity risk to workers. Other alternatives such as HFC-134a and HFC-152a also do not present a toxicity risk to workers in the same scenarios; therefore, HFO-1234yf poses the same or less risk than other alternatives.

EPA's review of consumer risks from toxicity of HFO-1234yf indicated that

[165] This was based on a NOAEL of 4000 ppm from the study, ''An Inhalation Prenatal Developmental Toxicity Study of HFO-1234yf (2,3,3,3-Tetrafluoropropene) in Rabbits,'' EPA–HQ–OAR–2008–0664–0041. We used a factor of 1.9 to account for differences in blood concentrations between animals and humans, and a margin of exposure or collective uncertainty factor of 30. Uncertainty factors of 3 were assigned for animal to human extrapolation, and 10 for variability within the human population. The long-term workplace exposure limit was calculated as follows: 4000 ppm (animal exposure) × 1.9 (ratio of estimated human exposure/animal exposure) × 1/3 (UF for animal to human extrapolation) × 1/10 (UF for variability within the human population) exposure) = 250 ppm. This value was compared against 8-hour average concentrations. See EPA–HQ–OAR–2008–0664–0036 and EPA–HQ–OAR–2008–0664–0038.

[166] This was based on a NOAEL of 51,690 ppm from the study, ''Sub-acute (2-week) Inhalation Toxicity Study with HFO-1234yf in rats,'' EPA–HQ–OAR–2008–0664–0020 through–0020.4, a factor of 1.9 to account for differences in blood concentrations between animals and humans and a margin of exposure or collective uncertainty factor of 30. Uncertainty factors of 3 were assigned for animal to human extrapolation, and 10 for variability within the human population. The short-term workplace exposure value was calculated as follows: 51,690 ppm (animal exposure) × 1.9 (ratio of estimated human exposure/animal exposure) = 98,211 ppm This value was then divided by the expected exposure in each scenario, and compared against the target margin of exposure of 30. See EPA–HQ–OAR–2008–0664–0036 and EPA–HQ–OAR–2008–0664–0038.

[167] For comparison, the SAE CRP used exposure limits of 500 ppm over 8 hours and 115,000 ppm over 30 minutes to evaluate risks for these same time periods. These are based on the 8-hr Workplace Environmental Exposure Limit (WEEL) for HFO-1234yf and for short-term exposure, assuming a NOAEL of approximately 405,800 ppm from the study, ''Acute (4-hour) inhalation toxicity study with HFO-1234yf in rats.'' Note that EPA disagrees with the finding that the acute inhalation toxicity study found a NOAEL. We consider this study to show adverse effects at all levels because of the presence of grey discoloration in the lungs of the test animals. In order to ensure sufficient protection, EPA's risk assessment used a NOAEL from a subacute study instead of a LOAEL from an acute study.

[168] This was based on a NOAEL of 4000 ppm from the study, ''An Inhalation Prenatal Developmental Toxicity Study of HFO-1234yf (2,3,3,3-Tetrafluoropropene) in Rabbits,'' EPA–HQ–OAR–2008–0664–0041. We used a factor of 1.9 to account for differences in blood concentrations between animals and humans, and a margin of exposure or collective uncertainty factor of 30. Uncertainty factors of 3 were assigned for animal to human extrapolation, and 10 for variability within the human population. The long-term workplace exposure limit was calculated as follows: 4000 ppm (animal exposure) × 1.9 (ratio of estimated human exposure/animal exposure) × 1/3 (UF for animal to human extrapolation) × 1/10 (UF for variability within the human population) exposure) = 250 ppm. This value was compared against 8-hour average concentrations. See EPA–HQ–OAR–2008–0664–0036 and EPA–HQ–OAR–2008–0664–0038.

[169] This was based on a NOAEL of 51,690 ppm from the study, ''Sub-acute (2-week) Inhalation Toxicity Study with HFO-1234yf in rats,'' EPA–HQ–OAR–2008–0664–0020 through–0020.4, a factor of 1.9 to account for differences in blood concentrations between animals and humans and a margin of exposure or collective uncertainty factor of 30. Uncertainty factors of 3 were assigned for animal to human extrapolation, and 10 for variability within the human population. The short-term workplace exposure value was calculated as follows: 51,690 ppm (animal exposure) × 1.9 (ratio of estimated human exposure/animal exposure) = 98,211 ppm. This value was then divided by the expected exposure in each scenario, and compared against the target margin of exposure of 30. See EPA–HQ–OAR–2008–0664–0036 and EPA–HQ–OAR–2008–0664–0038.

[170] For comparison, the SAE CRP used exposure limits of 500 ppm over 8 hours and 115,000 ppm over 30 minutes to evaluate risks for these same time periods. These are based on the 8-hr Workplace Environmental Exposure Limit (WEEL) for HFO-1234yf and for short-term exposure, assuming a NOAEL of approximately 405,800 ppm from the study, ''Acute (4-hour) inhalation toxicity study with HFO-1234yf in rats.'' Note that EPA disagrees with the finding that the acute inhalation toxicity study found a NOAEL. We consider this study to show adverse effects at all levels because of the presence of grey discoloration in the lungs of the test animals. In order to ensure sufficient protection, EPA's risk assessment used a NOAEL from a subacute study instead of a LOAEL from an acute study.

[171] EPA, 2009b. Risk Assessment: PMN 07–0601. Available at: *http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2008-0664-0036.*

[172] ICF International, 2009b. Risk Screen on Substitutes for CFC-12 in Motor Vehicle Air Conditioning: Substitute: HFO-1234yf. Available online at: *http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2008-0664-0038.*

[173] Ibid.

potential consumer (passenger) exposure from a refrigerant leak into the passenger compartment of a vehicle is not expected to present an unreasonable risk. The consumer risks due to exposure to HFC-152a and HFC-134a are comparable to those of HFO-1234yf, with exposure levels expected to be below relevant exposure limits such as their cardiotoxic NOAELs. The consumer toxicity risks due to CO_2 are mitigated by the use conditions for that refrigerant, resulting in comparable risks to other alternatives.

In addition to analyzing exposure to the refrigerant, EPA and the SAE CRPs have also considered risks of generating hydrogen fluoride (HF) from combustion of HFO-1234yf. With regards to consumer risks from the use of HFO-1234yf in MVAC systems, we have considered information concerning consumer exposure to HF from thermal decomposition or combustion of HFO-1234yf. The 2009 CRP risk assessments analyzed potential concentrations of HFO-1234yf, from a leak inside the passenger compartment, and HF, from thermal decomposition or ignition, in the passenger compartment. SAE CRP members conducted testing to measure HF concentrations and to identify factors that were most likely to lead to HF formation.[174] One test on HF concentrations inside a car cabin found maximum concentrations were in the range of zero to 35 ppm in trials both with HFO-1234yf and with HFC-134a, with concentrations dropping to 10 ppm or less after 10 minutes. In a second test of HF generated in the engine compartment, HF concentrations from thermal decomposition of HFO-1234yf reached as high as 120 ppm in the engine compartment in the worst case, with interior passenger cabin values of 40 to 80 ppm. Under the same extreme conditions (flash ignition, temperature of 700 °C, closed hood), HF concentrations from thermal decomposition of HFC-134a reached 36.1 ppm in the engine compartment with interior passenger cabin values of two to eight ppm. The other trials with less extreme conditions found HF concentrations from HFO-1234yf in the engine compartment of zero to 8 ppm.

The SAE CRP selected an Acute Exposure Guideline Limit (AEGL)-2 of 95 ppm over 10 minutes as its criterion for determining toxicity risk from HF.[175] Thus, even assuming levels inside a passenger compartment reached the highest level that occurred during the tests—80 ppm—a passenger inside a vehicle would at worst experience discomfort and irritation, rather than any permanent effects. HF levels that could result in similar effects were also observed for HFC-134a. The SAE CRP concluded that the probability of such a worst-case event is on the order of 10^{-12} occurrences per operating hour.[176] [177] This level of risk is similar to the current level of risk of HF generated from HFC-134a.[178] To date, EPA is unaware of any reports of consumers affected by HF generated by HFC-134a, which has been used in automobile MVAC systems across the industry since 1993. Therefore, EPA concludes that when used in accordance with use conditions, HFO-1234yf does not pose greater risk overall to human health and the environment than other alternatives.

SAE CRP1234–4 considered the need to reevaluate HF exposure due to decomposition or ignition of HFO-1234yf and determined it was unnecessary. This decision considered that: The risks of HF evaluated in the earlier CRP were not significantly different from the risks of HF generation during use of HFC-134a; a presentation from the German automobile manufacturing industry group VDA found that thermal decomposition would not lead to significant amounts of HF and confirmed that there is not expected to be additional risk due to HF from HFO-1234yf compared to HFC-134a. In addition, the CRP1234–4 considered new scenarios where an individual might not be able to leave a car; however, it is expected that because HF is irritating, individuals will leave the area unless they are unable to do so. The CRP1234–4 also considered that mitigating factors specific to HF, such as convection of HF away from the vehicle due to the heat of a fire, mean that the factors already analyzed were likely to be very conservative. Finally, the CRP1234–4 was aware of studies conducted by the CRP for a refrigerant blend, referred to as ''CRP MRB,'' that found HF from HFO-1234yf along the side of a vehicle never exceeded the health-based HF limit of 95 ppm, even in the case of fire. This additional information confirms that the consumer risks from generation of HF are no greater than in EPA's 2011 evaluation. Further, risks of generation of HF are comparable to those from HFC-134a, and likely also from HFC-152a. CO_2 contains no fluorine, and thus, there are no risks due to HF generation.

EPA did not analyze toxicity concerns from the generation of HF in the workplace. In its December 17, 2009, *Risk Assessment for Alternative Refrigerants HFO-1234yf and R-744 (CO_2),* the SAE CRP indicated that ''service technicians will be knowledgeable about the potential for HF generation and will immediately move away from the area when they perceive the irritancy of HF prior to being exposed above a health-based limit'' (EPA-HQ–OAR–2008–0664–0056.2). Because the potential to form HF from HFO-1234yf is similar to that from other MVAC refrigerants and because service technicians, recyclers, and disposers have historically handled refrigerants with the same concern, including HFC-134a which is the most commonly used refrigerant, EPA concludes that HFO-1234yf does not pose greater risk in the workplace with regard to HF generation than other available or potentially alternatives.

4. What are the proposed use conditions?

All MVAC refrigerants listed as acceptable are subject to use conditions requiring labeling and the use of unique fittings. HFC-152a and CO_2 are subject to additional use conditions mitigating flammability and toxicity as appropriate to the alternative. None of these alternative refrigerants can simply be ''dropped'' into existing HFC-134a AC systems because they are listed as acceptable only for newly manufactured vehicles.

EPA is proposing to list HFO-1234yf acceptable, subject to use conditions, because the use conditions are necessary to ensure that use of HFO-1234yf will not have a significantly greater overall impact on human health and the environment than other alternatives for use in MDPVs, HD pickup trucks, and complete HD vans. EPA is proposing to require the same use conditions for HFO-1234yf in the HD vehicle types included in today's proposal that are currently required for the use of HFO-1234yf in newly manufactured LD vehicles. Because of the similarities in the MVAC systems used for these vehicles, these use conditions will be sufficiently protective to ensure use of HFO-1234yf

[174] *http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2008-0664-0056.*

[175] The AEGL–2 is defined as ''the airborne concentration of a substance . . . above which it is predicted that the general population, including susceptible individuals could experience irreversible or other serious, long lasting adverse effects or an impaired ability to escape.'' *http://www.epa.gov/oppt/aegl/pubs/define.htm.*

[176] If we assume 250 million passenger vehicles in the U.S. and typical driving times of 500 hours per year per vehicle, a risk of 4.6×10^{-12} per operating hour equates roughly to one event every 2 years for all drivers in the entire United States.

[177] Regulations.gov, EPA–HQ–OAR–2008–0664–0056.2.

[178] Regulations.gov, EPA–HQ–OAR–2008–0664–0086.1.

in MDPVs, HD pickup trucks, and complete HD vans does not pose significantly greater risk than use of other alternatives.

The first use condition requires that MVAC systems designed to use HFO-1234yf must meet the requirements of SAE J639, ''Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems.'' This standard sets safety standards that include unique fittings; a warning label indicating the refrigerant's identity and that it is a flammable refrigerant; and requirements for engineering design strategies that include a high-pressure compressor cutoff switch and pressure relief devices. This use condition also requires that for connections with refrigerant containers for use in professional servicing, use fittings must be consistent with SAE J2844 (revised October 2011). SAE J639 (2011 version) which specifies quick-connect fittings that are different from those for any other refrigerant. The low-side service port and connections will have an outside diameter of 14 mm (0.551 inches) and the high-side service port will have an outside diameter of 17 mm (0.669 inches), both accurate to within 2 mm. Under SAE J2844 (revised October 2011), containers of HFO-1234yf for use in professional servicing of MVAC systems must have a left-handed screw valve with a diameter of 0.5 inches and Acme (trapezoidal) thread with 16 threads per inch. The SAE standards do not include and EPA has not received a submission for unique fittings for small containers of HFO-1234yf refrigerant.

Consistent with the conclusion EPA drew at the time of the EPA's listing decision for HFO-1234yf in LD vehicles relied, EPA believes that the safety requirements that are included in SAE J639 sufficiently mitigate risks of both HF generation and refrigerant ignition (March 29, 2011; 76 FR 17488) for MDPVs, HD pickup trucks, and complete HD vans subject to this proposed action. HFO-1234yf is mildly flammable (2L classification) and, like other fluorinated refrigerants, can decompose to form the toxic compound HF when exposed to flame or to sufficient heat. The SAE J639 standard can also address flammability and HF risks of HFO-1234yf for MDPVs, HD pickup trucks, and complete HD vans. For example, SAE J639 provides for a pressure relief device designed to minimize direct impingement of the refrigerant and oil on hot surfaces and for design of the refrigerant circuit and connections to avoid refrigerant entering the passenger cabin. The pressure release device ensures that pressure in the system will not reach an unsafe level that might cause an uncontrolled leak of refrigerant, such as if the AC system is overcharged. The pressure release device will reduce the likelihood that refrigerant leaks would reach hot surfaces that might lead to either ignition or formation of HF. Designing the refrigerant circuit and connections to avoid refrigerant entering the passenger cabin ensures that if there is a leak, the refrigerant is unlikely to enter the passenger cabin. Keeping refrigerant out of the passenger cabin minimizes the possibility that there would be sufficient levels of refrigerant to reach flammable concentrations or that HF would be formed and transported where passengers might be exposed.

The second use condition requires the manufacturer of MVAC systems and vehicles to conduct Failure Mode and Effects Analysis (FMEA) as provided in SAE J1739 (adopted 2009) and keep records of the FMEA on file for three years from the date of creation. SAE J1739 (adopted 2009) describes a FMEA as ''a systematic group of activities intended to: (a) Recognize and evaluate the potential failure of a product/process and the effects and causes of that failure, (b) identify actions that could eliminate or reduce the change of the potential failure occurring, and (c) document the process.'' Through the FMEA, OEMs determine the appropriate protective strategies necessary to ensure the safe use of HFO-1234yf across their vehicle fleet. It is standard industry practice to perform the FMEA and to keep it on file while the vehicle is in production and for several years afterwards. As with the previous use condition, this use condition is intended to ensure that new MDPVs, HD pickup trucks, and complete HD vans manufactured with HFO-1234yf MVAC systems are specifically designed to minimize release of the refrigerant into the passenger cabin or onto hot surfaces that might result in ignition or in generation of HF.

5. When would the listing apply?

EPA proposes that this listing would apply 30 days after the date of publication of a final rule. This date, the same as the proposed effective date of this regulation, allows for the safe use of this substitute at the earliest opportunity.

6. What is the relationship between this proposed SNAP rule and other federal rules?

a. CAA Sections 608 and 609

CAA section 609 establishes standards and requirements regarding servicing of MVAC systems. Under section 609, no person repairing or servicing motor vehicles for consideration [179] may perform any service on an MVAC that involves the refrigerant without properly using approved refrigerant recovery or recovery and recycling equipment and no such person may perform such service unless such person has been properly trained and certified. Refrigerant handling equipment must be certified by EPA or an independent organization approved by EPA. EPA has issued regulations interpreting this statutory requirement and those regulations are codified at subpart B of 40 CFR part 82. The statutory and regulatory provisions regarding MVAC servicing apply to all refrigerant alternatives and application is not limited to ozone-depleting refrigerants. Today's proposal will not have a direct impact on EPA's regulations under section 609.

Section 608 of the CAA prohibits the intentional release (venting) of all refrigerants except those specifically exempted; because HFO-1234yf is not exempt, intentional release from MVAC systems of MDVPs, HD pickup trucks, and HD vans addressed in this action would be prohibited if the decision to list HFO-1234yf as acceptable subject to use conditions is finalized. MVAC end-of-life disposal and recycling specifications are also covered under section 608 of the CAA and our regulations issued under that section of the Act, which are codified at subpart F of 40 CFR part 82.

b. Would this action listing HFO-1234yf as acceptable, subject to use conditions, for MDPVs, HD pickup trucks, and complete HD vans affect EPA's LD GHG standards?

Today's proposal to list HFO-1234yf as acceptable, subject to use conditions, if finalized, will have no direct effect on the MY 2017–2025 light-duty vehicle GHG standards since today's proposed action applies to HD vehicles, not light duty. We raise the issue here, however, because today's proposed action would apply to MPDVs. As noted above in section V.B.1.a., although MDPVs are classified as HD vehicles based on their GVWR, due to their similarities to LD vehicles, GHG emissions from MDPVs are regulated under the LD GHG and fuel economy standards, and they are excluded from the HD GHG and fuel economy standards.[180]

[179] Service for consideration means receiving something of worth or value to perform service, whether in money, credit, goods, or services.

[180] 40 CFR 1037.5(c).

Nonetheless, this proposed action would have no direct effect on the regulations on MDPVs established under the LD GHG standards. Those standards are established by rule and EPA is not reopening that rule in this action. We do note, however, that today's proposal is relevant to one of the compliance flexibilities in that rule. As part of the MY 2017–2025 LD GHG rule,[181] EPA established the availability of credits for the use of alternative refrigerants with lower GWPs than that of HFC-134a. If EPA lists HFO-1234yf as acceptable for MDPVs under SNAP, as proposed, vehicle manufacturers will be able to obtain credits for the use of HFO-1234yf in these vehicles as allowed for in the MY 2017–2025 LD GHG rule. The LD GHG standards do not require any specific means of compliance, so manufacturers have the flexibility to either switch refrigerants or to comply with the standards by other means.[182]

c. Would this action listing HFO-1234yf as acceptable, subject to use conditions, for certain HD vehicles affect EPA's HD GHG standards?

The Phase 1 HD GHG rules divided the industry into three discrete categories—combination tractors, heavy-duty pickups and vans, and vocational vehicles. The Phase 1 rules also set separate standards for engines that power vocational vehicles and combination tractors—based on the relative degree of homogeneity among vehicles within each category (76 FR 57106; September 15, 2011). On July 13, 2015, EPA and the National Highway Traffic Safety Administration (NHTSA) proposed Phase 2 HD GHG standards that would build on existing Phase 1 HD GHG standards, and also proposed GHG standards for certain trailers used in combination with HD tractors (80 FR 40137; July 12, 2015). Today's proposal, should EPA adopt it, will have no direct effect on the HD GHG standards, either for Phase 1 or the proposed Phase 2.

As part of today's action, EPA is proposing to list HFO-1234yf as acceptable, subject to use conditions, for MDPVs, HD pickup trucks, and complete HD vans. HD pickup trucks and vans are one of the categories of HD vehicles regulated under the Phase 1 HD GHG standards, and proposed to be further regulated under the Phase 2 program. As part of the Phase 1 HD GHG standards, EPA finalized a low leakage requirement of 1.50 percent leakage per year for AC systems installed in HD trucks and vans and combination tractors for model years 2014 and later. EPA finalized a standard of 1.50 percent leakage per year for heavy-duty pickup trucks and vans and combination tractors. See section II.E.5 of Phase 1 HD GHG standard preamble (76 FR 57194–57195) for further discussion of the MVAC leakage standard.

As part of the NPRM for Phase 2 of the HD GHG standards (80 FR 40343; July 12, 2015), EPA proposed regulatory provisions that would be in place if and when lower-GWP alternative refrigerants are approved and adopted by manufacturers of HD vehicles. EPA proposed to adopt the same MVAC leakage standard for vocational vehicles as apply for pickups and vans, and for combination tractors. If adopted, these provisions would have the effect of easing the burden associated with complying with the lower-leakage requirements when a lower-GWP refrigerant is used instead of HFC-134a. These provisions would recognize that leakage of refrigerants would be relatively less damaging from a climate perspective if one of the lower-GWP alternatives is used. Specifically, EPA proposed to allow a manufacturer to be ''deemed to comply'' with the leakage standard set through the Phase 1 regulations by using a lower-GWP alternative refrigerant. EPA proposed that in order to be ''deemed to comply'' the vehicle manufacturer would need to use a refrigerant other than HFC-134a that is listed as an acceptable alternative refrigerant for heavy-duty MVAC systems under SNAP, and defined under the LD GHG regulations at 40 CFR 86.1867–12(e) (80 FR 40343–44; July 12, 2015). The lower-GWP refrigerants currently defined at 40 CFR 86.1867–12(e) are HFC-152a, HFO-1234yf, and CO_2.

If HFO-1234yf is listed as acceptable under SNAP for use in HD pickup trucks and complete HD vans, as proposed, and if the incentive proposed in the Phase 2 HD NPRM is finalized, these types of HD vehicles manufactured with HFO-1234yf MVAC systems will be ''deemed to comply'' with the low leakage standard.

7. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposed action. EPA is particularly interested in any additional exposure scenarios or unique characteristics of the types of HD vehicles included in today's action as compared to LD vehicles where HFO-1234yf has previously been listed as acceptable. In addition, EPA also specifically requests comment on whether the proposed use conditions are adequately protective for MDPVs, HD pickup truck, and complete HD vans, or whether more protective use conditions are necessary. If a commenter believes more protective use conditions are necessary, the commenter should identify what additional, more protective use conditions could be implemented.

With regard to incomplete HD pickup trucks and vans, EPA requests information on any modifications to incomplete HD pickup trucks by secondary manufacturers that could result in modifying the OEM-installed MVAC system. Concerning incomplete HD vans, at this time, EPA does not have information on all potential vehicle conversions that could be made by secondary manufacturers or the impact those conversions may have with regard to the SNAP criteria. Due to lack of information on potential vehicle conversions, EPA cannot assess whether or not the same risk analysis used for complete HD vans would be applicable to all incomplete HD vans. However, EPA is aware that for some incomplete HD vans, secondary manufacturers do not modify the MVAC systems. An example of an incomplete HD van that is manufactured by the OEM with cabin cooling that is not altered by the secondary manufacturer might be a HD van customized by a secondary manufacturer for transportation of persons with disabilities. In this situation, the secondary manufacturer would install wheelchair ramps, lifts, and other equipment to meet the needs of their customer in an incomplete HD van from the OEM without making any modifications to the OEM-installed MVAC system. However, some secondary manufacturers may alter the OEM MVAC system design based on their needs (*e.g.,* alter the MVAC system to provide cooling to the back of a vehicle). We request comments on whether there is a distinction that can be made between HD vans that could not have the MVAC systems modified and those that could have the MVAC systems modified. EPA is not including these vehicle types in this proposed action but is interested in receiving information on this topic. If such information clearly indicates that necessary distinctions can be made, and EPA establishes that use of HFO-1234yf in these vehicles will not result in greater overall risk to human health and the environment, the Agency would consider taking further rulemaking action to include a subset of incomplete HD vans in the listing of HFO-1234yf instead.

[181] 77 FR 62624, 62807–810 (October 15, 2012); see also 75 FR 25325, 25431–32 (May 7, 2010) (discussing the same issue for MY 2012–2016 light-duty vehicles).

[182] 77 FR 62804–809.

Additional risk analysis would be necessary prior to considering a listing decision for HFO-1234yf in all incomplete HD vans, especially on those for which the OEM-installed MVAC system may be altered. EPA requests comment on secondary manufacturer modifications that are likely for HD vans and, we welcome information on the types of modifications that could result in altering the MVAC system installed by the OEMs and the procedures for those modifications. EPA requests information on potential exposure scenarios, and is especially interested in information relevant to risk assessment such as charge sizes, the ratio of charge size to cabin size, exposure levels, potential for leaks and for ignition events, and means of mitigating risks during system modifications by the secondary manufacturer, and subsequently during the useful life of the vehicle. This information may be used to inform a future listing.

Additionally, EPA requests information on development of HFO-1234yf MVAC systems for other HD vehicle types or off-road vehicles, or plans to develop these systems in the future. This information may be used to inform a future listing.

C. Foam Blowing Agents

1. Proposed Change of Status for Certain HFC Foam Blowing Agents for Rigid PU Spray Foam

As provided in the following table, for rigid PU spray foam, EPA is proposing to list as acceptable, subject to narrowed use limits, numerous foam blowing agents for military or space- and aeronautics-related applications, and change the status from acceptable to unacceptable for all other uses:

TABLE 17—PROPOSED CHANGE OF STATUS DECISIONS FOR FOAM BLOWING AGENTS IN RIGID PU SPRAY FOAM

End-use	Substitutes	Proposed decision
Rigid PU: Spray foam—high-pressure two-component.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* as of January 1, 2020. Unacceptable for all applications other than military or space- and aeronautics-related applications as of January 1, 2020. Unacceptable for all uses as of January 1, 2025.
Rigid PU: Spray foam—low-pressure two-component.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Acceptable subject to narrowed use limits for military or space- and aeronautics-related applications* as of January 1, 2021. Unacceptable for all applications other than military or space- and aeronautics-related applications as of January 1, 2021. Unacceptable for all uses as of January 1, 2025.
Rigid PU: Spray foam—one component foam sealants.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Unacceptable as of January 1, 2020.

* Under the narrowed use limit, an end user must make reasonable efforts to ascertain that other alternatives are not technically feasible due to performance or safety requirements.

EPA is proposing to change the listings from acceptable to unacceptable, for HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa; commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and the HFC blend Formacel TI for use in rigid PU spray foam, with the exception of certain narrowed use limits for military, space, and aeronautics uses. See section VI.C.3 for how these proposed changes would apply to imported foam products.

In the NPRM published on August 6, 2014, EPA proposed to change the listings from acceptable to unacceptable for HFC-134a and blends thereof, and the HFC blend Formacel TI for spray foam as of January 1, 2017 (79 FR 46149). In that proposal, EPA stated that a number of nonflammable HFCs and HFC blends, such as HFC-245fa, blends of HFC-365mfc with at least four percent HFC-245fa by weight, and commercial blends of HFC-365mfc and HFC-227ea, with seven to 13 percent HFC-227ea and the remainder HFC-365mfc, were available and posed significantly less risk in the spray foam end-uses. We noted that these available HFC foam blowing agents provide a non-flammable alternative where there are flammability concerns associated with *in situ* use and use with pressurized spray pumps that meant most flammable foam blowing agents were not feasible for use based on the current state of knowledge (79 FR 46149, 46152; August 6, 2014). After considering the comments received on the proposed rule, EPA deferred taking final action on spray foam in the final rule. See sections V.D.2.a and V.D.3.b of the preamble to the final rule (80 FR 42870; July 20, 2015).

a. What is the affected end-use?

In the past, EPA combined spray foam, commercial refrigeration foam, sandwich panels, and marine flotation foam within a single end-use: rigid PU spray foam. However, because of differences in the exposure and fire safety characteristics of these uses as well as the fact that different alternatives are generally used for each of these applications, EPA more recently created separate end-use listings for each of these applications. See 80 FR 42870; July 20, 2015. Commercial refrigeration and sandwich panels include insulation for walls, pipes (including ''pipe-in-pipe''), metal doors, vending machines, refrigerated and unrefrigerated coolers, refrigerated transport vehicles, and other laboratory and commercial refrigeration equipment, as well as foam for taxidermy. These foams may be injected or applied using ''pour-in-place'' equipment, depending on the agent used and on whether the formulation is pressurized. Marine flotation foam includes buoyancy or flotation foam used in construction of boats and ships. These foams typically are injected into a cavity in the boat wall from a two-canister (A- and B-side) system under lower pressures and they provide structure as well as buoyancy. Rigid PU

spray foam, hereafter called ''spray foam,'' includes insulation for roofing, walls, doors, and other construction uses, as well as foam for building breakers for pipelines. These foams are rigid with closed cells that still contain the foam blowing agent, which can contribute to the foam's ability to insulate. Spray foam may have similar chemistry to other rigid PU end-uses, but it differs by being sprayed onto a surface in the location where it is to be used, either when constructing a new building or when adding insulation to an existing building, rather than being injected or poured or being produced in a manufacturing facility. As a result, it may be more difficult to provide engineered ventilation during application of spray foam than for other foam end-uses. The proposed action applies only to this last end-use—spray foam and we have identified three distinct and separate spray foam applications for this end-use: (1) High-pressure two-component, (2) low-pressure two-component, and (3) one-component foam sealants.

i. High-Pressure Two-Component Spray Foam

High-pressure two-component spray foam products are pressurized 800–1600 psi during manufacture, are sold in pressurized containers as two parts (*i.e.,* A-side and B-side), and are sprayed in the field for thermal insulation and air sealing of buildings and in roofing applications. In the United States, Side A typically contains methylene diphenyl isocyanate (MDI), consisting of monomeric MDI and higher molecular weight oligomers. Side B typically contains polyols and a mixture of other chemicals, including catalysts, flame retardants, blowing agents, and surfactants. High-pressure two-component spray foam is blown and applied *in situ* using high-pressure pumps to propel the foam components, and thus, may use liquid blowing agents without an additional propellant. Common liquid foam blowing agents used in high-pressure two-component spray foam include HFC-245fa; blends of HFC-365mfc with at least four percent HFC-245fa; and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc. This type of spray foam is applied by professionals who wear personal protective equipment (PPE) while applying high-density foam insulation for roofing or walls. The amount of resin and foam blowing agent is more than for low-pressure two-component spray foam and for one-component spray foam sealants. High-pressure two-component spray foam comprises the largest portion of the spray foam market.

ii. Low-Pressure Two-Component Spray Foam

Low-pressure two-component spray foam products are pressurized to less than 250 psi during manufacture, are sold in pressurized containers as two parts (*i.e.,* A-side & B-side), and are sprayed in the field for thermal insulation and air sealing of buildings. Low-pressure two-component spray foams are typically applied *in situ* relying upon a gaseous foam blowing agent that also serves as a propellant; pumps typically are not needed. This end-use category has primarily used the gaseous blowing agent HFC-134a; the Foams Technical Option Committee has also identified CO_2 and water as options. Low-pressure two-component spray foam is usually applied by home improvement contractors to fill in cracks and gaps in a residence using kits that are available for sale.[183] The amount of resin and foam blowing agent is smaller than for high-pressure two-component spray foam.

iii. One-Component Spray Foam Sealants

One-component foam sealants are packaged in aerosol cans and are applied *in situ* using a gaseous foam blowing agent that is also the propellant for the aerosol formulation. Because the SNAP program has not expressly identified one-component spray foam sealants in the past descriptions of the end-use, manufacturers of one-component foam sealants may have considered acceptable substitutes in the larger rigid PU: Commercial refrigeration, spray, and sandwich panel end-use to apply for this end-use or acceptable propellants in the aerosol sector to apply. This end-use category primarily uses light saturated HCs as the blowing agent, as well as HFCs such as HFC-134a and HFC-152a. This type of spray foam may be used by consumers and by home improvement contractors in order to seal cracks and leaks in a residence, as well as used for pest management. The total amount of resin and foam blowing agent is smaller than for low-pressure two-component spray foam.

b. Which foam blowing agents is EPA proposing to list as unacceptable?

EPA is proposing to change the status of the following HFCs and HFC blends that are currently listed as acceptable foam blowing agents for use in spray foam: HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa; commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.[184]

c. How do the proposed unacceptable blowing agents compare to other blowing agents for these applications with respect to SNAP criteria?

HFCs have been widely used as blowing agents in spray foam in the United States since the phaseout of ODS blowing agents such as HCFC-141b, particularly where insulation value and flammability have been of greater concern. Over the past ten years, the number of available alternatives has increased and the variety of uses for acceptable blowing agents has also expanded. A number of new foam blowing agents with low GWPs, both fluorinated and non-fluorinated, have been introduced during the past several years. Many end users have indicated interest in these newer alternatives, often to improve energy efficiency of the foam products manufactured with the foam blowing agent. Production volumes for some of these newer substitutes are expanding rapidly to keep pace with growing demand.

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks (*e.g.,* flammability, exposure, and toxicity) are discussed below. In addition, a technical support document [185] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives in the relevant end-uses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

[183] Low-pressure two-component spray foam kits should only be used by trained professionals. The polyurethanes industry has guidance on how to use low pressure kits available at: *http://spraypolyurethane.org/spf-chemical-health-and-safety-training* and at *http://spraypolyurethane.org/Main-Menu-Category/Weatherization-Contractors/Installing-SPF.*

[184] We note that neat HFC-365mfc has never been listed as acceptable for use in spray foam.

[185] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

i. Environmental Impacts

The HFCs that we are proposing to find unacceptable have GWPs ranging from 1,030 for HFC-245fa to 1,430 for HFC-134a. The HFC blends that we are proposing to find unacceptable have GWPs that vary depending on the specific composition; the range of GWPs for blends is 740 to 1,030 for blends of HFC-365mfc with at least four percent HFC-245fa, 900 to 1,100 for commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc, and 1,330 to approximately 1,500 for Formacel TI.

Alternatives for all three spray foam applications include CO_2, water, Exxsol blowing agents, ecomate™, HFC-152a, HFO-1234ze(E), and *trans*-1-chloro-3,3,3-trifluoroprop-1-ene. As shown in Table 18, these alternatives have GWPs ranging from zero to 1,430. In addition, for one-component foam sealants only, light saturated HCs are acceptable, with GWPs in the range of three to 15. For high-pressure two-component spray foam only, HFO-1336mzz(Z) is acceptable, with a GWP of approximately nine. These GWPs are significantly lower than the GWPs of 740 to 1,430 for the HFC and HFC blend substitutes subject to the proposed change of status.

TABLE 18—GWP, ODP, AND VOC STATUS OF FOAM BLOWING AGENTS IN RIGID POLYURETHANE HIGH-PRESSURE TWO-COMPONENT SPRAY FOAM, LOW-PRESSURE TWO-COMPONENT SPRAY FOAM, AND RIGID PU ONE-COMPONENT FOAM SEALANTS [1] [2]

Blowing agents	GWP	ODP	VOC	Proposal
Rigid PU High-Pressure Two-Component Spray Foam				
HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel® TI.	790–1,430	0	No	Acceptable, subject to narrowed use limits [2] or unacceptable.
CO_2; Ecomate; Formic Acid; HFC-152a; HFO-1234ze; *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233ze(E)) [1]; Water.	0–124	0–0.00034	No	No change.
Exxsol Blowing Agents; Formic Acid; HFO-1336mzz(Z)	>1–9	0	Yes	No change.
Rigid PU Low-Pressure Two-Component Spray Foam				
HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel® TI.	794–1,430	0	No	Acceptable, subject to narrowed use limits [2] or unacceptable.
CO_2; Ecomate; HFC-152a; HFO-1234ze; *trans*-1-chloro-3,3,3-trifluoroprop-1-ene; Water.	0–124	0–0.00034	No	No change.
Exxsol Blowing Agents; Formic Acid; HFO-1336mzz(Z)	>1–9	0	Yes	No change.
Rigid PU One-Component Foam Sealants				
HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel® TI.	790–1,430	0	No	Unacceptable.
CO_2; Ecomate; HFC-152a; HFO-1234ze; Methyl Formate; *trans*-1-chloro-3,3,3-trifluoroprop-1-ene; Water.	0–124	0–0.00034	No	No change.
Exxsol Blowing Agents; Formic Acid; HFO-1336mzz(Z); Saturated Light Hydrocarbons C3-C6.	>1–9	0	Yes	No change.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-uses or additives combined with other acceptable blowing agents.

[2] For military or space- and aeronautics-related applications.

All of the HFCs and HFC blends for which we are proposing a change of status to unacceptable consist of compounds that are non-ozone-depleting. Of all of the alternatives in the three applications affected by the proposed change of status listed above, only *trans*-1-chloro-3,3,3-trifluoroprop-1-ene contains chlorine and thus might have an ODP. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene 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-use that are considered to be non-ozone-depleting.[186] [187]

All of the HFCs and HFC blends for which we are proposing a change of status to unacceptable consist of compounds that are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. With the exception of light saturated HCs (for one-component foam sealants only), Exxsol blowing agents (for all spray foam applications) and HFO-1336mzz(Z) (for high-pressure two-component spray foam only), the other alternatives contain compounds that are not VOC (*i.e.,* water) or are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS (*e.g.,* CO_2, component of ecomate, HFO-1234ze(E), *trans*-1-chloro-3,3,3,-trifluoroprop-1-ene). Based on the small anticipated usage of hydrocarbons and of Exxsol blowing agents, and due to existing state regulations affecting aerosol products that may include once-component foam sealants, we do not expect these alternative to have a significantly greater impact on local air quality than other available alternatives in these applications. The manufacturer of HFO-1336mzz(Z) has petitioned EPA to exempt HFO-1336mzz(Z) from the definition of VOC under those regulations. As provided in our decisions listing these substitutes as

[186] 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.

[187] 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.

acceptable, we determined that emissions of these alternatives in this end use would not pose a significantly greater risk than that posed by foam blowing agents that are not VOCs.

ii. Flammability

All of the HFCs and HFC blends for which we are proposing a change of status are nonflammable. There has been use of blends of HFC-134a and HFC-152a, composition unspecified, in the past; those blends may be flammable depending on the exact composition.

HFO-1234ze(E), HFO-1336mzz(Z), and *trans*-1-chloro-3,3,3-trifluoroprop-1-ene are nonflammable blowing agents that have recently been listed as acceptable. The manufacturers of the flammable alternatives Exxsol blowing agents and ecomate™ have developed training to assist users of high-pressure two-component spray foam users in addressing the flammability hazards of these flammable foam blowing agents in this end-use and thereby minimize flammability risks.[188] [189]

Use of flammable blowing agents in spray foam can be an issue. Spray foam is frequently used in situ in commercial and residential buildings and it is not practical to make all electrical fixtures explosion proof or to add engineered ventilation when applying spray foam in place in many circumstances. As mentioned above, flammability is a major issue for high-pressure and low-pressure two-component spray foam. Thus, all acceptable substitutes in these applications either are nonflammable or else are flammable but information in EPA's possession indicates there are measures available to mitigate flammability risk.

iii. Toxicity

Both the HFC substitutes for which we are proposing a change of status and other alternatives have workplace exposure limits, either as regulatory requirements (*i.e.,* OSHA PEL) or as a recommendation (*e.g.,* AIHA WEEL, ACGIH TLV or manufacturer recommended workplace exposure limits). Proper training, use of PPE, and use of ventilation should be adhered to when applying spray foam. As we determined at the time that we listed both the substitutes for which we are proposing a status change and the other available alternatives, they can be used consistent with the relevant workplace exposure limits in spray foam.

iv. Summary

EPA is proposing to find HFC-134a, HFC-245fa, and blends thereof; commercial blends of HFC-365mfc and HFC-227ea, containing seven to 13 percent HFC-227ea and the remainder HFC-365mfc; blends of HFC-365mfc and at least four percent HFC-245fa; and Formacel TI unacceptable in spray foam because there are other available or potentially available alternatives that reduce risk overall compared to these foam blowing agents. EPA has listed as acceptable several alternatives that pose lower overall risk to human health and the environment than the blowing agents whose status we are proposing to change to unacceptable. The risks other than GWP are not significantly different for the alternatives than for the blowing agents we are proposing to list as unacceptable, and the GWPs for the blowing agents we are proposing to list as unacceptable are significantly higher and thus pose significantly greater risk.

d. What narrowed use limits for military or space- and aeronautics-related applications is EPA proposing?

EPA is proposing an time-limited exception to the proposed unacceptability determination for HFC and HFC blend foam blowing agents for military or space- and aeronautics-related applications when used in low pressure two-component and high pressure two-component spray foam. Specifically, EPA is proposing a narrowed use limit that would expire on January 1, 2025. As provided in section e below, the vast majority of applications for spray foams are anticipated to be able to transition to acceptable alternatives by January 1, 2020, for high-pressure two-component spray foam and as of January 1, 2021, for low-pressure two-component spray foam. However, for the military, there are several unique performance requirements related to weapon systems that require extensive testing and qualification prior to qualifying alternatives for HFC-containing foams. In addition, some of the lower-GWP alternatives may not be available by 2020 or 2021in certain specialty applications with unique military requirements such as undersea; aerospace; and chemical, biological, and radiological warfare systems. In the case of space- and aeronautics- related applications, past experience indicates that transitions away from the foam blowing agents in current use took several years due to the challenging operational environment and the lengthy requalification process associated with human-rated space flight systems.

Users of a restricted agent within the narrowed use limits category must make a reasonable effort to ascertain that other substitutes or alternatives are not technically feasible. Users are expected to undertake a thorough technical investigation of alternatives to the otherwise restricted substitute. Although users are not required to report the results of their investigations to EPA, users must document these results, and retain them in their files for the purpose of demonstrating compliance.

Users should include the following additional documentation to demonstrate compliance with the narrowed use applications. This information includes 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.

e. When would the status change?

Except for the proposed narrow use limits addressed above, EPA is proposing to change the listings from acceptable to unacceptable (1) in high-pressure two-component spray foam and in one-component foam sealants as of January 1, 2020, and (2) in low-pressure two-component spray foam as of January 1, 2021. The change of status would apply to the following blowing agents: HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc and Formacel TI. The Agency is aware of several companies transitioning between now and 2017.[190] However, a transition date of January 1, 2020, is necessary for high-pressure two-component spray foam to allow sufficient opportunity for affected entities to redesign to address the technical issues associated with using a different foam blowing agent, including the time required for reformulation (about one year), and the time required for testing and certification of the final

[188] UNEP, 2013. Report of the Technology and Economic Assessment Panel, Volume 2: Decision XXIV/7 Task Force Report, Additional Information on Alternatives to ODS. September, 2013.

[189] FTOC, 2011. Report of the Rigid and Flexible Foams Technical Options Committee, 2010 Assessment. This document is accessible at: *http://ozone.unep.org/Assessment_Panels/TEAP/Reports/FTOC/FTOC-2010-Assessment-Report.pdf.*

[190] Public and private sector commitments made at the White House Roundtable on October 15, 2015 is available at: *https://www.whitehouse.gov/the-press-office/2015/10/15/fact-sheet-obama-administration-and-private-sector-leaders-announce.*

commercial product (one to one and a half years). Similarly, a transition date of January 1, 2021, is necessary for low-pressure two-component to address the technical issues associated with using a different foam blowing agent. Based on information from several companies developing low-pressure two-component spray foam products, the process of reformulation has been more difficult than for high-pressure two-component spray, because it must have a significantly longer shelf life and requires significant reformulation to achieve an acceptable shelf-life. These products are then sold to an end user many months after they are formulated. Thus, at least two years are expected to be needed for reformulation after issuance of a final rule and another one to one and a half years for testing for low-pressure two-component spray foam, resulting in a change of status date of January 1, 2021.

For high-pressure two-component and low-pressure two-component spray foam a certain insulation value may be required to meet building code requirements. Some studies have indicated that CO_2 may provide less insulation value to an insulation foam, pound for pound, than HFCs. Recent information on some of the newer fluorinated foam blowing agents with low GWPs, such as HFO-1234ze(E), HFO-1336mzz(Z), and *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, indicates these foam blowing agents provide comparable or greater insulation value than their HCFC and HFC predecessors. Part of the process of testing and certification for spray foam used for building insulation includes verifying sufficient insulation value to meet building code requirements.

January 1, 2020, is the earliest date by which there will be sufficient supply of alternatives for high-pressure two-component spray foam. Although alternatives are commercially available for this end-use (*e.g., trans*-1-chloro-trifluoroprop-1-ene, ecomate™), there is already demand and concerns about sufficient supply from foam manufacturers in other end-uses (80 FR 42870, 42925-42930; July 20, 2015). An additional blowing agent, HFO-1336mzz(Z), is expected to become commercially available in 2017,[191] providing greater supply of alternative foam blowing agent, as well as providing an additional nonflammable, low GWP option with good insulation properties that could be especially useful in high-pressure two-component spray foam.

For one-component foam sealants, we expect that the transition process for manufacturers of these products should be quicker than for manufacturers of low-pressure two-component spray foam because testing is required only for a final formulation in an aerosol can for one-component foam sealants, rather than testing both the formulation in separate containers (A- and B-side) and ensuring the long-term stability of the final blown foam once the two parts are mixed to blow the foam. Also, no certification testing would be required for the one-component foam sealant, unlike for high-pressure two-component foam. In Europe, one-component foam sealants have already converted away from using HFCs and predominantly use HCs or HFO-1234ze(E), which are available substitutes for this end-use under SNAP. Allowing for one year for reformulation and one to two years for testing of products and to allow existing stock of one-component foams to be purchased and used, we are proposing a change of status date of January 1, 2020, after which date, no more one-component foam sealants (cans) could be manufactured using the specified HFC blowing agents, but the end user could continue to use cans that had already been manufactured. In the July 20, 2015, final rule, EPA took such an approach for aerosol propellants, which are used in similar packages for consumer use as well as for manufacturing use, and similarly, may be in distribution for a year or more before they are purchased and eventually used by the end user. Under the proposed approach, we would limit the applicability of the use prohibition on closed cell foam products (discussed in section VI.C.3), so that it would not apply to closed cell foam products produced through the use of a one-component spray foam manufactured prior to the status change date.

For low-pressure two-component spray foam, commenters on the August 6, 2014, proposal with a change of status date of January 1, 2017, expressed concern about the feasibility of alternatives by that date. Specifically, two manufacturers mentioned the heightened challenges of shelf-life and stability for a product using HFO-1234ze(E), and suggested change of status dates of January 1, 2020 or 2021.[192] [193] One manufacturer of alternative foam blowing agents suggested that HFC-134a and Formacel® TI should remain listed as acceptable for use in low-pressure foam systems until multiple low-GWP alternatives with appropriate technical performance qualities would become commercially available,[194] while another foam blowing agent manufacturer claimed that multiple options are available for this use but would require a couple of years to be optimized.[195] Since that time, some of these same companies have provided additional information indicating that many of the technical challenges with use of HFO-1234ze(E) have been worked through and that this is expected to be a viable option given sufficient time to address the technical challenges of a transition.[196] [197] To allow sufficient time for manufacturers of low-pressure two-component spray foam kits to complete working through the technical challenges of alternatives, as well as time for existing kits to be distributed, purchased, and used by the end user, we are proposing, as our lead option, a change of status date of January 1, 2021. Alternatively, similar to an approach proposed above for one-component foam sealants, EPA proposing as an alternative option a change of status date of January 1, 2020, for low-pressure two-component spray foam kits, after which date no more kits could be manufactured using the specified HFC blowing agents, but the end user could continue to use kits that had already been manufactured. Although low-pressure two-part spray foam kits would typically be used by a professional (*e.g.,* home improvement contractor) rather than by a consumer, there are similar issues with an extended chain manufacture, distribution, and use for these kits that are more similar to aerosol canisters and

[191] Cooling Post, 2015. ''Chemours to build HFO-1336mzz plant.'' November 17, 2015. This document is accessible online at: *http://www.coolingpost.com/world-news/chemours-to-build-hfo-1336mzz-plant/.*

[192] Fomo, 2014. Comment Re: Proposed SNAP Program Status Change Rule Docket ID No. EPA–HQ–OAR–2014–0198, submitted by Dr. Thomas Fishback, Vice President, Research and Development, Fomo Products, Inc. October 16, 2014. Docket number EPA–HQ–OAR–2014–0198–0139.

[193] Clayton Corporation, 2014. Re: Proposed SNAP Program Status Change Rule Docket ID No. EPA–HQ–OAR–2014–0198. October 20, 2014. Docket number EPA–HQ–OAR–2014–0198–0133.

[194] DuPont, 2014. Re: Protection of Stratospheric Ozone: Change of Listing Status for Certain Substitutes under the Significant New Alternatives Policy Program. Submitted by Michael Parr and Mack McFarland, DuPont. October 17, 2014. Docket number EPA–HQ–OAR–2014–0198–0077.

[195] Honeywell, 2014. Comments on Proposed Rule: Protection of Stratospheric Ozone: Change of Listing Status for Certain Substitutes under the Significant New Alternatives Policy Program (Docket no. EPA–HQ–OAR–2014–0198). October 20, 2014. Docket number EPA–HQ–OAR–2014–0198–0170.

[196] Fomo, 2015. ''The Use of Solstice® Gas Blowing Agent (GBA) in Low Pressure Spray Polyurethane Foam Applications;'' Cline, Mojee and Bogdan, Mary; October, 2015. Polyurethane Industry Conference 2015.

[197] Clayton Corporation, 2015. Clayton Corporation Meeting with EPA Stratospheric Protection Division, December 8, 2015.

one-component spray foam sealants than to high-pressure two-component spray foam or other foam blowing end-uses (*e.g.,* rigid PU appliance, rigid PU commercial refrigeration and sandwich panel). Under this alternative proposal, as under the proposed approach for one-component spray foams, we would limit the applicability of the use prohibition on closed cell foam products (discussed in section VI.C.3) so that it would not apply to closed cell foam products produced through the use of a low-pressure two-component spray foam kit manufactured prior to the status change date.

f. What is the relationship between this proposed SNAP rule and other federal rules?

Over the past several years, to address potential exposure to workers and consumers, the Federal Partnership and each of its member agencies, including EPA, CPSC, OSHA, and NIOSH have worked to reduce exposure to various chemicals emitted from spray foam. For example, EPA and its federal partners have continued to work with industry to develop best practices for application of spray foam, and EPA's Office of Research and Development has been developing methods to measure emissions of chemicals from spray foam as part of the ASTM Indoor Air Subcommittee D.22.05 on Spray Polyurethane Foam Insulation. The list of proposed and final standards represents the issues raised by the committee and the range of compounds of interest includes isocyanates, blowing agents, amine catalysts, flame retardants, and aldehydes.[198] In addition to federal rules and guidance applying to the spray foam industry, insulation foam used in construction (*e.g.,* high-pressure two-component spray foam) must meet insulation value requirements in state and local building codes, as discussed above in section VI.C.1.d.

g. On which topics is EPA specifically requesting comment?

EPA requests comments on all aspects of this proposed decision to change the listings of certain foam blowing agents in the three for spray foam end-uses. In particular, EPA requests comment on the proposed decision to change the status of the identified substitutes to unacceptable (1) in high-pressure two-component spray foam and in one-component foam sealants on January 1, 2020, and (2) in low-pressure two-component spray foam on January 1, 2021. EPA is interested in comment on whether there are specific applications for one-component spray foam sealants, low-pressure two-component, and high-pressure two-component spray foam for which there are no alternatives available with lower overall risks to human health and the environment than the substitutes for which we are proposing a change of status: HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI, for reasons of fire safety or technical feasibility. EPA requests comment on whether the proposed change of status dates for one-component spray foam sealants, low pressure two-component, and high pressure two-component spray foam are appropriate in light of technical challenges and the supply of other alternatives. Where commenters indicate more time is needed due to supply or technical challenges, EPA is interested in information concerning what is limiting supply of substitutes and on the specific technical steps and time needed for each step in order to transition to alternatives. Additionally, EPA requests comment on whether the change of status date for one component foam sealants and low-pressure two-component spray foam should be based upon the date the product may no longer be used or whether it should be based upon a date of manufacture of the product with no restriction on the use of products sold prior to the change of status date.

2. Proposed Revision To Change of Status Date of Certain HFCs and HFC Blends for Space- and Aeronautics-Related Foam Applications

EPA is proposing to change the date upon which certain HFCs and HFC blend foam blowing agents for space- and aeronautics-related applications change status from acceptable, subject to narrowed use limits, to unacceptable. EPA is proposing to revise this change of status date to January 1, 2025. EPA is proposing to revise the change of status date only for space- and aeronautics-related applications and not for military uses.

Table 19 summarizes the end-uses and blowing agents that in the July 20, 2015, final rule were listed as unacceptable for military and space- and aeronautics-related applications as of January 1, 2022 and for which we are proposing to revise the change of status date to January 1, 2025.

TABLE 19—PROPOSED REVISIONS TO CHANGE OF STATUS DATES FOR FOAM BLOWING AGENTS

End-use	Substitutes	Proposed 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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 applications * and unacceptable for all other uses as of *January 1, 2017.* Unacceptable for military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.

[198] Sleasman, K. and Biggs, M., 2015. Lessons learned from the Federal Partners Workgroup on Spray Polyurethane Foam (SPF), presented at the Center for the Polyurethanes Industry Technical Conference, October, 2015.

TABLE 19—PROPOSED REVISIONS TO CHANGE OF STATUS DATES FOR FOAM BLOWING AGENTS—Continued

End-use	Substitutes	Proposed decision *
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.
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 military uses as of January 1, 2022 and unacceptable for space- and aeronautics-related applications as of January 1, 2025.

* 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 are the affected end-uses?

This proposal would apply specifically to space- and aeronautics-related applications in the same end-uses that are regulated in appendix U to subpart G of 40 CFR part 82, as listed above in Table 19. This proposal to revise the changes of status date does not apply to the narrowed use limit for military uses for which the change of status date is January 1, 2022.

b. Which foam blowing agents are affected?

This proposal applies to the HFC and HFC blend foam blowing agents that are regulated in appendix U to subpart G of 40 CFR part 82, as listed above in Table 19. This proposal does not affect any HCFC foam blowing agents.

c. When would the status change?

We are proposing to revise the status change date for certain HFC and HFC blend foam blowing agents for space and aeronautics-related foam applications from acceptable, subject to narrowed use limits to unacceptable as of January 1, 2025—three years later than the current status change date of January 1, 2022. Based on recent discussions with other government agencies, EPA is aware that some space flight hardware used in the United States is being developed in the European Union. Under E.U. regulations, certain types of HFC foams may be blown and used after January 1, 2022, but by the mid-2020s those regulations will no longer allow the use of the HFC blowing agents restricted under EPA's SNAP regulations. Further, the most recent U.S. space flight program is still being developed, and it now appears that it may not be possible to qualify all foams needed with alternative foam blowing agents by the current January 1, 2022, date in order to ensure the safety of space vehicles. Thus, we are proposing to extend the period during which the narrowed use limits apply for space and aeronautics related applications from January 1, 2022, to January 1, 2025.

d. What is the relationship between this proposed SNAP rule and other federal rules?

EPA is not aware of any other relevant federal rules that would be affected by this proposed revision to the change in status date for certain HFC and HFC blend foam blowing agents for space and aeronautics-related foam applications.

e. On which topics is EPA specifically requesting comment?

EPA requests comment on the revised date of January 1, 2025, for the change of status for certain HFC and HFC blend foam blowing agents space and aeronautics-related foam applications from acceptable, subject to narrowed use limits, to unacceptable.

3. Proposed Change of Status for Methylene Chloride in Flexible PU, Integral Skin PU, and Polyolefin Foams

As provided in the following table, EPA is proposing to change the status methylene chloride from acceptable to unacceptable for multiple foam blowing end-uses.

TABLE 20—PROPOSED CHANGE OF STATUS DECISIONS FOR FLEXIBLE PU, INTEGRAL SKIN PU, AND POLYOLEFIN FOAM BLOWING AGENTS

End-use	Substitutes	Proposed decision
Flexible PU	Methylene chloride	Unacceptable as of 30 days after publication of a final rule.
Integral Skin PU	Methylene chloride	Unacceptable as of January 1, 2017.
Polyolefin	Methylene chloride	Unacceptable as of January 1, 2020.

a. What are the affected end-uses?

EPA is proposing to change the status of methylene chloride from acceptable to unacceptable when used as a blowing agent in the production of flexible PU foam, integral skin PU foam, and polyolefin foam. Flexible PU includes foam in furniture, bedding, chair cushions, and shoe soles. Integral skin PU includes car steering wheels, dashboards, and shoe soles. Polyolefin includes foam sheets and tubes.

Methylene chloride, also known as dichloromethane, has the chemical formula CH_2Cl_2 and the CAS Reg. No. 75–09–2. EPA initially listed this substitute as acceptable for flexible PU foam and integral skin PU foam acceptable in the initial SNAP rule (79 FR 13044; March 18, 1994), and then listed it as acceptable for polyolefin foam on August 26, 1994 (79 FR 44240).

b. How does methylene chloride compare to other blowing agents for these end-uses with respect to SNAP criteria?

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks (*e.g.,* flammability, exposure, and toxicity) are discussed below. In addition, a technical support document [199] that provides the **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–HQ–OAR–2015–0663).

i. Flexible PU

(a) Environmental Impacts

Methylene chloride contains chlorine and thus could have an ODP. We are unaware of a calculated ODP for methylene chloride in the peer-reviewed literature, but it has historically been considered negligibly small.[200] Recent research indicates that emissions of methylene chloride from multiple industrial sources have been increasing and could have a detectible impact on the ozone layer,[201] despite the historical assumption of negligible ODP. For flexible polyurethane, available substitutes include acetone, Exxsol blowing agents, CO_2, ecomate™, HFC-152a, HFO-1336mzz(Z), methylal, saturated light HCs (C3-C6), *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, and water. Of the other available alternatives for flexible PU, only *trans*-1-chloro-3,3,3-trifluoroprop-1ene contains chlorine and thus might have an ODP. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene 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-use that are considered to be non-ozone-depleting.[202] [203]

Methylene chloride has a GWP of approximately nine. As shown in Table 21, other acceptable alternatives have GWPs that are comparable or lower than methylene chloride's GWP of nine except for HFC-152a, which has a GWP of 124.

TABLE 21—GWP, ODP, AND VOC STATUS OF METHYLENE CHLORIDE COMPARED TO OTHER FOAM BLOWING AGENTS IN FLEXIBLE PU FOAMS, INTEGRAL SKIN PU FOAMS, AND POLYOLEFIN FOAMS [1]

Blowing agents	GWP	ODP	VOC	Proposal
Methylene Chloride	9	unknown	No	Proposed unacceptable.
Flexible PU Foams				
Acetone; CO_2; Ecomate; HFC-152a; Methylal; *trans*-1-chloro-3,3,3-trifluoroprop-1-ene; Water.	0–124	0–0.00034	No	No change.
AB Technology; Exxsol Blowing Agents; HFO-1336mzz(Z); Methylal; Saturated Light Hydrocarbons C3-C6 [1].	>1–9	0	Yes	No change.
Integral Skin PU Foams				
Acetone; CO_2; Ecomate; Formic Acid; HFO-1234ze; HFO-1336mzz(Z) HFC-152a; Methyl Formate; *trans*-1-chloro-3,3,3-trifluoroprop-1-ene [1]; Water.	0–124	0–0.00034	No	No change.
AB Technology; Exxsol Blowing Agents; Formic Acid; HFO-1336mzz(Z); Methylal; Saturated Light Hydrocarbons C3-C6.	>1–9	0	Yes	No change.
Polyolefin Foams				
CO_2; Ecomate; HFO-1234ze; HFC-152a; Water	0–124	0	No	No change.
Exxsol Blowing Agents; Formic Acid; HFO-1234ze; HFC-152a/Saturated Light Hydrocarbon Blends; Saturated Light Hydrocarbons C3-C6.	0–120	0	Yes	No change.

[1] The table does not include not-in-kind technologies listed as acceptable for the stated end-uses or additives combined with other acceptable blowing agents.

[199] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[200] INCHEM, 1996. International Programme on Chemical Safety. Environmental Health Criteria 164. Methylene chloride, second edition. World Health Organization, 1996. This document is accessible online at *http://www.inchem.org/documents/ehc/ehc/ehc164.htm.*

[201] Hossaini, et al., 2015. R. Hossaini, M.P. Chipperfield, S.A. Montzka, A. Rap, S. Dhomse, W. Feng. Efficiency of short-lived halogens at influencing climate through depletion of stratospheric ozone. *Nature Geoscience,* 2015. This document is accessible online at *http://DOI: 10.1038/ngeo2363* and is reported in ''New ozone-destroying gases on the rise; not controlled by treaty.'' ScienceDaily. 16 February 2015. This document is accessible online *at http://www.sciencedaily.com/releases/2015/02/150216130241.htm.*

[202] 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.

[203] 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.

Methylene chloride is excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. With the exception of HCs, Exxsol blowing agents, HFO-1336mzz(Z), and methylal, the other alternatives contain compounds that are excluded from the definition of VOC. The manufacturer of HFO-1336mzz(Z) has petitioned EPA to exempt HFO-1336mzz(Z) from the definition of VOC under those regulations. As provided in our decisions listing these substitutes as acceptable, we determined that emissions of these alternatives in this end use would not pose a significantly greater risk than that posed by foam blowing agents that are not VOCs.

(b) Flammability

Methylene chloride exhibits no flash point under standard testing conditions and thus is considered nonflammable, although it does exhibit lower and upper flammability limits of 13 percent and 23 percent, respectively. Of the various alternatives, ecomate™, Exxsol blowing agents, HFC-152a, HCs, and methylal are flammable, and the others are nonflammable. The flammability hazards of the flammable compounds in this end-use can be adequately addressed in the process of meeting OSHA regulations and fire codes.

(c) Toxicity

Health effects of concern with methylene chloride include cancer, liver, and kidney effects (longer-term exposure) and neurotoxic effects (acute exposure), in addition to irritation to the skin, eyes, and respiratory tract. Other alternatives for this end-use have potential health effects such as impacts on body weight, mononuclear infiltration of heart tissue, neurotoxic effects, and irritation to the skin, eyes, and respiratory tract; no other alternatives in this end-use have evidence of cancer as a health effect. Toxicity is not a significant concern in the workplace for methylene chloride or for the other available alternatives because they may be used for blowing flexible PU foam consistent with required or recommended workplace exposure limits. Workplace exposure limits for the other available alternatives range from 100 ppm to 5,000 ppm. Methylene chloride's workplace exposure limits include a PEL of 25 p.m. (8-hr TWA) and 125 ppm over a 15-minute period. Methylene chloride is regulated for its toxicity as a hazardous air pollutant under the CAA and potentially as a U-listed hazardous waste under RCRA (40 CFR 261.33). None of the other alternative blowing agents are regulated as hazardous air pollutants or as U-listed hazardous wastes.

In the initial SNAP rulemaking, EPA listed methylene chloride as acceptable in this end-use, citing the presence of the OSHA regulations as sufficient to address workplace risk. Information regarding general population risk was not available for methylene chloride or for any of the other alternatives at the time EPA listed them as acceptable for this end use.

Since EPA's initial listing decision for methylene chloride in flexible PU foam, the Agency has separately issued a health-based residual risk standard under section 112 of the CAA for flexible PU foam production. (*National Emission Standards for Hazardous Air Pollutants Residual Risk and Technology Review for Flexible Polyurethane Foam Production,* (79 FR 48073; August 15, 2014). In that regulation, EPA examined the risk to the general population and determined to prohibit the use of HAP-based blowing products, including methylene chloride, as auxiliary blowing agents in flexible PU slabstock foam production operations at major sources. Because EPA has separately determined in setting a risk-based standard that methylene chloride cannot be used as a blowing agent by major sources for production of flexible PU slabstock foam, we are proposing to change the status of methylene chloride in this end-use on the basis that it poses significantly more risk than other available alternatives.

ii. Integral Skin PU

(a) Environmental Impacts

Methylene chloride contains chlorine and thus could have an ODP. We are unaware of a calculated ODP for methylene chloride in the peer-reviewed literature, but it has historically been considered negligibly small.[204] Recent research indicates that emissions of methylene chloride from multiple industrial sources have been increasing and could have a detectible impact on the ozone layer,[205] despite the historical assumption of negligible ODP. For integral skin PU, available alternatives include acetone, CO_2, ecomate™, Exxsol blowing agents, formic acid, HFC-152a, HFO-1234ze(E), HFO-1336mzz(Z), methylal, methyl formate, saturated light HCs (C3-C6), *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, and water. Of the other available alternatives for flexible PU, only *trans*-1-chloro-3,3,3-trifluoroprop-1ene contains chlorine and thus might have an ODP. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene 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-use that are considered to be non-ozone-depleting.[206] [207]

Methylene chloride has a GWP of approximately nine. As shown in Table 21, other acceptable alternatives have GWPs that are comparable or lower than methylene chloride's GWP of nine except for HFC-152a, which has a GWP of 124.

Methylene chloride is excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. With the exception of HCs, Exxsol blowing agents, formic acid, HFO-1336mzz(Z), and methylal, the other alternatives contain compounds that are exempt from the definition of VOC. The manufacturer of HFO-1336mzz(Z) has petitioned EPA to exempt HFO-1336mzz(Z) from the definition of VOC under those regulations. As provided in our decisions listing these alternatives as acceptable, we determined that emissions of these alternatives in this end-use would not pose a significantly greater risk than that posed by foam blowing agents that are not VOCs.

(b) Flammability

Methylene chloride exhibits no flash point under standard testing conditions and thus is considered nonflammable, although it does exhibit lower and upper flammability limits of 13 percent and 23 percent, respectively. Of the

[204] INCHEM, 1996. International Programme on Chemical Safety. Environmental Health Criteria 164. Methylene chloride, second edition. World Health Organization, 1996. This document is accessible online at *http://www.inchem.org/documents/ehc/ehc/ehc164.htm.*

[205] Hossaini, et al., 2015. R. Hossaini, M.P. Chipperfield, S.A. Montzka, A. Rap, S. Dhomse, W. Feng. Efficiency of short-lived halogens at influencing climate through depletion of stratospheric ozone. *Nature Geoscience,* 2015. This document is accessible online at *http://DOI: 10.1038/ngeo2363* and is reported in ''New ozone-destroying gases on the rise; not controlled by treaty.'' ScienceDaily. 16 February 2015. This document is accessible online at *http://www.sciencedaily.com/releases/2015/02/150216130241.htm.*

[206] 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.

[207] 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.

various alternatives, acetone, methyl formate, ecomate™, Exxsol blowing agents, HFC-152a, HCs, and methylal are flammable, and CO_2, formic acid, HFO-1234ze(E), HFO-1336mzz(Z), *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, and water are nonflammable. The flammability hazards of the flammable compounds in this end-use can be adequately addressed in the process of meeting OSHA regulations and fire codes.

(c) Toxicity

Health effects of concern with methylene chloride include cancer, liver, and kidney effects (longer-term exposure) and neurotoxic effects (acute exposure), in addition to irritation to the skin, eyes, and respiratory tract. Other alternatives for this end-use have potential health effects such as impacts on body weight, mononuclear infiltration of heart tissue, neurotoxic effects, and irritation to the skin, eyes, and respiratory tract; no other alternatives in this end-use have evidence of cancer as a health effect. Toxicity is not a significant concern in the workplace for methylene chloride or for the other available alternatives because they may be used for blowing integral skin PU consistent with required or recommended workplace exposure limits. Workplace exposure limits for the other available alternatives range from 100 ppm to 5,000 ppm. Methylene chloride's workplace exposure limits include a PEL of 25 p.m. (8-hr TWA) and 125 ppm over a 15-minute period. Methylene chloride is regulated for its toxicity as a hazardous air pollutant under the CAA and potentially as a U-listed hazardous waste under RCRA (40 CFR 261.33). None of the other alternative blowing agents are regulated as hazardous air pollutants or as U-listed hazardous wastes.

Methylene chloride is the only acceptable alternative in this end-use that is a carcinogen. On this basis, we are proposing that methylene chloride poses significantly greater toxicity risks than the other alternatives available for this end use. The risk posed by methylene chloride and the other alternatives based on the other SNAP review criteria are not significantly different. Because of the significantly greater toxicity risk posed by methylene chloride, we believe it poses significantly greater overall risk than other available substitutes and we are proposing to change the status to unacceptable.

iii. Polyolefin Foam

(a) Environmental Impacts

Methylene chloride contains chlorine and thus could have an ODP. We are unaware of a calculated ODP for methylene chloride in the peer-reviewed literature, but it has historically been considered negligibly small.[208] Recent research indicates that emissions of methylene chloride from multiple industrial sources have been increasing and could have a detectible impact on the ozone layer,[209] despite the historical assumption of negligible ODP. In polyolefin foam, available alternatives include CO_2, ecomate™, Exxsol blowing agents, methyl formate, HFC-152a, blends of HFC-152a and saturated light HCs, HFO-1234ze(E), saturated light HCs (C3–C6), *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, and water. Of the other available alternatives for flexible PU, only *trans*-1-chloro-3,3,3-trifluoroprop-1ene contains chlorine and thus might have an ODP. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene 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-use that are considered to be non-ozone-depleting.[210] [211]

Methylene chloride has a GWP of approximately nine. As shown in Table 21, the other acceptable substitutes have GWPs that are comparable or lower than methylene chloride's GWP of nine except for HFC-152a, which has a GWP of 124.

Methylene chloride is excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. With the exception of HCs, HC blends, and Exxsol blowing agents, the other alternatives contain compounds that are exempted from the definition of VOC. The manufacturer of HFO-1336mzz(Z) has petitioned EPA to exempt HFO-1336mzz(Z) from the definition of VOC under those regulations. As provided in our decisions listing these alternatives as acceptable, we determined that emissions of these alternatives in this end-use would not pose a significantly greater risk than that posed by foam blowing agents that are not VOCs.

(b) Flammability

Methylene chloride exhibits no flash point under standard testing conditions and thus is considered nonflammable, although it does exhibit lower and upper flammability limits of 13 percent and 23 percent, respectively. Of the various alternatives, blends of HFC-152a and HCs, ecomate™, Exxsol blowing agents, HFC-152a, HCs, and methyl formate are flammable, and CO_2, HFO-1234ze(E), *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, and water are nonflammable. The flammability hazards of the flammable compounds in this end-use can be adequately addressed in the process of meeting OSHA regulations and fire codes.

(c) Toxicity

Health effects of concern with methylene chloride include cancer, liver, and kidney effects (longer-term exposure) and neurotoxic effects (acute exposure), in addition to irritation to the skin, eyes, and respiratory tract. Other alternatives for this end-use have potential health effects such as impacts on body weight, mononuclear infiltration of heart tissue, neurotoxic effects, and irritation to the skin, eyes, and respiratory tract; no other alternatives in this end-use have evidence of cancer as a health effect. Toxicity is not a significant concern in the workplace for methylene chloride or for the other available alternatives because they may be used for blowing polyolefin foam consistent with required or recommended workplace exposure limits. Workplace exposure limits for the other available alternatives range from 100 ppm to 5,000 ppm. Methylene chloride's workplace exposure limits include a PEL of 25 p.m. (8-hr TWA) and 125 ppm over a 15-minute period. Methylene chloride is regulated for its toxicity as a hazardous air pollutant under the CAA and potentially as a U-listed hazardous waste under RCRA (40 CFR 261.33). None of the other alternative blowing agents are regulated as hazardous air pollutants or as U-listed hazardous wastes.

Methylene chloride is the only acceptable alternative in this end-use

[208] INCHEM, 1996.

[209] Hossaini, et al., 2015. R. Hossaini, M. P. Chipperfield, S. A. Montzka, A. Rap, S. Dhomse, W. *Feng.* Efficiency of short-lived halogens at influencing climate through depletion of stratospheric ozone. *Nature Geoscience,* 2015; This document is accessible online at *http://DOI:10.1038/ngeo2363* and is reported in ''New ozone-destroying gases on the rise; not controlled by treaty.'' ScienceDaily. 16 February 2015. This document is accessible online *at http://www.sciencedaily.com/releases/2015/02/150216130241.htm.*

[210] 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.

[211] 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.

that is a carcinogen. On this basis, we are proposing that methylene chloride poses significantly greater toxicity risks than the other alternatives available for this end use. The risk posed by methylene chloride and the other alternatives based on the other SNAP review criteria are not significantly different. Because of the significantly greater toxicity risk posed by methylene chloride, we believe it poses significantly greater overall risk than other available substitutes and we are proposing to change the status to unacceptable.

c. When would the status change?

EPA proposes to change the status of methylene chloride in flexible PU foam as of 30 days after a final rule is published in the **Federal Register**. Because this blowing agent has already been prohibited in flexible PU foam manufacturing operations for major sources by EPA's *National Emission Standards for Hazardous Air Pollutants (NESHAP) Residual Risk and Technology Review for Flexible Polyurethane Foam Production* (79 FR 48073; August 15, 2014), we expect that most businesses have already transitioned away from this substitute in that end-use. This proposed rule does not apply to area sources.

For integral skin PU foam and polyolefin, we propose the respective change of status dates to be January 1, 2017, and January 1, 2020. These dates are consistent with the change of status dates we previously established for certain HFCs in these end-uses (80 FR 42870; July 20, 2015). These dates were established considering factors such as the supply of alternatives, time required for testing of alternatives, and time required to prepare facilities for use of flammable foam blowing agents. By proposing to change the status of methylene chloride from acceptable to unacceptable, we expect that end-users will consider blowing agents other than methylene chloride as they plan their transition away from HFCs in these end-uses.

d. What is the relationship between this proposed SNAP rule and other federal rules?

In a recent rulemaking, *National Emission Standards for Hazardous Air Pollutants Residual Risk and Technology Review for Flexible Polyurethane Foam Production,* EPA prohibits the use of HAP, including methylene chloride, as auxiliary blowing agents in slabstock flexible PU foam production operations at major sources as of November 13, 2014 (79 FR 48073; August 15, 2014). This action is consistent with that previously issued prohibition.

e. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on the proposed dates for a change of status for methylene chloride (30 days after publication of a final rule for flexible PU foam, January 1, 2017, for integral skin PU foam, and January 1, 2020, for polyolefin foam). We request comments on, the extent to which methylene chloride is currently being used in these end-uses in integral skin PU, in polyolefin, or by area sources that manufacture flexible PU foam and the technical challenges that exist for transitioning from methylene chloride to other available alternatives.

4. Proposed Application of Listings to Foam Products

EPA is proposing to apply the unacceptability determinations in this action for foam blowing agents to closed cell foam products and products containing closed cell foam. In addition, EPA is proposing to apply all listings for foam blowing agents codified in the appendices to 40 CFR part 82 subpart G to such products. This would mean that closed cell foam products and products containing closed cell foams manufactured abroad and imported could not be used in the United States if the foam blowing agent was listed as unacceptable.

a. What are the affected end-uses?

The foam sector includes both closed cell and open cell foams. Closed cell foams are specifically designed to retain the foam blowing agent in the cells; in insulation foam products, the foam blowing agent continues to perform a function in providing thermal insulation, once the foam has already been blown. With open cell foams, the foam blowing agent completes its function once the foam is blown; almost all of the foam blowing agent escapes from the open cells prior to import, and any vestigial amounts remaining do not perform a function.

Foam blowing end-uses that contain closed-cell foams include rigid PU spray foam (all three applications described in section VI.C.1); rigid PU commercial refrigeration and sandwich panels; rigid PU marine flotation foam; rigid PU appliance foam; rigid PU slabstock and other; rigid PU and polyisocyanurate laminated boardstock; polystyrene: Extruded boardstock and billet; polystyrene: Extruded sheet; polyolefin; and phenolic insulation board and bunstock. Foam blowing end-uses containing open cell foams include flexible PU and integral skin PU. Open cell phenolic, and some other open cell foams also exist within the SNAP foam blowing end-uses that include closed cell foams. Integral skin foam may include a rigid surface with an interior flexible core.

b. How would this proposal change the treatment of foam products under SNAP?

Currently, an unacceptable foam blowing agent may not be used to manufacture products in the United States, whether for domestic use or for export. However, products made abroad with unacceptable foam blowing agents may be imported and used in the United States. This is because EPA has historically interpreted the use prohibitions for this sector to apply to blowing foam with the foam blowing agent and not to the use of products made with foam. For example, commercial refrigerators containing appliance foam blown with an unacceptable blowing agent may be imported into and used in the United States, though commercial refrigerators manufactured in the United States may not be manufactured with foam blown with that same agent.

If this proposal were to be finalized as proposed, use of closed cell foam products (*e.g.,* manufactured rigid PU insulation or XPS boardstock) or products that contain closed cell foam (*e.g.,* household and commercial appliances, boats) manufactured with an unacceptable foam blowing agent on or after the specified date would be subject to the use prohibitions under SNAP. This would include, but would not be limited to, incorporating a closed cell foam blown with an unacceptable blowing agent into a subsequent product and installing a closed cell foam product or product containing closed cell foam. Products manufactured prior to the specified date would not be subject to the use prohibitions. In addition, under this proposal the use prohibitions would not apply to consumers once a product had been installed.

c. How do other stratospheric ozone protection requirements apply to foam products?

Several provisions of CAA Title VI and EPA's implementing regulations are relevant to HCFC foam products. Under regulations implementing CAA section 611, EPA requires labeling of products that contain an ODS and those that are manufactured with an ODS. EPA determined that open cell foams blown with an ODS must be labeled as a

product manufactured with an ODS. (58 FR 8136, 8143–8150, February 11, 1993; 79 FR 64253, 64258–64259, October 28, 2014) In contrast, closed cell foam products blown with an ODS must be labeled as a product *containing* an ODS for labeling purposes. (58 FR 8136, 8150–8151, February 11, 1993; 79 FR 64253, 64258–64259, October 28, 2014) As of January 1, 2015, any product containing a closed cell foam blown with an HCFC must be labeled as a product containing an ozone-depleting substance under the regulations at 40 CFR 82.106 implementing CAA section 611.

Section 610 restricts sale and distribution and offers of sale and distribution of certain products containing or manufactured with CFCs and HCFCs.[212] Section 610(d)(3)(A) explicitly provides an exception for foam insulation products containing HCFCs. EPA has implemented this restriction and the exception for HCFC foam insulation products through its Nonessential Products Ban regulations codified at 40 CFR part 82 subpart C. These regulations define foam insulation product as a product containing or consisting of the following types of foam:

- Closed cell rigid polyurethane foam;
- Closed cell rigid polystyrene boardstock foam;
- Closed cell rigid phenolic foam; and
- Closed cell rigid polyethylene foam

when such foam is suitable in shape, thickness and design to be used as a product that provides thermal insulation around pipes used in heating, plumbing, refrigeration, or industrial process systems.

CAA section 605(a) prohibits the introduction into interstate commerce or use of any class II substance effective January 1, 2015, unless such substance: (1) Has been used, recovered, and recycled; (2) is used and entirely consumed (except for trace quantities) in the production of other chemicals; (3) is used as a refrigerant in appliances manufactured prior to January 1, 2020; or (4) is listed as acceptable for use as a fire suppression agent for nonresidential applications in accordance with section 612(c).

The section 605(a) implementing regulations codified at 40 CFR part 82, subpart A restrict the use of virgin HCFCs to air conditioning, refrigeration, and fire suppression applications, with minor exceptions. Thus, while the Nonessential Products Ban does not apply to HCFC insulating foams, section 605(a) and its implementing regulations prohibit the use of HCFCs for blowing foam in the United States. The combined effect of the Nonessential Products Ban and the section 605(a) implementing regulations is that HCFC foam insulation products may be imported, sold, and distributed in the United States but cannot be manufactured in the United States.

In the preamble to a July 11, 2000, SNAP proposed rule, EPA reviewed its authority under CAA section 610 and noted that HCFC insulating foams were exempt from regulation under that section of the statute. EPA stated that ''Title VI of the Act thus does not provide EPA with the authority to prevent imports of products containing those foams'' (65 FR 42653, 42656). EPA did not, however, base this statement on a full examination of the various authorities under Title VI. In taking final action on that proposal, EPA noted that while under section 610 it could not ban the *sale* of HCFC foam insulation products, section 610 ''does not address EPA's ability to regulate the transition from use of ODS to alternatives in the manufacturing of products such as foam.'' EPA further noted: ''Section 612 can restrict the use of a substitute in a product regardless of whether or not that product is considered nonessential under Section 610'' (69 FR 58275, September 30, 2004).

d. How is EPA reexamining treatment of foam products under SNAP?

In the August 6, 2014, NPRM (79 FR 46126; 46154), EPA proposed to consider use of a foam blowing agent to include use of closed cell foam products or products containing closed cell foam. In response to that proposal, some commenters supported applying the unacceptability determinations to the use of closed cell foam products or products containing closed cell foam with unacceptable foam blowing agents, on the basis that it would maintain a ''level playing field'' for domestically manufactured products made with lower-GWP foam blowing agents that were going to compete with imported products. Some commenters also supported extending such a prohibition to open cell foams, stating that there was still some foam blowing agent left in the foam and citing the negative impacts of allowing cheaper imported products containing unacceptable foam blowing agents.

Other commenters opposed applying unacceptability determinations to anything other than the act of blowing foam in the United States. These commenters stated that this would be a significant departure from the Agency's previous interpretation and suggested that EPA needed to explain the basis for such a change. For example, one commenter stated that ''without any legal rationale, EPA has proposed to reverse its long-standing interpretation of the Clean Air Act with respect to the import of products containing HCFC-141b as a foam-blowing agent.'' 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 did not take final action in the July 20, 2015, final rule (80 FR 42870) but instead elected to continue assessing the merits of the change.

In this action, EPA is again proposing to apply listings and prohibitions for foam blowing agents to use of closed cell foam products and products containing closed cell foam. To the extent EPA's earlier statements regarding Title VI reflect an interpretation that the agency could not address imported closed cell foam products or products containing closed cell foam under any provision of Title VI, EPA is proposing to change that interpretation.

Section 612 requires EPA to promulgate regulations prohibiting the replacement of ODS with certain substitutes and to publish lists of the substitutes prohibited for specific uses as well as those found acceptable for those uses. EPA's implementing regulations at 40 CFR 82.174 state, in part: ''No person may use a substitute after the effective date of any rulemaking adding such substitute to the list of unacceptable substitutes'' (40 CFR 82.174(d)). The SNAP regulations define ''use'' of a substitute as including, but not being 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.'' (§ 82.172)

EPA currently treats use of foam blowing agents in the manufacture of a foam product as covered by the use prohibition. In this action, EPA is proposing to apply the use prohibition more broadly in the case of closed cell foam products. With respect to other sectors, EPA has treated use of a product manufactured with or containing a substance as constituting use of the substance where the product holds some amount of the substance, the substance continues to perform its intended function, and the substance is likely to be emitted in the United States either during use of the product or at the time of its disposal. For example, an

[212] Section 610 does not address products containing or manufactured with substitutes.

aerosol can is manufactured to contain a substance as a propellant, and then that propellant leaks, is released by the end user during use of the aerosol can's contents, or is emitted at the time of disposal if it has not already been used up. In the July 20, 2015 SNAP rule, in changing the status of certain substances with respect to aerosols, EPA prohibited use of aerosol products containing those substances, while stating that products manufactured prior to the change of status date could still be used after that date (80 FR 42883). By analogy, we are proposing that ''use'' of a foam blowing agent includes use of a closed cell foam product manufactured after the specified date. For such products, the foam blowing agent remains in the cells and continues to be used for the purpose of insulation during the lifetime of the product. Furthermore, emissions of the foam blowing agent occur at the time of disposal of the closed cell foam product. Thus, emissions from a closed cell product used in the United States can be expected to occur in the United States regardless of whether the product was manufactured domestically or abroad. This proposed action would ensure that products manufactured abroad and subsequently imported would be treated the same as products manufactured domestically.

EPA does not propose to treat use of an open cell foam product as constituting use of the foam blowing agent. The foam blowing agent in an open cell foam product does not continue to perform its intended function during the lifetime of the product. Except for insignificant amounts remaining in the cells, emissions of the foam blowing agent would occur at the time and place of manufacture. Therefore, we are proposing to differentiate between closed cell and open cell foam products for this purpose. This would be consistent with the different treatment of closed and open cell foam products under the section 611 labeling regulations.

e. When would use of closed cell foam products with unacceptable blowing agents be unacceptable?

For changes of status proposed in this rulemaking (section VI.C.1 and VI.C.2), we are proposing that the unacceptability determination would apply to use of closed cell foam products and products that contain closed cell foam where the products are manufactured on or after the change of status date. As noted in the July 15, 2015 SNAP rule with respect to MVAC and stand-alone refrigeration equipment (80 FR 42884), it is reasonable to allow use of products manufactured before the change of status date to avoid market disruption, creation of stranded inventory, and perverse incentives for releasing these substances to the environment.

For alternatives that have already been listed as unacceptable with a change of status date of January 1, 2017,[213] or earlier—namely, HCFC blowing agents listed as unacceptable in appendices K, M, Q, and U to 40 CFR part 82 subpart G, and HFC blowing agents listed as unacceptable for rigid PU and PIR boardstock, extruded polystyrene sheet, and phenolic foams in appendix U to 40 CFR part 82 subpart G—we are proposing that the unacceptability determination would apply to use of closed cell foam products and products that contain closed cell foam manufactured on or after the date one year after the date of publication of a final rule. This timing is intended to allow importers and international manufacturers of such products time to adjust their manufacture and import plans. For substitutes that have already been listed as unacceptable with a change of status date after January 1, 2017—namely, HFC blowing agents listed as unacceptable in rigid PU slabstock and other; rigid PU appliance foam; rigid PU commercial refrigeration and sandwich panels; rigid PU marine flotation foam; polyolefin; and polystyrene extruded boardstock and billet- we are proposing that the unacceptability determination would apply to use of closed cell foam products and products that contain closed cell foam manufactured on or after the change of status date for each end-use (January 1 of 2019, 2020, or 2021). For the substitutes already listed as unacceptable, we are proposing to add language regarding use of products to the relevant tables. We do not intend to re-open the listing of those substitutes as unacceptable or the change of status dates for those substitutes.

f. On which topics is EPA specifically requesting comment?

EPA requests comment on all aspects of this proposal. In particular, we request comment on our proposal to revise our previous interpretation and to consider use of the foam blowing agent to include use of closed cell foam products and products containing closed cell foam. We are also taking comment on whether use of an open cell foam product should constitute use of the foam blowing agent. Finally, we request comment on the amount of time provided after which closed cell foam products and products containing closed cell foams manufactured on or after the specified dates would be subject to the use prohibitions.

D. Fire Suppression and Explosion Protection

1. Proposed Listing of 2-bromo-3,3,3-trifluoropropene (2-BTP) as Acceptable, Subject to Use Conditions, for Total Flooding and Streaming

EPA is proposing to list 2-bromo-3,3,3-trifluoropropene (hereinafter referred to as 2-BTP) as acceptable, subject to use conditions, for use in engine nacelles and APUs on aircraft in total flooding fire suppression systems. In addition, EPA proposes to list 2-BTP as acceptable, subject to use conditions, for use in aircraft as a streaming agent. EPA is reviewing additional potential fire suppression applications for 2-BTP but is not taking action on those other uses in this proposed rule.

a. What are the affected end-uses?

The fire suppression and explosion protection end-uses addressed in this action are total flooding and streaming. Total flooding systems, which historically employed halon 1301 as a fire suppression agent, are used in both normally occupied and unoccupied areas. In the United States, approximately 90 percent of installed total flooding systems protect anticipated hazards from ordinary combustibles (*i.e.,* Class A fires), while the remaining ten percent protect against applications involving flammable liquids and gases (*i.e.,* Class B fires).[214] It is also estimated that approximately 75 percent of total flooding systems protect electronics (*e.g.,* computers, telecommunications, process control areas) while the remaining 25 percent protect other applications, primarily in civil aviation (*e.g.,* engine nacelles/APUs, cargo compartments, lavatory trash receptacles), military weapons systems (*e.g.,* combat vehicles, machinery spaces on ships, aircraft engines and tanks), oil/gas and manufacturing industries (*e.g.,* gas/oil pumping, compressor stations), and maritime (*e.g.,* machinery space, cargo pump rooms). Streaming applications, which have historically used halon 1211 as an extinguishing agent, include portable fire

[213] There will also be a change of status on January 1, 2017 for flexible PU and integral skin PU, but these are open cell foams and are not part of this proposal for closed cell foams.

[214] Wickham, 2002. Status of Industry Efforts to Replace Halon Fire Extinguishing Agents. March, 2002.

extinguishers designed to protect against specific hazards.

b. How does 2-BTP compare to other fire suppressants for these end-uses with respect to SNAP criteria?

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document [215] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives in the relevant end-uses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

i. Total Flooding

(a) Environmental Impacts

In addition to halon 1301, the current market for total flooding systems also includes HCFCs, HFCs, inert gases, and a variety of NIK extinguishing agents (*e.g.,* powdered aerosols, foams, water).[216] 2-BTP has a GWP of 0.23–0.26 and a lower climate impact compared to other alternatives (*e.g.,* HFC-227ea) used as total flooding and streaming agents. As shown in Table 22, the GWPs of other total flooding alternatives range from <1 to 3,500.

TABLE 22—GWP, ODP, AND VOC STATUS OF 2-BTP COMPARED TO OTHER TOTAL FLOODING AND STREAMING AGENTS

Fire suppressants	GWP	ODP	VOC	Proposal
2-BTP	[1] 0.23–0.26	0.0028	Yes	Acceptable, subject to use conditions.
Total flooding				
FK-5-1-12mmy2 (C6 Perfluoroketone)	<1	0	Yes	No change.
CF_3I	0.4	0.008	Yes	No change.
CO_2	1	0	No	No change.
HCFC Blend A [2]	1,546	0.048	No	No change.
HFC-227ea	3,220	0	No	No change.
HFC-125	3,500	0	No	No change.
Water, Inert gases, Powdered aerosols A–E	0	0	No	No change.
Streaming				
HCFC Blend B [3]	77	0.00098	No	No change.
HFC-227ea	3,220	0	No	No change.
HFC-236fa	9,810	0	No	No change.
FK-5-1-12mmy2 (C6 Perfluoroketone)	<1	0	Yes	No change.
CF_3I	0.4	0.008	Yes	No change.
CO_2	1	0	No	No change.
Water	0	0	No	No change.
H Galden HFPEs	2,790–6,230	0	No	No change.

[1] GWP range represents GWPs for 30°N to 60°N and 60°S to 60°N emissions scenarios for a 100-year time horizon. A tropospherically well-mixed approximation of the GWP is equal to 0.59.[217]
[2] HCFC Blend A is a blend consisting of HCFC-123 (4.75%), HCFC-22 (82%), HCFC-124 (9.5%), and D-limonene (3.75%).
[3] HCFC Blend B is a proprietary blend consisting largely of HCFC-123.

In addition to global impacts on the atmosphere, EPA evaluated potential impacts of emissions of 2-BTP on local air quality. 2-BTP is a VOC and is not excluded from that definition under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. EPA compared the annual VOC emissions from the use of 2-BTP as a total flooding agent to other anthropogenic sources of VOC emissions considering both worst case and more realistic scenarios. Under either scenario, emissions are a small fraction of a percentage (5.6×10^{5} percent to 2.1×10^{3} percent) of all anthropogenic VOC emissions in the United States in 2014.[218] [219] Given this emission level, we determined it was not necessary to perform an assessment of the effect of these emissions on ambient ozone levels; any effect would be insignificant. This is particularly true since most releases of 2-BTP are expected to be at altitude, not in the lower troposphere. Other acceptable fire suppression agents currently in use in this end-use are also VOC (*e.g.,* C6-perfluoroketone), and thus, use of 2-BTP would not pose more risk than use of other alternatives.

(b) Flammability

2-BTP is nonflammable, as are all other available total flooding agents.

(c) Toxicity

When identifying potential alternatives, toxicity is an important characteristic to consider for manufacturing personnel, service technicians, and end users. Typical concerns include residual oxygen concentration in the protected space

[215] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

[216] ICF, 2016h. Market Characterization for Fire Suppression, Comfort Cooling, Cold Storage, and Household Refrigeration Industries in the United States. Prepared for the U.S. Environmental Protection Agency. October 2015.

[217] Patten et al., 2012. Correction to ''OH reaction rate constant, IR absorption spectrum, ozone depletion potentials and global warming potentials of 2-bromo-3,3,3-trifluoropropene,'' J. Geophys. Res., 117, D22301, doi:10.1029/2012JD019051.

[218] ICF, 2016j. Analysis of annual VOC emissions from the use of 2-BTP.

[219] Based on the 2014 annual total VOC emissions for the United States (*i.e.,* approximately 17.13×10^{6} MT) as reported in the National Emissions Inventory (EPA, 2015).

after discharge and cardiac effects as a consequence of absorption of the agent into the bloodstream.

EPA has evaluated the risks associated with potential exposures to 2-BTP during production operations and the filling of fire extinguishers as well as in the case of an inadvertent discharge of the system during maintenance activities on the fire extinguishing system. EPA's review of the human health impacts of 2-BTP, including the summary of available toxicity studies, and EPA's review of the human health impacts of 2-BTP is in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).[220] [221]

According to the MSDS, exposure to 2-BTP through ocular or dermal absorption, inhalation, or ingestion is unlikely to be harmful. However, the most likely pathway of exposure is through inhalation, which may cause central nervous system effects, such as dizziness, confusion, physical incoordination, drowsiness, anesthesia, or unconsciousness. EPA uses the NOAEL value as the basis to ensure protection to the worker population. The cardiotoxic Lowest-Observed-Adverse-Effect-Level (LOAEL) for this agent is 1.0 percent (10,000 ppm), at which level exposure may cause increased sensitivity of the heart to adrenaline, which might cause irregular heartbeats and possibly ventricular fibrillation or death; the cardiotoxic NOAEL for this agent is 0.5 percent (5,000 ppm).

2-BTP vapors are heavier than air and may reduce oxygen available for breathing, causing asphyxiation in high concentrations. Such vapors pose a potential hazard if large volumes are trapped in enclosed or low places. In addition, as noted above, if person(s) are exposed to high concentrations, the person(s) may experience central nervous system effects, such as drowsiness and dizziness, which may result in the person(s) not realizing that he/she is suffocating. These health effects after exposure are similar for other common fire suppressants.

Employees responsible for manufacturing the systems should wear the appropriate PPE, such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation. Use of respirators is recommended during activities in which exposure to the proposed substitute cannot be controlled through other means. When handling a leak in a storage container, protective clothing is recommended as well as vapor-in air detection systems. Gloves (*i.e.,* neoprene, polyvinyl chloride, or polyvinyl alcohol) should be worn when handling equipment containing the proposed substitute for prolonged periods.

For operations requiring regular handling of 2-BTP, engineering controls should include adequate ventilation systems and enclosed or confined operations to ensure exposure levels to the proposed substitute are below the occupational AEL. 2-BTP is not expected to pose a risk to workers when the engineering controls and PPE recommendations referenced in the MSDS for this proposed substitute are followed.

Exposure to 2-BTP is not likely during installation or servicing of 2-BTP total flooding systems for engines and APUs on aircraft. These are both considered to be unoccupiable areas, meaning personnel cannot physically occupy these spaces, thus reducing the risk from exposure to an inadvertent discharge. The risk of accidental activation of the fire extinguishing system while personnel are present near the protected space is highly unlikely if proper procedures, including those of the 2-BTP system manufacturer as well as the aircraft manufacturer, are followed. Instructions on system installation and servicing included in manuals for the 2-BTP systems should be adhered to. In the case of an inadvertent discharge of the system during maintenance activities on the fire extinguishing system or surrounding equipment, the cowl doors that would be open to allow access to the area will allow personnel to immediately egress and avoid exposure. Protective gloves and tightly sealed goggles should be worn for installation and servicing activities, to protect workers in any event of potential discharge of the proposed substitute, accidental or otherwise. Filling or servicing operations should be performed in well-ventilated areas.

2-BTP is not expected to cause a significant risk to human health in the general population when used as a total flooding fire extinguishing agent. Disposal of 2-BTP total flooding systems is subject to local, state, and federal regulations, which ensure that 2-BTP and water contaminated with 2-BTP are not be dumped into sewers, on the ground, or into any body of water, but rather taken to a wastewater treatment facility or disposed of properly. 2-BTP is not considered to be hazardous waste under EPA regulations implementing RCRA.

EPA's evaluation indicates that the use of 2-BTP is not expected to pose a significant toxicity risk to personnel or the general population. 2-BTP is not expected to cause a significant risk to human health in the general population when used as a total flooding fire extinguishing agent in systems designed specifically for engines and APUs on aircraft. Exposure to 2-BTP is not likely for technicians during installation or servicing of 2-BTP total flooding systems for engines and APUs. As indicated by the submitter, the risk of accidental activation of the fire extinguishing system while personnel are present near the protected space is highly unlikely if proper procedures are followed. Proper instructions on system installation and servicing included in manuals for the 2-BTP systems should be adhered to. The locations of the 2-BTP bottles in the engine and APU compartments will vary by airplane model. The engine bottles could be installed inside or outside the pressurized volume, but they are connected through piping to the engines. APU bottles are typically installed forward of the APU firewall, outside of the pressurized volume of the plane. The bottles are hermetically sealed and the piping system is pressure tested, mitigating the potential for any leak of 2-BTP from the system. According to the submitter, in the case of an inadvertent discharge of the system during maintenance activities on the fire extinguishing system or surrounding equipment, the cowl doors that would be open to allow access to the area will allow service personnel to immediately egress and avoid exposure. Furthermore, aircraft maintenance procedures provide specific instruction to prevent accidental discharge of 2-BTP systems. It is expected that procedures identified in the MSDS for 2-BTP and good manufacturing practices will be adhered to, and that the appropriate safety and PPE (*e.g.,* protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation) consistent with OSHA guidelines will be used, as applicable, during manufacture and disposal of 2-BTP total flooding systems.

The toxicity risks can be minimized through the use conditions specified in section VI.D.c below. The risks after exposure are common to many total

[220] ICF, 2016k. Significant New Alternatives Policy Program. Fire Extinguishing and Explosion Prevention Sector. Risk Screen on Substitutes as a Streaming Agent in Civil Aviation Applications. Substitute: 2-bromo-3,3,3-trifluoropropene (2-BTP).

[221] ICF, 2016l. Significant New Alternatives Policy Program. Fire Extinguishing and Explosion Prevention Sector. Risk Screen on Substitutes for Total Flooding Systems in Unoccupied Spaces. Substitute: 2-bromo-3,3,3-trifluoropropene (2-BTP).

flooding agents, including those already listed as acceptable under SNAP for this same end-use such as C6-perfluoroketone. EPA is proposing to find 2-BTP acceptable, subject to use conditions, as a total flooding agent for use in engine nacelles and APUs on aircraft because the overall environmental and human health risk posed by the substitute is lower than or comparable to the overall risk posed by other alternatives listed as acceptable in the same end-use.

ii. Streaming Uses

(a) Environmental Impacts

In addition to halon 1211, the current market for streaming applications also includes HCFCs, HFCs, and a variety of other agents (*e.g.,* dry chemical, CO_2, water).[222] Specific alternatives used for streaming uses include HCFC Blend B (with an ODP of roughly 0.01 and a GWP of roughly 80), HFC-227ea (with an ODP of zero and a GWP of 3,220), and C7 Fluoroketone (with an ODP of zero and a GWP of approximately one). The ODP, GWP, and atmospheric lifetime of 2-BTP and other alternatives that are also used as total flooding agents are described above under total flooding applications. 2-BTP has a lower climate impact a shorter atmospheric lifetime compared to other alternatives in this end-use.

Regarding local air quality impacts, EPA compared the annual VOC emissions from the use of 2-BTP as a streaming agent to other anthropogenic sources of VOC emissions considering both worst case and more realistic scenarios. Under either scenario, emissions are a small fraction of a percentage (7.4×10^{-5} percent to 2.1×10^{-3} percent) of all anthropogenic VOC emissions in the United States in 2014.[223] Given this emission level, we determined it was not necessary to perform an assessment of the effect of these emissions on ambient ozone levels; any effect would be insignificant. This is particularly true since most releases of 2-BTP are expected to be at altitude, not in the lower troposphere. Other acceptable fire suppression agents currently in use in this end-use are also VOC (*e.g.,* C6-perfluoroketone, C7-fluoroketone), and thus, use of 2-BTP would not pose more risk than use of other alternatives.

(b) Flammability

2-BTP is nonflammable, as are all other available streaming agents.

(c) Toxicity

EPA evaluated occupational and general population exposure at manufacture and at end-use to ensure that the use of 2-BTP as a streaming agent will not pose unacceptable risks to workers or the general public. EPA has evaluated the risks associated with potential exposures to 2-BTP during production operations and the filling of fire extinguishers as well as in the case of an inadvertent discharge of the fire extinguisher during maintenance activities.

2-BTP is not expected to pose a risk to workers during manufacture when the engineering controls and PPE requirements as also referenced in the MSDS for this proposed substitute are followed as described below in section VI.D.1.c.i. The combination of appropriate engineering controls and the use of PPE will ensure exposure levels to the proposed substitute are below the occupational AEL. Exposure to 2-BTP is not likely during installation or servicing of 2-BTP fire extinguishers. As indicated by the submitter, the risk of accidental activation of the fire extinguisher while personnel are present in the protected space is highly unlikely if proper procedures are followed. Proper instructions on system installation and servicing included in manuals for the 2-BTP systems should be adhered to.

EPA also assessed potential end-use exposure scenario, 15-minute and 30-minute TWA exposures for 2-BTP following potential release of agent from the handheld extinguisher on-board aircraft. These exposures were then compared to the cardiotoxic LOAEL for 2-BTP. The modeled 15-minute and 30-minute exposures for varying ventilation rates were significantly lower than the LOAEL of 10,000 ppm for 2-BTP, as well as below the NOAEL of 5,000 ppm. 2-BTP handheld extinguishers must follow required minimum room volumes established by UL 2129, Halocarbon Clean Agent Fire Extinguishers,[224] when discharged into a confined space. This standard prohibits the exceedance of the cardiotoxic LOAEL for any fire suppressant (*i.e.,* 10,000 ppm or 1.0% for 2-BTP). Therefore, per UL 2129, labels for 2-BTP extinguishers will contain the statement, ''Do not use in confined spaces less than 896 cubic feet per extinguisher.'' Based on the above results, 2-BTP is not expected to pose significant risk to end users when used as a streaming fire extinguishing agent in aircraft.

There are various precautions described above, but the actual use conditions are described below. The general population risks during release or disposal of the agent are described in section VI.D.1.b above. The risks after exposure are common to many streaming agents, including those already listed as acceptable under SNAP for this same end-use, such as C6-perfluoroketone. EPA is proposing to find 2-BTP acceptable, subject to use conditions, as a streaming agent on aircraft because the overall environmental and human health risk posed by the substitute is lower than or comparable to the overall risk posed by other alternatives listed as acceptable in the same end-use.

c. What are the proposed use conditions?

i. Engine Nacelles and APU Fire Suppression Systems on Aircraft Only

EPA is proposing to add 2-BTP to the list of acceptable total flooding substitutes, subject to use conditions. For the total flooding end-use, the proposed use conditions would require that 2-BTP be used only for engine nacelles and APU on aircraft.

ii. Handheld Extinguishers in Aircraft Only

For the streaming end-use, the use condition would require that 2-BTP be used only for handheld extinguishers in aircraft.

d. What further information is EPA providing in the acceptable subject to use conditions listing for 2-BTP?

In the ''Further Information'' column of the regulatory listing, EPA is providing the following additional information for establishments manufacturing, installing and maintaining total flooding systems using this agent:

- This agent should be used in accordance with the safety guidelines in the latest edition of the National Fire Protection Association (NFPA) 2001 Standard for Clean Agent Fire Extinguishing Systems;
- In the case that 2-BTP is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention;
- In case of ocular exposure, person(s) should immediately flush the eyes, including under the eyelids, with

[222] ICF, 2016h. Market Characterization for Fire Suppression, Comfort Cooling, Cold Storage, and Household Refrigeration Industries in the United States. Prepared for the U.S. Environmental Protection Agency. October 2015.

[223] ICF, 2016j. Analysis of annual VOC emissions from the use of 2-BTP.

[224] UL, 2005. Standard 2129—Halocarbon Clean Agent Fire Extinguishers. This document is accessible at: *http://ulstandards.ul.com/standard/?id=2129_2.*

fresh water and move to a non-contaminated area, and medical attention should be sought if irritation develops or persists;

• Eye wash and quick drench facilities should be available. In case of ocular exposure, person(s) should immediately flush the eyes, including under the eyelids, with fresh water and move to a non-contaminated area; Exposed persons should remove all contaminated clothing and footwear to avoid irritation; and medical attention should be sought if irritation develops or persists;

• Although unlikely, in case of ingestion of 2-BTP, the person(s) should consult a physician immediately;

• Manufacturing space should be equipped with specialized engineering controls and well ventilated with a local exhaust system and low-lying source ventilation to effectively mitigate potential occupational exposure; regular testing and monitoring of the workplace atmosphere should be conducted;

• Employees responsible for chemical processing should wear the appropriate PPE, such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation;

• All spills should be cleaned up immediately in accordance with good industrial hygiene practices; and

• Training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent.

• Safety features that are typical of total flooding systems such as pre-discharge alarms, time delays, and system abort switches should be provided, as directed by applicable OSHA regulations and NFPA standards. Use of this agent should also conform to relevant OSHA requirements, including 29 CFR 1910, subpart L, sections 1910.160 and 1910.162.

In the ''Further Information'' column of the regulatory listing, EPA is providing the following additional information for establishments manufacturing, installing and maintaining streaming agents:

• This agent should be used in accordance with the latest edition of NFPA Standard 10 for Portable Fire Extinguishers;

• In the case that 2-BTP is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention;

• Eye wash and quick drench facilities should be available. In case of ocular exposure, person(s) should immediately flush the eyes, including under the eyelids, with fresh water and move to a non-contaminated area. Exposed person(s) should remove all contaminated clothing and footwear to avoid irritation, and medical attention should be sought if irritation develops or persists;

• Although unlikely, in case of ingestion of 2-BTP, the person(s) should consult a physician immediately;

• Manufacturing space should be equipped with specialized engineering controls and well ventilated with a local exhaust system and low-lying source ventilation to effectively mitigate potential occupational exposure; regular testing and monitoring of the workplace atmosphere should be conducted;

• Employees responsible for chemical processing should wear the appropriate PPE, such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation;

• All spills should be cleaned up immediately in accordance with good industrial hygiene practices;

• Training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent;

• 2-BTP use as a streaming fire extinguishing agent in handheld extinguishers on aircraft should be in accordance with UL 711, *Rating and Testing of Fire Extinguishers* [225] and the *Federal Aviation Administration (FAA) Minimum Performance Standard for Hand-Held Extinguishers* (DOT/FAA/AR–01/37),[226] with regard to the size and number of extinguishers depending on the size of aircraft. 2-BTP handheld extinguishers should also follow required minimum room volumes established by UL 2129, *Halocarbon Clean Agent Fire Extinguishers,* when discharged into a confined space.[227] This standard prohibits the exceedance of the cardiotoxic LOAEL for any fire suppressant (*i.e.,* 10,000 ppm or 1.0 percent for 2-BTP).

e. When would the listing apply?

EPA proposes that this listing would apply 30 days after the date of publication of a final rule. This date, the same as the proposed effective date of this regulation, allows for the safe use of this substitute at the earliest opportunity.

f. What is the relationship between this proposed SNAP rule and other federal rules?

As required for a new chemical, the manufacturer of this agent submitted a Toxic Substance Control Act (TSCA) Premanufacture Notice (PMN) for review by EPA. The PMN, designated as P–14–260, has completed EPA review and the manufacturer is presently subject to requirements contained in a TSCA section 5(e) Consent Order. Other future manufacturers and processors will be subject to a TSCA section 5(a)(2) Significant New Use Rule (SNUR) that is expected to be promulgated in 2016. The requirements of the consent order and SNUR would apply to all commercial manufacturing, processing, distribution in commerce, use and disposal of 2-BTP, unless exempted. Consistent with today's proposed listing, the consent order and SNUR will require use of 2-BTP for aircraft either (1) as a total flooding agent in engine nacelles and APUs on aircraft or (2) as a streaming agent in handheld extinguishers in aircraft. As noted above in section VI.D.1.d, FAA has issued guidance on the use of hand-held fire extinguishers on aircraft that is relevant to the streaming uses proposed in this rule.

g. On which topics is EPA specifically requesting comment?

EPA is requesting comment on all aspects of the proposed listing decision, including the proposed use conditions.

2. Proposed Change of Status for Certain Perfluorocarbons

As described in Table 23, EPA is proposing to change the listings from acceptable to unacceptable for C_3F_8 (PFC-218) and C_4F_{10} (PFC-410) in total flooding systems. We note that these changes of status apply to the manufacture of new equipment using these agents. Existing equipment that contains these agents may continue to be used for the remaining lifetime of the equipment.

[225] UL, 2004. Standard 711—Rating and Testing of Fire Extinguishers. This document is accessible at: *http://ulstandards.ul.com/standard/?id=711_7.*

[226] FAA, 2002. Federal Aviation Administration (FAA) Minimum Performance Standard for Hand-Held Extinguishers. This document is accessible at: *http://www.fire.tc.faa.gov/pdf/01-37.pdf.*

[227] UL, 2005. Standard 2129—Halocarbon Clean Agent Fire Extinguishers. This document is accessible at: *http://ulstandards.ul.com/standard/?id=2129_2.*

TABLE 23—PROPOSED CHANGE OF STATUS DECISIONS FOR TOTAL FLOODING

End-use	Substitutes	Proposed decision
Total flooding	PFCs (C_3F_8 and C_4F_{10})	Unacceptable as of one year after publication of a final rule.

a. What is the affected end-use?

The fire suppression and explosion protection end-uses addressed in this action is total flooding. The fire suppression industry has historically used halons, a class of halogenated chemicals containing bromine, as clean extinguishing agents (*i.e.,* those that do not leave residue following system discharge) in many different applications. Halon 1301 has been used in fixed total flooding systems.

Halons have a unique combination of characteristics including being electrically non-conductive, dissipating rapidly without residue (*i.e.,* clean), efficiently extinguishing most types of fires, and low toxicity. These agents are extremely effective on ordinary combustibles, flammable liquids and gases, and electrical fires (*i.e.,* Class A, Class B, and Class C fires, respectively). These characteristics allowed halon systems to be widely used to effectively protect valuable and sensitive assets in locations such as computer and control rooms, electronic data processing facilities, museums, military equipment, shipboard machinery, space, aircraft, and oil and gas industry facilities.

Halons have very high ODPs because they contain bromine, which has a higher reactivity with ozone than chlorine. Specifically, the ODP of halon 1301 is 15.9.[228] EPA banned the production and import of newly produced halons beginning January 1, 1994 (58 FR 65018; December 10, 1993) consistent with the requirements of the CAA and the Montreal Protocol. In addition, EPA issued regulations codified at 40 CFR part 82 subpart H to reduce emissions of halon through technician training and proper disposal. The U.S. fire suppression industry supported the phase out of halon production by working to find effective substitutes and to reduce unnecessary emissions of halon. Recycled halon is relied on for continuing uses of halons.

In response to the early 1994 phaseout of halon production, industry took early actions to find alternatives including less ozone-depleting HCFCs, non-ozone-depleting HFCs, as well as a variety of lower-GWP or no-GWP alternatives (*e.g.,* inert gases, CO_2, powdered aerosols, foams, water). Industry also took actions to minimize emissions and halon recycling emerged as an important initiative to both reduce unnecessary emissions, and to ensure supplies of halons during the transition. Other efforts included changes to national and international fire codes and standards to discourage the use of halons for testing and training while supporting the adoption of the alternatives listed as acceptable in fire suppression and explosion protection by EPA's SNAP program.

b. Which fire suppressants is EPA proposing to list as unacceptable?

EPA is proposing to list C_4F_{10} (PFC-410) and C_3F_8 (PFC-218) as unacceptable in certain uses for which they are currently listed as acceptable subject to narrowed use limits.

c. How do the proposed unacceptable fire suppressants compare to other fire suppressants for this end-use with respect to SNAP criteria?

The SNAP program considers a number of environmental criteria when evaluating substitutes: ODP; climate effects, primarily based on GWP; local air quality impacts, particularly potential impacts on smog formation from emissions of VOC; and ecosystem effects, particularly from negative impacts on aquatic life. These and other environmental and health risks are discussed below. In addition, a technical support document [229] that provides the **Federal Register** citations concerning data on the SNAP criteria (*e.g.,* ODP, GWP, VOC, toxicity, flammability) for acceptable alternatives in the relevant end-uses may be found in the docket for this rulemaking (EPA–HQ–OAR–2015–0663).

(a) Environmental Impacts

PFCs are fully fluorinated compounds, unlike CFCs, HCFCs, or HFCs. These chemicals have an ODP of zero, are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS, and have high GWPs (5,000–10,000 times greater than CO_2). Although the actual contributions to global warming depend upon the quantities emitted, because of their long atmospheric lifetimes, the warming effects of PFCs are essentially irreversible. As discussed in Section III above and in EPA's Endangerment Finding (74 FR 66496; December 7, 2009), EPA determined that PFCs are one of the six key well-mixed greenhouse gases in the atmosphere—in addition to CO_2, CH_4, N_2O, HFCs, and SF_6—whose current and projected concentrations were found to threaten the public health and welfare of current and future generations.

TABLE 24—GWP, ODP, AND VOC STATUS OF C_3F_8, AND C_4F_{10} COMPARED TO OTHER TOTAL FLOODING AGENTS

Fire suppressants	GWP	ODP	VOC	Proposal
Total flooding				
C_3F_8, C_4F_{10}	8,830–8,860	0	No	Unacceptable.
CF_3I	0.4	0.008	Yes	No change.
FK-5-1-12mmy2	<1	0	No	No change.
HCFC-124, HCFC Blend A	610–1,550	0.048–0.22	No	No change.
Halotron II, HFC-125, HFC-227ea	1,600–3,500	0	No	No change.
HFC-236fa	9,810	0	No	No change.
HFC-23	14,800	0	No	No change.

[228] WMO, 2011. Scientific Assessment of Ozone Depletion: 2010, Global Ozone Research and Monitoring Project. Geneva, Switzerland, 2011. This document is accessible at: *http://www.esrl.noaa.gov/csd/assessments/ozone/2010/report.html.*

[229] EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

TABLE 24—GWP, ODP, AND VOC STATUS OF C_3F_8, AND C_4F_{10} COMPARED TO OTHER TOTAL FLOODING AGENTS—Continued

Fire suppressants	GWP	ODP	VOC	Proposal
Water, Inert gases, Powdered aerosols A–E	0	0	No	No change.
Streaming				
C_6F_{14}	9,300	0	No	Unacceptable.
CO_2	1	0	No	No change.
C7 fluoroketone, FK-5-1-12mmy2	<1	0	No	No change.
HCFC Blend B, HCFC-123, HCFC-124	77–1,546	0.00098–0.048	No	No change.
HFC-227ea, HFC-236fa	3,220–9,810	0	No	No change.
H Galden HFPEs	2,790–6,230	0	No	No change.
Water	0	0	No	No change.

As shown in Table 24, C_3F_8 has a GWP of 8,830. EPA found the substitute acceptable only in those limited instances where no other alternative is technically feasible due to performance or safety requirements (60 FR 31092; July 13, 1995). C_4F_{10} has a GWP of 8,860. Because of similar concerns including the GWPs, EPA listed these as substitutes that would be used as a last resort. Other commonly-used alternatives for total flooding applications have lower GWPs including HFC-227ea (with GWP of 3,220), HFC-125 (with a GWP of 3,500), and C_6 Fluoroketone (with a GWP of approximately one).

(b) Flammability

C_3F_8 and C_4F_{10} are non-flammable, like all other fire suppression agents listed as acceptable under SNAP.

(c) Toxicity

In evaluating the toxicity concerns with fire suppression agents, we evaluate consumer and worker exposures to discharges of substitutes during fire emergencies and accidental discharges. In these acute, episodic exposures to the substitutes, cardiac sensitization is of particular interest. The term cardiac sensitization refers to an increased susceptibility of the heart to adrenaline (or other catecholamines) which may result in potentially fatal heart arrhythmias. Human heart arrhythmias and sudden deaths resulting from overexposure to CFCs, halons, and other halogenated hydrocarbons have been documented in workplace settings.

The determination of the toxicity risk to either workers or the general population from an accidental discharge of either a flooding or streaming agent substitute is also dependent on a number of other related factors. For total flood systems, the magnitude of exposure will depend on the design concentration of the flooding agent (as determined by the substitute's extinguishing concentration plus a safety factor, as specified by NFPA guidelines) and the length of time it takes a person to evacuate the area in which the agent is released. Because total flood systems are designed to achieve a uniform concentration of agent within a space, the magnitude of exposure is independent of the size of space, size of fire, or proximity of person to the fire. In assessing exposure the design concentration of a total flood substitute is compared to its cardiotoxic NOAEL and LOAEL levels. Generally, for occupied areas, if the design concentration is higher than the agent's NOAEL level, conditions are placed on the use of the agent to ensure human safety (*e.g.,* lower time allowed for safe egress).

Compared to other substitutes in the same total flooding end-use, these PFCs have lower toxicity profiles. The cardiotoxic NOAEL for C_4F_{10} is 40 percent which is well above its demonstrated extinguishing concentration of 5.5 percent in total flood applications, indicating its safe use in occupied areas. The cardiotoxic NOAEL for C_3F_8 is 30 percent which is also well above its demonstrated extinguishing concentration of 7.3 percent with cup burner tests in heptane (with a resulting design concentration of 8.8 percent), also indicating its safe use in occupied areas. In comparison, HFC-227ea has a cardiotoxic NOAEL of nine percent and an extinguishing concentration of 5.2 percent (minimum extinguishing concentration for Class A fires) and C6-perfluoroketone has a cardiotoxic NOAEL of ten percent and an extinguishing concentration of 3.5 percent (minimum extinguishing concentration for Class A fires). For HFC-227ea and C6-perfluoroketone, the concentrations needed to extinguish typical Class A fires are below the NOAEL. In addition, NFPA 2001 Standard for Clean Agent Extinguishing Systems contains the times for safe human exposure at specific concentrations for both HFC-227ea and C6-pefluoroketone in order to allow safe egress of personnel from the protected space in the event of a system discharge. Current industry practices include additional safeguards for these systems such as pre-discharge alarms and time-delays. While C_4F_{10} and C_3F_8 have lower toxicity profiles, the greater toxicity risks of the other alternatives for the same end-uses are mitigated by requirements as established in NFPA 2001, which requires that the alternative have first been reviewed in a process equivalent to that used by SNAP and then provides the minimum requirements for the safe design, installation, maintenance, and operation of total flooding systems using clean agent alternatives such as HFC-227ea and C6-perfluoroketone.

In comparing the environmental and health risks of C_3F_8 and C_4F_{10} with other alternatives in the same total flooding end-use, C_3F_8 and C_4F_{10} both have higher GWPs. While C_3F_8 and C_4F_{10} have lower toxicity profiles, the greater toxicity of other alternatives in the same end-use are mitigated by the fact that requirements for safe use of these alternatives are contained in fire protection industry standards (*e.g.,* NFPA 2001). Other criteria are comparable to many agents already listed as acceptable under SNAP for this end-use. Because the GWPs for C_3F_8 and C_4F_{10} are significantly higher and thus pose significantly greater risk than other alternatives in the same end-use, we are proposing to list C_3F_8 and C_4F_{10} as unacceptable for total flooding applications.

(d) Summary

EPA has listed as acceptable several substitutes that pose lower overall risk to human health and the environment than the two fire suppression alternatives, C_3F_8 and C_4F_{10}, whose status we are proposing to change to

unacceptable. The risks other than GWP are not significantly different for the other available alternatives in the same total flooding end-use than for the fire suppression agents we are proposing to list as unacceptable. Neither the substitutes we are proposing to list as unacceptable nor the other available alternatives pose a significantly greater risk based on toxicity because all may be used consistent with NFPA 2001. However, the GWPs for the fire suppression agents, C_3F_8 and C_4F_{10}, which we are proposing to list as unacceptable, are significantly higher and thus pose significantly greater risk. Because the GWPs for C_3F_8 and C_4F_{10} are significantly higher than other available alternatives in this end-use and there is no significant difference in risk based on the other evaluation criteria, we are proposing to list C_3F_8 and C_4F_{10} as unacceptable for total flooding applications.

d. When would the status change?

Today, the demand in the fire suppression total flooding end-use is being met through the availability of clean agents and not-in-kind (NIK) substitutes (*i.e.,* non-gaseous agents, including powdered aerosols, foam, and water mist).[230] The current market for the total flooding end-use consists of commercially available and proven alternatives including HCFCs, HFCs, inert gases, and a variety of NIK extinguishing agents (*e.g.,* powdered aerosols, foams water) and technologies. National and international standards currently cover the requirements, specifications, and recommendations for design, installation, testing, maintenance, and safety factors for many of these alternatives in the total flooding end-use.

Considering the above, and the current suite of other available substitutes in the fire suppression total flooding end uses EPA is proposing to change the listings from acceptable to unacceptable for C_3F_8 and C_4F_{10} in total flooding systems as of one year after publication of a final rule. Based on the information available to EPA today on the total flooding agent markets as discussed above, including through various discussions with industry representatives, users have other available alternatives with lower overall risks to human health and the environment. Given the broad commercial availability of the alternative systems already and coverage by national and international standards of many of the alternatives, one year provides a reasonable timeframe for the change in status for C_3F_8 and C_4F_{10} in total flooding systems.

e. What is the relationship between this proposed SNAP rule and other federal rules?

EPA is not aware of other federal rules applying to these two fire suppression agents in the total flooding end-use.

f. On which topics is EPA specifically requesting comment?

EPA requests comments on all aspects of these proposed changes. EPA specifically requests comment on the proposed decision to change the status of C_3F_8 and C_4F_{10} to unacceptable one year after the date of publication of a final rule, and requests updated information with regard to the use of these PFCs in total flooding applications as well as the availability of other substitutes for this end-use. EPA is also interested in advance comments on whether to take similar action with respect to certain additional fire suppression agents. Specifically, EPA requests advance comments and updated information on total flooding uses of SF_6,HFC-23, and HFC-125, and on both total flooding and streaming uses of HFC-227ea. SF_6 is listed as acceptable subject to narrowed use limits for use as a discharge test agent in military uses and civilian aircraft uses only (60 FR 31092; July 13, 1995). SF_6 is a nonflammable, nontoxic gas which is colorless and odorless. SF_6 is relatively inert, and has an atmospheric lifetime of 3,200 years, with a GWP of 22,800. SF_6 is the most potent GHG the IPCC has evaluated. The U.S. Navy has used SF_6 as a test gas simulant in place of halon in new halon total flooding systems on ships which have been under construction prior to identification and qualification of substitute agents. Halon systems are no longer included in designs for new ships. Similarly, the airline industry had an interest in using SF_6 as a discharge test agent simulating halon 1301 in aircraft system certification testing to ensure aircraft in-flight fire safety. The amount of SF_6 released in developing and certifying these critical systems for commercial aircraft was estimated to be approximately 1,000 pounds per year or less for this development period, however airlines continue to build new aircraft with halon systems. EPA is not aware of SF_6 use in other commercial sector testing regimes, and EPA imposed a narrowed use limit on SF_6 as a discharge test agent to ensure that emissions of this agent remain minimal. The NFPA 12a and NFPA 2001 standards recommend that halon or other total flooding gases not be used in discharge testing, but that alternative methods of ensuring enclosure and piping integrity and system functioning be used. Alternative methods can often be used, such as the ''door fan'' test for enclosure integrity, UL 1058 testing to ensure system functioning, pneumatic test of installed piping, and a ''puff'' test to ensure against internal blockages in the piping network. These stringent design and testing requirements have largely obviated the need to perform a discharge test for total flood systems containing either halon 1301 or a substitute agent outside of military and civil aircraft uses.

EPA requests comment and updated information on whether there is current or continuing use of SF_6 in this end-use and the availability of substitutes or alternative technologies or processes that would obviate its continued use.

HFC-23 is listed as acceptable as a total flooding substitute. In the SNAP final rule of March 18, 1994 (59 FR 13044), EPA decided not to adopt the proposed narrowed use limits on HFC-23 in response to comments that its cardiotoxicity profile was favorable compared to its design or inerting concentration and in some cases it was the only acceptable alternative in particular applications such as: (1) Where temperatures are likely to go below zero degrees, (2) where pre-inerting is required for occupied areas, and (3) where occupied areas can suffer considerable variation in fire volume. HFC-23 is used as a total flooding agent in occupied areas because of its favorable cardiotoxicity profile with values of 30 percent for the NOAEL and 50 percent for the LOAEL, compared to a design concentration of 14.4 percent, based on cup burner tests in heptane. Compared to an inerting concentration in methane of 20.5 percent and an inerting design concentration of 22.6 percent in methane, the agent made for an excellent candidate for use in explosion inertion. Nevertheless, it is also a potent greenhouse gas with a GWP of 14,800.

In its 2014 Assessment, the UNEP TEAP HTOC reported on the status of the use of halons and alternatives in the various sector of use including in pipelines and the oil and gas industry.[231] Halon 1301 is used for

[230] ICF, 2016h. Market Characterization for Fire Suppression, Comfort Cooling, Cold Storage, and Household Refrigeration Industries in the United States. Prepared for the U.S. Environmental Protection Agency. October 2015.

[231] TEAP/HTOC, 2015. 2014 Report of the Halons Technical Options Committee (Vol. 1). This document is accessible at: *http://ozone.unep.org/en/Assessment_Panels/TEAP/Reports/HTOC/HTOC%202014%20Assessment%20Report.pdf.*

maintaining legacy systems used to prevent explosions and to suppress fires in inhospitable locations such as the Alaskan North Slope in the United States. This situation remains the same today since ''existing facilities were designed and constructed with halon 1301 fixed systems as an integral part of the safety system design as well as the physical layout of the facility.'' New facilities adopt inherently safe design approaches that eliminate the p otential flammable or explosive hazards. New technologies such as advanced detection systems also reduce reliance on need to close and inert the space. However, where an inerting agent is still required in occupied spaces, halon 1301 has been replaced by HFC-23 or C6-perfluoroketone, if temperatures permit. Currently, HFC-23 is the only alternative determined to meet both the requirement to mitigate inerting high-GWP gas release, such as methane, and perform its function in fully enclosed spaces in very cold climatic conditions. EPA requests comment and updated information on the continuing use of HFC-23 in this and potentially other applications in this end-use and the availability of substitutes or alternative technologies or processes that would obviate its continued use.

With significant progress made by the U.S. total flooding systems industry in adopting a variety of suppression agent alternatives, EPA understands that, as a result, a mix of agents are in use today with high-GWP HFCs occupying a substantial portion of the products on the market. Currently, HFCs account for approximately 23 percent of the alternatives used to replace halon 1301, while HFC-227ea constitutes a majority of that total, with some use of other HFCs such as HFC-23 and HFC-125.[232] EPA, therefore, also requests comment and updated information on the continuing use of HFC-125 and HFC-227ea in fire protection and explosion protection. HFC-227ea is an acceptable alternative for both total flooding (59 FR 12044; March 18, 1994) and streaming (64 FR 22987; April 28, 1999) applications; HFC-125 is an acceptable alternative for total flooding uses (59 FR 12044; March 18, 1994). The extinguishing concentration for HFC-227ea for typical Class A fires in heptane is below its NOAEL making it appropriate it for use as a total flooding agent in normally occupied spaces, while the extinguishing concentration for HFC-125 is above its cardiotoxic NOAEL making it appropriate for use in spaces that are not normally occupied. EPA is requesting comment and updated information on the continuing use of these alternatives and the availability of substitutes or alternative technologies or processes that would obviate their continued use.

3. Proposed Removal of Powdered Aerosol D in Total Flooding From the List of Substitutes Acceptable for Use Subject to Use Conditions

Powdered Aerosol D is a pyrotechnic particulate aerosol and explosion suppressant that also is marketed under the trade names of Aero-K® and Stat-X®. This fire suppressant is supplied to users as a solid housed in a double-walled hermetically-sealed steel container. When the unit is triggered by heat (300 °C), the product is pyrotechnically activated to produce gases and aerosol particles from a mixture of chemicals. EPA listed Powdered Aerosol D as acceptable subject to use conditions as a total flooding agent (71 FR 56359; September 7, 2006). The use conditions required that Powdered Aerosol D be used only in areas that are not normally occupied, because the Agency did not have sufficient information at that time supporting its safe use in areas that are normally occupied. Based on a review of additional information from the submitter to support the safe use of Powdered Aerosol D in normally occupied spaces, EPA subsequently determined that Powdered Aerosol D is also acceptable for use in total flooding systems for normally occupied spaces (79 FR 62863; October 21, 2014). The listing provides that Powdered Aerosol D is acceptable for total flooding uses, which includes both unoccupied and occupied spaces. In the October 2014 listing action, EPA noted that in a subsequent rulemaking, the Agency would remove the previous listing of acceptable subject to use conditions. Today, EPA is proposing to remove this listing for Powdered Aerosol D.

VII. Statutory and Executive Orders Reviews

Additional information about these statutes and Executive Orders can be found at *http://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. It raises novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order. Any changes made in response to OMB recommendations have been documented in the docket. EPA prepared an analysis of the potential costs and benefits associated with this action. These are available in docket EPA–HQ–OAR–2015–0663 under the titles, ''Climate Benefits of the Proposed SNAP Program Status Change Rule'' and ''Preliminary Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression.''

B. Paperwork Reduction Act (PRA)

This action does not impose any new information collection burden under the PRA. OMB has previously approved the information collection requirements contained in the existing regulations and has assigned OMB control number 2060–0226. This proposed 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 under the RFA. The small entities subject to the requirements of this action are small businesses. For purposes of assessing the impacts of this proposed rule on small entities, EPA evaluated small businesses as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201. The Agency has determined that about 90 small businesses could be subject to the rulemaking, and roughly 76 percent of the small businesses subject to this proposed rulemaking would be expected to experience compliance costs of less than one percent of annual sales revenue. Details of this analysis are presented in the document entitled, ''Economic Impact Screening Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Motor Vehicle Air Conditioners, Foams, and Fire Suppression.'' EPA evaluated the potential costs to small businesses associated with the proposed rule. EPA estimates that the total annualized compliance costs for all small businesses would be approximately $11.8 to $14.4 million at a seven percent discount rate, or $11.5 to $14.0 million at a three percent discount rate.[233]

[232] ICF, 2016h. Market Characterization for Fire Suppression, Comfort Cooling, Cold Storage, and Household Refrigeration Industries in the United States. Prepared for the U.S. Environmental Protection Agency. October 2015.

[233] ICF, 2016a. Preliminary Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air

Today's action allows equipment manufacturers the additional options of using propane, HFO-1234yf, and 2-BTP in the specified end-uses but does not mandate such use. Because these substitutes are not yet being used in the United States for the end-uses (with the exception of limited test-marketing), no change in business practice would be required to meet the use conditions, resulting in no adverse impact compared to the absence of this rule. Provisions that allow venting of hydrocarbon refrigerants in the uses of propane addressed by this proposed rule would reduce regulatory burden. We have therefore concluded that this action would relieve regulatory burden for all small entities that choose to use propane as a refrigerant in the end-uses in this proposed listing. The use conditions of this proposed rule apply to manufacturers of commercial ice machines, water coolers, and very low temperature refrigeration equipment that choose to use propane.

The requirements of this proposed rule with respect to HFCs, if finalized as proposed, would impact small businesses that manufacture food processing and dispensing equipment, household refrigerators and freezers, cold storage refrigeration systems, and polyurethane foams; operators of cold storage refrigeration systems, including refrigerated warehouses, wholesalers, and food manufacturers; and manufacture and use cold storage warehouses, and small businesses that import products containing closed cell phenolic, polyisocyanurate, polyolefin, PU, and polystyrene foams manufactured with HFC or HCFC foam blowing agents. The proposal to prohibit use of methylene chloride as a foam blowing agent is not anticipated to impact small businesses because this substance is not expected to be used currently as a blowing agent. This rule's provisions do not create enforceable requirements for refrigeration and AC technicians, but they would indirectly affect technicians servicing motor vehicle AC systems, certain types of retail food refrigeration equipment, cold storage warehouses, and commercial AC equipment where the technician, rather than the refrigeration or AC equipment owner, purchases servicing equipment for different refrigerants. EPA expects these indirect impacts on technicians are minimal, because the transitions to different refrigerants required by this proposed rule are already occurring due to corporate social responsibility initiatives (*e.g.,* Consumer Goods Forum pledge concerning HFC refrigerants), and because many of the still-acceptable alternatives are already used for these refrigeration or AC equipment types. Further, most acceptable HFC refrigerant blends can be recovered and serviced using equipment that service technicians already own. In some uses, there is no significant impact of the proposed rule because the substitutes proposed to be prohibited are not widely used (*e.g.,* use of perfluorocarbons for fire suppression, use of methylene chloride as a foam blowing agent in various types of foam). A significant portion of the businesses regulated under this proposed rule are not small businesses (*e.g.,* commercial AC manufacturers). We have therefore concluded that this action will not have a significant impact on a significant 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. The 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. EPA is aware that the California Air Resources Board is considering regulation of a number of the substitutes and end-uses in this proposed rule. EPA specifically solicits comment on whether any state agencies have existing environmental requirements affecting the substitutes and the end-uses in this proposed rule.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action does not have tribal implications as specified in Executive Order 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, as specified in Executive Order 13175. Thus, Executive Order 13175 does not apply to this action. EPA specifically solicits additional comment on this proposed action from tribal officials.

G. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks

This action is not subject to Executive Order 13045 because it is not economically significant as defined in Executive Order 12866, and because EPA does not believe the environmental health or safety risks addressed by this action present a disproportionate risk to children. This proposed rule 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. The public is invited to submit comments or identify peer-reviewed studies and data that assess effects of early life exposure to the alternatives addressed in the comparisons of toxicity for the various substitutes, as well as risk screens for the substitutes that are proposed to be listed as acceptable, subject to use conditions, or are newly listed as unacceptable.[234] [235] [236] [237] [238] The risk screens are in the docket for this rulemaking.

H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use

This action is not a ''significant energy action'' because it is not likely to have a significant adverse effect on the supply, distribution or use of energy. For the end-uses that are related to energy effects such as refrigeration and AC, a number of alternatives are available to replace those refrigerants that are proposed as unacceptable in this action; many of the alternatives are as energy efficient or more energy efficient than the substitutes being

Conditioning, Foams, and Fire Suppression. February, 2016.

[234] ICF, 2016c. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Water Coolers Substitute: Propane (R-290).

[235] ICF, 2016d. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Very Low Temperature Refrigeration Substitute: Propane (R-290) and Ethane (R-170).

[236] ICF, 2016e. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Commercial Ice Machines Substitute: Propane (R-290).

[237] ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

[238] ICF, 2016g. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Chillers and Cold Storage Warehouses. Substitute: Propylene (R-1270).

proposed unacceptable. Thus, we have concluded that this proposed rule is not likely to have any adverse energy effects.

I. National Technology Transfer and Advancement Act (NTTAA) and 1 CFR Part 51

This action involves technical standards. EPA proposes to use standards from UL in the use conditions for propane. These use conditions would ensure that these new substitutes for very low temperature refrigeration equipment, commercial ice machines, and water coolers, do not present significantly greater risk to human health or the environment than other alternatives.

EPA is proposing to incorporate by reference portions of current editions of the UL Standard 399, ''Standard for Drinking-Water Coolers''; UL Standard 471, ''Standard for Commercial Refrigerators and Freezers''; and UL Standard 563, ''Standard for Ice Makers'', which includes requirements for the safe use of refrigerants . Specifically, these standards are:

1. Supplement SB to UL Standard 399: Requirements for Drinking Water Coolers Employing A Flammable Refrigerant in the Refrigerating System (7th Edition, August 22, 2008). This document establishes requirements for self-contained drinking water coolers, including those supplying cold and/or hot water and those employing flammable refrigerants. The standard is available at *http://ulstandards.ul.com/standard/?id=399,* and may be purchased by mail at: COMM 2000, 151 Eastern Avenue, Bensenville, IL 60106; Email: *orders@comm-2000.com;* Telephone: 1–888–853–3503 in the U.S. or Canada (other countries dial +1–415–352–2168); Internet address: *http://ulstandards.ul.com/* or *www.comm-2000.com.* The cost of UL 399 is $798 for an electronic copy and $998 for hardcopy. UL also offers a subscription service to the Standards Certification Customer Library (SCCL) that allows unlimited access to their standards and related documents. The cost of obtaining this standard is not a significant financial burden for equipment manufacturers and purchase is not required for those selling, installing and servicing the equipment. Therefore, EPA concludes that the UL standard being incorporated by reference is reasonably available.

2. Supplement SB to UL Standard 471: Requirements for Refrigerators and Freezers Employing A Flammable Refrigerant in the Refrigerating System (10th Edition, November 24, 2010). This document establishes requirements for commercial refrigerators and freezers that employ a refrigerant that has been identified as having flammable characteristics. The standard is available at *http://ulstandards.ul.com/standard/?id=471&edition=10&doctype=ulstd,* and may be purchased by mail at: COMM 2000, 151 Eastern Avenue, Bensenville, IL 60106; Email: *orders@comm-2000.com;* Telephone: 1–888–853–3503 in the U.S. or Canada (other countries dial +1–415–352–2168); Internet address: *http://ulstandards.ul.com/* or *www.comm-2000.com.* The cost of UL 471 is $716 for an electronic copy and $897 for hardcopy. UL also offers a subscription service to the SCCL that allows unlimited access to their standards and related documents. The cost of obtaining this standard is not a significant financial burden for equipment manufacturers and purchase is not required for those selling, installing and servicing the equipment. Therefore, EPA concludes that the UL standard being incorporated by reference is reasonably available.

3. Supplement SA to UL Standard 563: Requirements for Ice Makers Employing a Flammable Refrigerant in the Refrigeration System (8th Edition, July 31, 2009). This document establishes requirements for automatic ice makers, including unitary and remote ice makers. The standard is available at *http://ulstandards.ul.com/standard/?id=563&edition=8&doctype=ulstd,* and may be purchased by mail at: COMM 2000, 151 Eastern Avenue, Bensenville, IL 60106; Email: *orders@comm-2000.com;* Telephone: 1–888–853–3503 in the U.S. or Canada (other countries dial +1–415–352–2168); Internet address: *http://ulstandards.ul.com/* or *www.comm-2000.com.* The cost of UL 563 is $716 for an electronic copy and $897 for hardcopy. UL also offers a subscription service to the SCCL that allows unlimited access to their standards and related documents. The cost of obtaining this standard is not a significant financial burden for equipment manufacturers and purchase is not required for those selling, installing and servicing the equipment. Therefore, EPA concludes that the UL standard being incorporated by reference is reasonably available.

In addition, EPA is proposing to incorporate by reference the list of refrigerants that ASHRAE designates as flammability Class 3 according to ASHRAE Standard 34–2013, *Designation and Safety Classification of Refrigerants,* in the unacceptability listing for certain highly flammable refrigerants for use in existing residential and light commercial split AC systems. This standard is available at *https://www.ashrae.org/resources-publications/bookstore/standards-15-34,* and may be purchased by mail at: 6300 Interfirst Drive, Ann Arbor, MI 48108; by telephone: 1–800–527–4723 in the U.S. or Canada; Internet address: *http://www.techstreet.com/ashrae/ashrae_standards.html?ashrae_auth_token=.* The cost of ASHRAE Standard 34–2013 is $107 for an electronic or hardcopy. The cost of obtaining this standard is not a significant financial burden for equipment manufacturers and purchase is not required for those selling, installing and servicing the equipment. Therefore, EPA concludes that the ASHRAE standard being incorporated by reference is reasonably available.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

The human health or environmental risk addressed by this action will not have potential disproportionately high and adverse human health or environmental effects on minority, low-income or indigenous populations. This action's health and risk assessments are contained in the comparisons of toxicity for the various substitutes, as well as risk screens for the substitutes that are proposed to be listed as acceptable, subject to use conditions, or are newly listed as unacceptable.[239] [240] [241] [242] [243] The risk screens are in the docket for this rulemaking.

VIII. References

A.S. Trust & Holdings, 2014. Response to Incompleteness Letter from A.S. Trust & Holdings to EPA—Sent March 7, 2014.

AHRI, 2014. Guideline N–2014 for Assignment of Refrigerant Container Colors. This document is accessible

[239] ICF, 2016c. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Water Coolers Substitute: Propane (R-290).

[240] ICF, 2016d. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Very Low Temperature Refrigeration Substitute: Propane (R-290) and Ethane (R-170).

[241] ICF, 2016e. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Commercial Ice Machines Substitute: Propane (R-290).

[242] ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

[243] ICF, 2016g. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Chillers and Cold Storage Warehouses. Substitute: Propylene (R-1270).

online at *http://www.ahrinet.org/App_Content/ahri/files/Guidelines/AHRI_Guideline_N_2014.pdf.*

AHRI, 2015. AHRI Will Reinforce Refrigerant R&D Commitment at White House Event. October 15, 2015. This document is accessible at: *http://www.ahrinet.org/site/320/News-Events/News-and-Shipping-Releases?A=1112.*

AIRAH, 2013. Australian Institute of Refrigeration, Air Conditioning and Heating. Safety Guide: Flammable Refrigerants. 2013. This document is accessible at: *http://www.unep.fr/ozonaction/information/mmcfiles/7681-e-FlammableRefrigerantsGuide AIRAH.pdf.*

Airgas, 2015. Safety Data Sheet for Propylene.

Akerman, 2013. Hydrofluorocarbons and Climate Change: Summaries of Recent Scientific and Papers. 2013.

ASHRAE, 2013. ANSI/ASHRAE Standard 15–2013: Safety Standard for Refrigeration Systems.

ASHRAE, 2013. ANSI/ASHRAE Standard 34–2013: Designation and Safety Classification of Refrigerants.

ASHRAE, 2014. 2014 Handbook—Refrigeration. The American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc. Atlanta, Georgia, USA. ISBN 978–1–936504–71–8; ISSN 1930–7195.

Blupura, 2015. SNAP Information Notice for R-290 in Water Coolers. October, 2015.

Clayton Corporation, 2014. Re: Proposed SNAP Program Status Change Rule Docket ID No. EPA–HQ–OAR–2014–0198, comment submitted by Clayton Corporation. October 20, 2014. Docket number EPA–HQ–OAR–2014–0198–0133.

Clayton Corporation, 2015. Clayton Corporation Meeting with EPA Stratospheric Protection Division, December 8, 2015.

Cooling Post, 2014. Trane first with 1233zd chiller, June 30, 2014. This document is accessible at *www.coolingpost.com/world-news/trane-first-with-1233zd-chiller/.*

Cooling Post, 2015. ''Chemours to build HFO-1336mzz plant,'' November 17, 2015. This document is accessible online at: *http://www.coolingpost.com/world-news/chemours-to-build-hfo-1336mzz-plant/.*

DOE, 2014. Building Energy Codes Program. Energy Efficiency Standards for Federal Buildings. Available at: *https://www.energycodes.gov/regulations/federal-building-standards.* Last updated February 13, 2014.

Doniger and Yurek, 2016. Doniger, David (NRDC) and Stephen Yurek (AHRI), February 1, 2016. AHRI/NRDC Letter Regarding Chiller Actions Under SNAP.

DuPont, 2014. Re: Protection of Stratospheric Ozone: Change of Listing Status for Certain Substitutes under the Significant New Alternatives Policy Program. Submitted by Michael Parr and Mack McFarland, DuPont. October 17, 2014. Docket number EPA–HQ–OAR–2014–0198–0077.

Ecomall, 2015. Greenfreeze: A Revolution in Domestic Refrigeration. Accessible at: *http://www.ecomall.com/greenshopping/greenfreeze.htm.*

EIA, 2015. Petition requesting EPA to modify the status under the Significant New Alternatives Policy Program, of certain high-GWP chemicals in various end-uses. Submitted October 6, 2015.

EPA, 2009a. Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. December, 2009. This document is accessible at: *http://www3.epa.gov/climatechange/Downloads/endangerment/Endangerment_TSD.pdf.*

EPA, 2009b. Risk Assessment: PMN 07–0601. Available at: *http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2008-0664-0036.*

EPA, 2013. Finding of Violation, issued to Enviro-Safe Refrigerants, Inc. June, 2013. This document is accessible at: *http://www2.epa.gov/sites/production/files/2015-07/documents/mailfov_envirosafe_06112013.pdf.*

EPA, 2015. Draft Regulatory Impact Analysis: Proposed Rulemaking for Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2. EPA–420–D–15–900. June 2015. Available at *http://www3.epa.gov/otaq/climate/documents/420d15900.pdf.*

EPA, 2016a. Draft Climate Benefits of the SNAP Program Status Change Rule. February 2016.

EPA, 2016b. Draft Tables of Alternatives for End-Uses Considered in the Notice of Proposed Rule Making, Protection of Stratospheric Ozone: Listing Modifications for Certain Substitutes under the Significant New Alternatives Policy Program. March, 2016.

Eppendorf, 2015. SNAP Information Notice for R-170 and R-290 in Very Low Temperature Refrigeration. May, 2015.

EU, 2014. Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006. Available online at: *http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.150.01.0195.01.ENG.*

FAA, 2002. Federal Aviation Administration (FAA) Minimum Performance Standard for Hand-Held Extinguishers. This document is accessible at: *http://www.fire.tc.faa.gov/pdf/01-37.pdf.*

Fomo, 2014. Comment Re: Proposed SNAP Program Status Change Rule Docket ID No. EPA–HQ–OAR–2014–0198, submitted by Dr. Thomas Fishback, Vice President, Research and Development, Fomo Products, Inc. October 16, 2014. Docket number EPA–HQ–OAR–2014–0198–0139.

Fomo, 2015. ''The Use of Solstice® Gas Blowing Agent (GBA) in Low-Pressure Spray Polyurethane Foam Applications,'' Cline, Mojee and Bogdan, Mary, October, 2015. Polyurethane Industry Conference 2015.

FTOC, 2011. 2010 Report of the Rigid and Flexible Foams Technical Options Committee. This document is accessible at: *http://ozone.unep.org/Assessment_Panels/TEAP/Reports/FTOC/FTOC-2010-Assessment-Report.pdf.*

Gradient, 2013. Additional Risk Assessment of Alternative Refrigerant R-1234yf. Prepared by Gradient for SAE International Cooperative Research Program 1234–4. July 24, 2013. The Executive Summary of this document is accessible at: *http://www.sae.org/standardsdev/tsb/cooperative/executivesummary.pdf.*

Honeywell, 2014. Comments on Proposed Rule: Protection of Stratospheric Ozone: Change of Listing Status for Certain Substitutes under the Significant New Alternatives Policy Program (Docket no. EPA–HQ–OAR–2014– 0198). October 20, 2014. Docket number EPA–HQ–OAR–2014–0198–0170.

Hossaini, et al., 2015. R. Hossaini, M.P. Chipperfield, S.A. Montzka, A. Rap, S. Dhomse, W. Feng. Efficiency of short-lived halogens at influencing climate through depletion of stratospheric ozone. *Nature Geoscience,* February 16, 2015. This document is accessible online at *http://DOI:10.1038/ngeo2363.*

ICCT, 2015. International Council on Clean Transportation: Regulatory Considerations for Advancing Commercial Pickup and Van Efficiency Technology in the United States. Available online at: *http://www.theicct.org/us-commercial-pickups-vans-efficiency-technology.*

ICF, 2008. Air-Conditioning Refrigerant Charge Size to Passenger Compartment Volume Ratio Analysis. Confidential Memorandum Prepared for the U.S. Environmental Protection Agency. 2008.

ICF, 2009a. Revised Final Draft Assessment of the Potential Impacts of HFO-1234yf and the Associated Production of TFA on Aquatic Communities and Local Air Quality.

ICF, 2009b. Risk Screen on Substitutes for CFC-12 in Motor Vehicle Air Conditioning: Substitute: HFO-1234yf. This document is accessible at: *http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2008-0664-0038.*

ICF, 2010a. Summary of HFO-1234yf Emissions Assumptions.

ICF, 2010b. Summary of Updates to the Vintaging Model that Impacted HFO-1234yf Emissions Estimates.

ICF, 2010c. Revised Assessment of the Potential Impacts of HFO-1234yf and the Associated Production of TFA on Aquatic Communities, Soil and Plants, and Local Air Quality.

ICF, 2010d. Sensitivity Analysis CMAQ results on projected maximum TFA rainwater concentrations and maximum 8-hr ozone concentrations.

ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

ICF, 2014b. Risk Screen on Substitutes for HCFC-22 in Residential and Light Commercial Air Conditioning and Heat Pumps; Substitute: Propane (R-290).

ICF, 2014c. Risk Screen on Substitutes for HCFC-22 in Residential and Light Commercial Air Conditioning and Heat Pumps; Substitute: R-441A.

ICF, 2015. 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.

ICF, 2016a. Preliminary Cost Analysis for Regulatory Changes to the Listing Status of High-GWP Alternatives used in Refrigeration and Air Conditioning, Foams, and Fire Suppression. February, 2016.

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

ICF, 2016c. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Water Coolers Substitute: Propane (R-290).

ICF, 2016d. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Very Low Temperature Refrigeration Substitute: Propane (R-290) and Ethane (R-170).

ICF, 2016e. Significant New Alternatives Policy Program: Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Commercial Ice Machines Substitute: Propane (R-290).

ICF, 2016f. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Residential and Light Commercial Air Conditioning and Heat Pumps. Substitute: R-443A.

ICF, 2016g. Significant New Alternatives Policy Program. Refrigeration and Air Conditioning Sector Risk Screen on Substitutes in Chillers and Cold Storage Warehouses. Substitute: Propylene (R-1270).

ICF, 2016h. Market Characterization for Fire Suppression, Comfort Cooling, Cold Storage, Refrigerated Food Processing and Dispensing Equipment, and Household Refrigeration Industries in the United States. Prepared for the U.S. Environmental Protection Agency. February, 2016.

ICF, 2016i. Technical Support Document for Acceptability Listing of HFO-1234yf for Motor Vehicle Air Conditioning in Limited Heavy-Duty Applications.

ICF, 2016j. Analysis of annual VOC emissions from the use of 2-BTP.

ICF, 2016k. Significant New Alternatives Policy Program. Fire Extinguishing and Explosion Prevention Sector. Risk Screen on Substitutes as a Streaming Agent in Civil Aviation Applications. Substitute: 2-bromo-3,3,3-trifluoropropene (2-BTP).

ICF, 2016l. Significant New Alternatives Policy Program. Fire Extinguishing and Explosion Prevention Sector. Risk Screen on Substitutes for Total Flooding Systems in Unoccupied Spaces. Substitute: 2-bromo-3,3,3-trifluoropropene (2-BTP).

INCHEM, 1996. International Programme on Chemical Safety. Environmental Health Criteria 164. Methylene chloride, second edition. World Health Organization, 1996. This document is accessible online at: *http://www.inchem.org/documents/ehc/ehc/ehc164.htm.*

IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. This document is accessible at: *www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html.*

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. This document is accessible at: *http://www.ipcc.ch/report/ar5/wg1/.*

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. This document is accessible at: *https://www.ipcc.ch/pdf/special-reports/sroc/sroc_full.pdf.*

JARN, 2015a. First Carrier AquaForce Chillers using HFO-1234ze, July 30, 2015. This document is accessible at: *http://www.ejarn.com/news.aspx?ID=35619.*

JARN, 2015b. Trane Exhibits First Air-cooled Chiller with Climate-friendly Refrigerant DR-55, September 21, 2015. This document is accessible at: *www.ejarn.com/news.aspx?ID=36282.*

Kazil et al., 2014. Deposition and rainwater concentrations of trifluoroacetic acid in the United States from the use of HFO-1234yf. JGR-Atmospheres, 2014.

Luecken et al., 2009. Ozone and TFA impacts in North America from degradation of 2, 3, 3, 3-tetrafluoropropene (HFO-1234yf), a potential greenhouse gas replacement. Environmental Science & Technology 2009. The document is accessible at: *http://www.researchgate.net/profile/Robert_Waterland/publication/40481734_Ozone_and_TFA_impacts_in_North_America_from_degradation_of_2333-Tetrafluoropropene_(HFO-1234yf)_a_potential_greenhouse_gas_replacement/links/00b7d514ca9595bf5e000000.pdf.*

Manitowoc, 2015. SNAP Information Notice, September, 2013. EPA SNAP Submittal—Revision to Extend R-290 Use to Commercial Ice Machines, Manitowoc Ice, Inc. October, 2015.

Montzka, 2012. HFCs in the Atmosphere: Concentrations, Emissions and Impacts. ASHRAE/NIST Conference 2012. This document is accessible at: *ftp://ftp.cmdl.noaa.gov/hats/papers/montzka/2012_pubs/Montzka_ASHRAE_2012.pdf.*

NRDC/IGSD, 2015. Petition for Change of Status of HFCs under Clean Air Act Section 612 (Significant New Alternatives Policy). Submitted October 6, 2015.

ORNL, 2015. ORNL's JUMP Challenge: JUMP in to Advance Tech Innovation! Presented by Brian Fricke, Oak Ridge National Laboratory. November 17, 2015.

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.

Patten et al., 2012. Correction to ''OH reaction rate constant, IR absorption spectrum, ozone depletion potentials and global warming potentials of 2-bromo-3,3,3-trifluoropropene,'' J. Geophys. Res., 117, D22301, doi:10.1029/2012JD019051.

RTOC, 2015. 2014 Report of the Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee. This document is accessible at: *http://ozone.unep.org/sites/ozone/files/documents/RTOC-Assessment-Report-2014.pdf.*

SAE, 2013. SAE International Cooperative Research Project CRP1234–4 on R-1234yf Safety, Finishes Work and Presents Conclusions. This document is accessible at: *http://www.sae.org/servlets/pressRoom?OBJECT_TYPE=PressReleases&PAGE=showRelease&RELEASE_ID=2146.*

Sleasman, K. and Biggs, M., 2015. Lessons learned from the Federal Partners Workgroup on Spray Polyurethane Foam (SPF), presented at the Center for the Polyurethanes Industry Technical Conference, October, 2015.

TEAP, 2013. Report of the Technology and Economic Assessment Panel, Volume 2: Decision XXIV/7 Task Force Report, Additional Information on Alternatives to ODS. September, 2013. This document is accessible at: *http://ozone.unep.org/Assessment_Panels/TEAP/Reports/TEAP_Reports/TEAP_TaskForce%20XXIV-7-September2013.pdf.*

TEAP, 2015. 2014 Assessment Report of the Technology and Economic Assessment Panel. This document is accessible at: *http://conf.montreal-protocol.org/meeting/oewg/oewg-36/presession/Background%20Documents%20are%20available%20in%20English%20only/TEAP_Assessment_report_2014.pdf.*

TEAP/HTOC, 2015. 2014 Report of the Halons Technical Options Committee (Vol. 1). This document is accessible at: *http://ozone.unep.org/en/Assessment_Panels/TEAP/Reports/HTOC/HTOC%202014%20Assessment%20Report.pdf.*

The White House, 2013. President's Climate Action Plan. This document is accessible at: *https://www.whitehouse.gov/sites/*

default/files/image/president27sclimateactionplan.pdf.

The White House, 2015. Fact Sheet: Obama Administration and Private-Sector Leaders Announce Ambitious Commitments and Robust Progress to Address Potent Greenhouse Gases, October 15, 2015. Accessible at *https://www.whitehouse.gov/the-press-office/2015/10/15/fact-sheet-obama-administration-and-private-sector-leaders-announce.*

Trane, 2015. Trane® Sintesis™ Air-cooled Chillers. This document is accessible at: *http://www.trane.com/content/dam/Trane/Commercial/global/products-systems/equipment/chillers/air-cooled/TRANE_Sintesis_Brochure.pdf.*

UL, 2004. Standard 711—Rating and Testing of Fire Extinguishers. This document is accessible at: *http://ulstandards.ul.com/standard/?id=711_7.*

UL, 2005. Standard 2129—Halocarbon Clean Agent Fire Extinguishers. This document is accessible at: *http://ulstandards.ul.com/standard/?id=2129_2.*

UL, 2008. Standard 399—Standard for Drinking-Water Coolers. A summary of this document is accessible at: *http://ulstandards.ul.com/standard/?id=399_7.*

UL, 2009. Standard 563—Standard for Ice Makers. A summary of this document is accessible at: *http://ulstandards.ul.com/standard/?id=563.*

UL, 2010. Standard 471—Standard for Commercial Refrigerators and Freezers. A summary of this document is accessible at: *http://ulstandards.ul.com/standard/?id=471_10.*

UNEP, 2011. HFCs: A Critical Link in Protecting Climate and the Ozone Layer, A UNEP Synthesis Report. November, 2011. This document is accessible at: *www.unep.org/dewa/portals/67/pdf/HFC_report.pdf.*

VASA, 2014. Two injured in Perth HC refrigerant explosion. May 24, 2014. This document is accessible at: *http://www.vasa.org.au/two-injured-in-perth-hc-refrigerant-explosion/.*

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.

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.

Wickham, 2002. Status of Industry Efforts to Replace Halon Fire Extinguishing Agents. March, 2002.

WMO, 2011. Scientific Assessment of Ozone Depletion: 2010, Global Ozone Research and Monitoring Project. Geneva, Switzerland, 2011. This document is accessible at: *http://www.esrl.noaa.gov/csd/assessments/ozone/2010/report.html.*

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: March 29, 2016.

Gina McCarthy,

Administrator.

For the reasons set forth in the preamble, EPA proposes to amend 40 CFR part 82 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 F—Recycling and Emissions Reduction

■ 2. Amend § 82.154 by adding paragraph (a)(1)(iv) to read as follows:

§ 82.154 Prohibitions.

(a) * * *

(1) * * *

(iv) Effective [DATE 30 DAYS AFTER PUBLICATION OF THE FINAL RULE], propane (R-290) in self-contained commercial ice machines, very low temperature refrigeration equipment, and water coolers.

* * * * *

Subpart G—Significant New Alternatives Policy Program

■ 3. Appendix B to subpart G of part 82 is amended by adding three entries at the end of the table titled ''Refrigerants—Acceptable Subject to Use Conditions'' to 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
*	*	*	* *	* *
Motor vehicle air conditioning (newly manufactured medium-duty passenger vehicles).	HFO-1234yf	Acceptable subject to use conditions.	As of [date 30 days after publication of final rule]: (1) HFO-1234yf MVAC systems must adhere to all of the safety requirements of SAE J639 (adopted 2011), including requirements for a flammable refrigerant warning label, high-pressure compressor cutoff switch and pressure relief devices, and unique fittings. For connections with refrigerant containers for use in professional servicing, use fittings must be consistent with SAE J2844 (revised October 2011). (2) Manufacturers must conduct Failure Mode and Effect Analysis (FMEA) as provided in SAE J1739 (adopted 2009). Manufacturers must keep the FMEA on file for at least three years from the date of creation.	Additional training for service technicians recommended. HFO-1234yf is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS. Reg. No. 754–12–1).

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

Application	Substitute	Decision	Conditions	Comments
Motor vehicle air conditioning (newly manufactured heavy-duty pickup trucks).	HFO-1234yf	Acceptable subject to use conditions.	As of [date 30 days after publication of final rule]: (1) HFO-1234yf MVAC systems must adhere to all of the safety requirements of SAE J639 (adopted 2011), including requirements for a flammable refrigerant warning label, high-pressure compressor cutoff switch and pressure relief devices, and unique fittings. For connections with refrigerant containers for use in professional servicing, use fittings must be consistent with SAE J2844 (revised October 2011). (2) Manufacturers must conduct Failure Mode and Effect Analysis (FMEA) as provided in SAE J1739 (adopted 2009). Manufacturers must keep the FMEA on file for at least three years from the date of creation.	Additional training for service technicians recommended. HFO-1234yf is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS No 754–12–1).
Motor vehicle air conditioning (newly manufactured complete heavy-duty vans only).	HFO-1234yf	Acceptable subject to use conditions.	As of [date 30 days after publication of final rule]: (1) HFO-1234yf MVAC systems must adhere to all of the safety requirements of SAE J639 (adopted 2011), including requirements for a flammable refrigerant warning label, high-pressure compressor cutoff switch and pressure relief devices, and unique fittings. For connections with refrigerant containers for use in professional servicing, use fittings must be consistent with SAE J2844 (revised October 2011). (2) Manufacturers must conduct Failure Mode and Effect Analysis (FMEA) as provided in SAE J1739 (adopted 2009). Manufacturers must keep the FMEA on file for at least three years from the date of creation.	Additional training for service technicians recommended. HFO-1234yf is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS No 754–12–1). HFO-1234yf is acceptable for complete heavy-duty vans. Complete heavy-duty vans are not altered by a secondary or tertiary manufacturer.

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■ 4. Appendix H to subpart G of part 82 is amended by revising the entries for ''C_3F_8'' and ''C_4F_{10}'' in the table titled ''Fire Suppression and Explosion Protection-Acceptable Subject to Narrowed Use Limits: Total Flooding Agents'' to read as follows:

Appendix H to Subpart G of Part 82—Substitutes Subject to Use Restrictions and Unacceptable Substitutes, Effective May 28, 1999

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FIRE SUPPRESSION AND EXPLOSION PROTECTION—ACCEPTABLE SUBJECT TO NARROWED USE LIMITS: TOTAL FLOODING AGENTS

End-use	Substitute	Decision	Conditions	Further information
Total flooding	HFC-236fa ..	Acceptable subject to narrowed use limits.	Acceptable when manufactured using any process that does not convert perfluoroisobutylene (PFIB) directly to HFC-236fa in a single step: For use in explosion suppression and explosion inertion applications, and for use in fire suppression applications where other non-PFC agents or alternatives are not technically feasible due to performance or safety requirements: (a) Because of their physical or chemical properties, or (b) where human exposure to the extinguishing agents may result in failure to meet safety guidelines in the latest edition of the NFPA 2001 Standard for Clean Agent Fire Extinguishing Systems.	Use of this agent should be in accordance with the safety guidelines in the latest edition of the NFPA 2001 Standard for Clean Agent Fire Systems. Users should observe the limitations on HFC-236fa acceptability by taking the following measures: (i) Conduct an evaluation of foreseeable conditions of end-use; (ii) determine that the physical or chemical properties, or other technical constraints of the other available agents preclude their use; and (iii) determine that human exposure to the other alternative extinguishing agents may result in failure to meet safety guidelines in the latest edition of the NFPA 2001 Standard for Clean Agent Fire Extinguishing Systems. Documentation of such measures should be available for review upon request. The principal environmental characteristic of concern for HFC-236fa is its high GWP of 9400 and long atmospheric lifetime of 226 years. Actual contributions to global warming depend upon the quantities emitted. See additional comments 1, 2, 3, 4, 5.

Additional comments:
1—Should conform with relevant OSHA requirements, including 29 CFR 1910, Subpart L, Sections 1910.160 and 1910.162.

2—Per OSHA requirements, protective gear (SCBA) should be available in the event personnel should reenter the area.
3—Discharge testing should be strictly limited to that which is essential to meet safety or performance requirements.
4—The agent should be recovered from the fire protection system in conjunction with testing or servicing, and recycled for later use or destroyed.
5—EPA has no intention of duplicating or displacing OSHA coverage related to the use of personal protective equipment (*e.g.,* respiratory protection), fire protection, hazard communication, worker training or any other occupational safety and health standard with respect to halon substitutes.

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■ 5. Appendix K to subpart G of part 82 is revised to read as follows:

Appendix K to Subpart G of Part 82—Substitutes Subject to Use Restrictions and Unacceptable Substitutes Listed in the July 22, 2002, Final Rule Effective August 21, 2002

FOAM BLOWING—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Comments
Replacements for HCFC-141b in the following rigid polyurethane/polyisocyanurate applications: —Boardstock —Appliance —Spray	HCFC-22, HCFC-142b and blends thereof.	Unacceptable ..... Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	Alternatives exist with lower or zero-ODP.
All foam end-uses	HCFC-124	Unacceptable ..... Closed cell foam products and products containing closed cell foams manufactured with this substitute on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date	Alternatives exist with lower or zero-ODP.

■ 6. Appendix M to subpart G of part 82 is revised to read as follows:

Appendix M to Subpart G—Unacceptable Substitutes Listed in the September 30, 2004 Final Rule, Effective November 29, 2004

FOAM BLOWING—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Comments
All foam end-uses: —rigid polyurethane and polyisocyanurate laminated boardstock —rigid polyurethane appliance —rigid polyurethane spray and commercial refrigeration, and sandwich panels —rigid polyurethane slabstock and other foams —polystyrene extruded insulation boardstock and billet —phenolic insulation board and bunstock —flexible polyurethane —polystyrene extruded sheet Except for: [1] —space vehicle —nuclear —defense —research and development for foreign customers	HCFC-141b	Unacceptable ..... Closed cell foam products and products containing closed cell foams manufactured with this substitute on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	Alternatives exist with lower or zero-ODP.

[1] Exemptions for specific applications are identified in the list of acceptable substitutes.

■ 7. Appendix O to subpart G of part 82 is revised to read as follows:

Appendix O to Subpart G of Part 82—Substitutes Listed in the September 27, 2006 Final Rule, Effective November 27, 2006

FIRE SUPPRESSION AND EXPLOSION PROTECTION SECTOR—TOTAL FLOODING SUBSTITUTES—ACCEPTABLE SUBJECT TO USE CONDITIONS

End-use	Substitute	Decision	Conditions	Further information
Total flooding	Gelled Halocarbon/Dry Chemical Suspension (Envirogel) with sodium bicarbonate additive.	Acceptable subject to use conditions.	Use of whichever hydrofluorocarbon gas (HFC-125, HFC-227ea, or HFC-236fa) is employed in the formulation must be in accordance with all requirements for acceptability (*i.e.*, narrowed use limits) of that HFC under EPA's SNAP program.	Use of this agent should be in accordance with the safety guidelines in the latest edition of the NFPA 2001 Standard for Clean Agent Fire Extinguishing Systems, for whichever hydrofluorocarbon gas is employed, and the latest edition of the NFPA 2010 standard for Aerosol Extinguishing Systems. Sodium bicarbonate release in all settings should be targeted so that increased blood pH level would not adversely affect exposed individuals. Users should provide special training, including the potential hazards associated with the use of the HFC agent and sodium bicarbonate, to individuals required to be in environments protected by Envirogel with sodium bicarbonate additive extinguishing systems. Each extinguisher should be clearly labeled with the potential hazards from use and safe handling procedures. See additional comments 1, 2, 3, 4, 5.
Total flooding	Powdered Aerosol E (FirePro®).	Acceptable subject to use conditions.	For use only in normally unoccupied areas.	Use of this agent should be in accordance with the safety guidelines in the latest edition of the NFPA 2010 standard for Aerosol Extinguishing Systems. For establishments manufacturing the agent or filling, installing, or servicing containers or systems to be used in total flooding applications, EPA recommends the following: —Adequate ventilation should be in place to reduce airborne exposure to constituents of agent; —an eye wash fountain and quick drench facility should be close to the production area; —training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent; —workers responsible for clean up should allow for maximum settling of all particulates before reentering area and wear appropriate protective equipment; and —all spills should be cleaned up immediately in accordance with good industrial hygiene practices. —See additional comments 1, 2, 3, 4, 5.
Total flooding	Phosphorous Tribromide (PBr_3).	Acceptable subject to use conditions..	For use only in aircraft engine nacelles..	For establishments manufacturing the agent or filling, installing, or servicing containers or systems, EPA recommends the following: —Adequate ventilation should be in place and/or positive pressure, self-contained breathing apparatus (SCBA) should be worn; —training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent; and —all spills should be cleaned up immediately in accordance with good industrial hygiene practices. —See additional comments 1, 2, 3, 4, 5.

Additional comments:
1—Should conform to relevant OSHA requirements, including 29 CFR 1910, Subpart L, Sections 1910.160 and 1910.162.
2—Per OSHA requirements, protective gear (SCBA) should be available in the event personnel should reenter the area.
3—Discharge testing should be strictly limited to that which is essential to meet safety or performance requirements.
4—The agent should be recovered from the fire protection system in conjunction with testing or servicing, and recycled for later use or destroyed.
5—EPA has no intention of duplicating or displacing OSHA coverage related to the use of personal protective equipment (*e.g.,* respiratory protection), fire protection, hazard communication, worker training or any other occupational safety and health standard with respect to halon substitutes.

■ 8. Appendix Q to subpart G of part 82 is revised to read as follows:

Appendix Q to Subpart G of Part 82—Unacceptable Substitutes Listed in the March 28, 2007 Final Rule, Effective May 29, 2007

FOAM BLOWING UNACCEPTABLE SUBSTITUTES

End use	Substitute	Decision	Further information
—Rigid polyurethane commercial refrigeration —Rigid polyurethane sandwich panels —Rigid polyurethane slabstock and other foams	HCFC-22, HCFC-142b as substitutes for HCFC-141b.	Unacceptable [1] ..... Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	Alternatives exist with lower or zero-ODP.
—Rigid polyurethane and polyisocyanurate laminated boardstock —Rigid polyurethane appliance —Rigid polyurethane spray and commercial refrigeration, and sandwich panels —Rigid polyurethane slabstock and other foams —Polystyrene extruded insulation boardstock and billet —Phenolic insulation board and bunstock —Flexible polyurethane —Polystyrene extruded sheet	HCFC-22, HCFC-142b as substitutes for CFCs.	Unacceptable [2] ..... Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	Alternatives exist with lower or zero-ODP.

[1] For existing users of HCFC-22 and HCFC-142b as of November 4, 2005 other than in marine applications, the unacceptability determination is effective on March 1, 2008; for existing users of HCFC-22 and HCFC-142b as of November 4, 2005 in marine applications, including marine flotation foam, the unacceptability determination is effective on September 1, 2009. For an existing user of HCFC-22 or HCFC-142b that currently operates in only one facility that it does not own, and is scheduled to transition to a non-ODS, flammable alternative to coincide with a move to a new facility and installation of new process equipment that cannot be completed by March 1, 2008, the unacceptability determination is effective January 1, 2010.

[2] For existing users of HCFC-22 and HCFC-142b in polystyrene extruded insulation boardstock and billet and the other foam end uses, as of November 4, 2005, the unacceptability determination is effective on January 1, 2010.

■ 9. Appendix U to subpart G of part 82 is amended by revising the tables titled ''Foam Blowing Agents—Substitutes Acceptable Subject to Narrowed Use Limits'' and ''Unacceptable Substitutes'' to read as follows:

Appendix U to Subpart G of Part 82—Unacceptable Substitutes and Substitutes Subject to Use Restrictions Listed in the July 20, 2015 Final Rule, Effective September 18, 2015

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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, in military applications and until January 1, 2025, in 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, in military applications and until January 1, 2025, in 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.

FOAM BLOWING AGENTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS—Continued

End-use	Substitute	Decision	Narrowed use limits	Further information
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 in military applications and until January 1, 2025 in 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, in military applications and until January 1, 2025, in 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, in military applications and until January 1, 2025, in 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, in military applications and until January 1, 2025, in 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, in military applications and until January 1, 2025, in 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.

FOAM BLOWING AGENTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS—Continued

End-use	Substitute	Decision	Narrowed use limits	Further information
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, in military applications and until January 1, 2025, in 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, in military applications and until January 1, 2025, in 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, in military applications and until January 1, 2025, in 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, in military applications and until January 1, 2025, in 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 September 18, 2015. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	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 September 18, 2015. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	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.

UNACCEPTABLE SUBSTITUTES—Continued

End-use	Substitute	Decision	Further information
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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2019, may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before [DATE ONE YEAR AFTER PUBLICATION OF FINAL RULE] may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2021, may be used after that date.	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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date.	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.

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■ 10. Add appendix V to subpart G of part 82, to read as follows:

Appendix V to Subpart G of Part 82—Substitutes Subject to Use Restrictions and Unacceptable Substitutes Listed in the [DATE OF PUBLICATION OF FINAL RULE IN THE FEDERAL REGISTER] Final Rule

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS

End-use	Substitute	Decision	Use Conditions	Further information
Commercial ice machines (self-contained) (new only).	Propane (R-290)	Acceptable, subject to use conditions.	As of [date 30 days after publication of final rule]: This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant—i.e., this refrigerant may not be used as a conversion or ''retrofit'' refrigerant for existing equipment. This refrigerant may be used only in self-contained commercial ice machines that meet all requirements listed in Supplement SA to UL 563.[125] In cases where this rule includes requirements more stringent than those in UL 563, the equipment must meet the requirements of the final rule in place of the requirements in the UL Standard. The charge size must not exceed 150 g (5.29 oz) in each refrigerant circuit of a commercial ice machine.	Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), and 1910.1000 (toxic and hazardous substances). Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing hydrocarbon refrigerants through adherence to good manufacturing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit, the space should be evacuated and reentry should occur only after the space has been properly ventilated.
			As provided in clauses SA6.1.1 and SA6.1.2 of UL 563, the following markings must be attached at the locations provided and must be permanent:	Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling these refrigerants. Special care should be taken to avoid contact with the skin since these refrigerants, like many refrigerants, can cause freeze burns on the skin.
			(a) ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing.'' This marking must be provided on or near any evaporators that can be contacted by the consumer.	A Class B dry powder type fire extinguisher should be kept nearby. Technicians should only use spark-proof tools when working on refrigerators and freezers with these refrigerants.
			(b) ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.'' This marking must be located near the machine compartment.	Any recovery equipment used should be designed for flammable refrigerants. Any refrigerant releases should be in a well-ventilated area, such as outside of a building.
			(c) ''CAUTION—Risk of Fire or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.'' This marking must be located near the machine compartment.	Only technicians specifically trained in handling flammable refrigerants should service refrigerators and freezers containing these refrigerants. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.
			(d) ''CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.'' This marking must be provided on the exterior of the refrigeration equipment.	Room occupants should evacuate the space immediately following the accidental release of this refrigerant.
			(e) ''CAUTION—Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.'' This marking must be provided near all exposed refrigerant tubing.	If a service port is added then retail food refrigerators and freezers using these refrigerants should have service aperture fittings that differ from fittings used in equipment or containers using non-flammable refrigerant. ''Differ'' means that either the diameter differs by at least 1/16 inch or the thread direction is reversed (i.e., right-handed vs. left-handed). These different fittings should be permanently affixed to the unit at the point of service and maintained until the end-of-life of the unit, and should not be accessed with an adaptor.
			All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.	

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

End-use	Substitute	Decision	Use Conditions	Further information
			The equipment must have red Pantone Matching System (PMS) #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations.	
Very low temperature refrigeration equipment (new only).	Propane (R-290)	Acceptable, subject to use conditions.	As of [date 30 days after publication of final rule]: This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant—i.e., this refrigerant may not be used as a conversion or ''retrofit'' refrigerant for existing equipment.	Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation) and 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), and 1910.1000 (toxic and hazardous substances).
			This refrigerant may only be used in equipment that meets all requirements in Supplement SB to UL 471.[1 2 4] In cases where the final rule includes requirements more stringent than those of UL 471, the appliance must meet the requirements of the final rule in place of the requirements in the UL Standard. The charge size for the equipment must not exceed 150 grams (5.29 ounces) in each refrigerant circuit of the very low temperature refrigeration equipment.	Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing hydrocarbon refrigerants through adherence to good manufacturing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit, the space should be evacuated and re-entry should occur only after the space has been properly ventilated.
			As provided in clauses SB6.1.2 to SB6.1.5 of UL 471, the following markings must be attached at the locations provided and must be permanent: (a) ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing.'' This marking must be provided on or near any evaporators that can be contacted by the consumer.	Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling ethane. Special care should be taken to avoid contact with the skin since ethane, like many refrigerants, can cause freeze burns on the skin. A Class B dry powder type fire extinguisher should be kept nearby.
			(b) ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.'' This marking must be located near the machine compartment.	Technicians should only use spark-proof tools when working on equipment with flammable refrigerants. Any recovery equipment used should be designed for flammable refrigerants. Any refrigerant releases should be in a well-ventilated area, such as outside of a building. Only technicians specifically trained in handling flammable refrigerants should service equipment containing ethane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.
			(c) ''CAUTION—Risk of Fire or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.'' This marking must be located near the machine compartment.	
			(d) ''CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.'' This marking must be provided on the exterior of the refrigeration equipment.	Room occupants should evacuate the space immediately following the accidental release of this refrigerant.
			(e) ''CAUTION—Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.'' This marking must be provided near all exposed refrigerant tubing. All of these markings must be in letters no less than 6.4 mm (¼ inch) high.	If a service port is added then retail food refrigerators and freezers using these refrigerants should have service aperture fittings that differ from fittings used in equipment or containers using non-flammable refrigerant. ''Differ'' means that either the diameter differs by at least 1/16 inch or the thread direction is reversed (i.e., right-handed vs. left-handed). These different fittings should be permanently affixed to the unit at the point of service and maintained until the end-of-life of the unit, and should not be accessed with an adaptor.

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

End-use	Substitute	Decision	Use Conditions	Further information
			The equipment must have red PMS #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations.	Very low temperature equipment using propane may also use another acceptable refrigerant substitute in a separate refrigerant circuit or stage (e.g., one temperature stage with propane and a second stage with ethane).
Water coolers (new only).	Propane (R-290)	Acceptable, subject to use conditions.	As of [date 30 days after publication of final rule]: This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant—i.e., this refrigerant may not be used as a conversion or ''retrofit'' refrigerant for existing equipment.	Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation) and 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), and 1910.1000 (toxic and hazardous substances).
			This refrigerant may be used only in water coolers that meet all requirements listed in Supplement SB to UL 399[1 2 3] In cases where the rule includes requirements more stringent than those of the UL 399, the appliance must meet the requirements of the final rule in place of the requirements in the UL Standard. The charge size must not exceed 150 grams (5.29 ounces) per refrigerant circuit in the water cooler.	Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing hydrocarbon refrigerants through adherence to good manufacturing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit, the space should be evacuated and re-entry should occur only after the space has been properly ventilated.
			The equipment must have red PMS #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations. As provided in clauses SB6.1.2 to SB6.1.5 of UL 399, the following markings must be attached at the locations provided and must be permanent:	Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling ethane. Special care should be taken to avoid contact with the skin since ethane, like many refrigerants, can cause freeze burns on the skin. A Class B dry powder type fire extinguisher should be kept nearby.
			(a) ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing.'' This marking must be provided on or near any evaporators that can be contacted by the consumer. (b) ''DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.'' This marking must be located near the machine compartment.	Technicians should only use spark-proof tools when working on equipment with flammable refrigerants. Any recovery equipment used should be designed for flammable refrigerants. Any refrigerant releases should be in a well-ventilated area, such as outside of a building. Only technicians specifically trained in handling flammable refrigerants should service equipment containing ethane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.
			(c) ''CAUTION—Risk of Fire or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.'' This marking must be located near the machine compartment.	Room occupants should evacuate the space immediately following the accidental release of this refrigerant.

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

End-use	Substitute	Decision	Use Conditions	Further information
			(d) ''CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.'' This marking must be provided on the exterior of the refrigeration equipment. (e) ''CAUTION—Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.'' This marking must be provided near all exposed refrigerant tubing.	If a service port is added then retail food refrigerators and freezers using these refrigerants should have service aperture fittings that differ from fittings used in equipment or containers using non-flammable refrigerant. ''Differ'' means that either the diameter differs by at least 1/16 inch or the thread direction is reversed (i.e., right-handed vs. left-handed). These different fittings should be permanently affixed to the unit at the point of service and maintained until the end-of-life of the unit, and should not be accessed with an adaptor.

[1] The Director of the Federal Register approves the materials in these footnotes for incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51 You may inspect a copy at U.S. EPA's Air and Radiation Docket; EPA West Building, Room 3334, 1301 Constitution Ave. NW., Washington DC or at the National Archives and Records Administration (NARA). For questions regarding access to these standards, the telephone number of EPA's Air and Radiation Docket is 202–566–1742. For information on the availability of this material at NARA, call 202–741–6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.*

[2] Underwriters Laboratories Inc. (UL) COMM 2000; 151 Eastern Avenue; Bensenville, IL 60106; *orders@comm-2000.com*;: 1–888–853–3503 in the U.S. or Canada (other countries dial +1–415–352–2168); *http://ulstandards.ul.com/* or *www.comm-2000.com.*

[3] UL 399. Standard for Drinking-Water Coolers. 7th edition. Supplement SB: Requirements for Room Air Conditioners Employing a Flammable Refrigerant in the Refrigerating System. Underwriters Laboratories, Inc. August 22, 2008.

[4] UL 471. Standard for Commercial Refrigerators and Freezers. 10th edition. Supplement SB: Requirements for Refrigerators and Freezers Employing a Flammable Refrigerant in the Refrigerating System. Underwriters Laboratories, Inc. November 24, 2010.

[5] UL 563. Standard for Ice Makers. 8th edition. Supplement SA: Requirements for Refrigerators and Freezers Employing a Flammable Refrigerant in the Refrigerating System. Underwriters Laboratories, Inc. July 31, 2009.

REFRIGERANTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS

End-use	Substitutes	Decision	Narrowed use limits	Further information
Centrifugal chillers (new only).	HFC-134a	Acceptable subject to narrowed use limits.	Acceptable after January 1, 2024, only in military marine vessels 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: • Application 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 qualified and projected time for switching.
Centrifugal chillers (new only).	HFC-134a and R-404A.	Acceptable subject to narrowed use limits.	Acceptable after January 1, 2024, only inhuman-rated spacecraft and related support equipment 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: • Application 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 qualified and projected time for switching.
Positive displacement chillers (new only).	HFC-134a	Acceptable subject to narrowed use limits.	Acceptable after January 1, 2024, only in military marine vessels 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: • Application in which the substitute is needed;

REFRIGERANTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS—Continued

End-use	Substitutes	Decision	Narrowed use limits	Further information
				• 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 qualified and projected time for switching.
Positive displacement chillers (new only).	HFC-134a and R-404A.	Acceptable subject to narrowed use limits.	Acceptable after January 1, 2024, only inhuman-rated spacecraft and related support equipment 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: • Application 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 qualified and projected time for switching.

REFRIGERANTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitutes	Decision	Further information
Centrifugal chillers (new only).	FOR12A, FOR12B, HFC-134a, HFC-227ea, HFC-236fa, HFC-245fa, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R-438A, R-507A, RS-44 (2003 composition), and THR-03.	Unacceptable as of January 1, 2024 except where allowed under a narrowed use limit.	These refrigerants have GWPs ranging from approximately 900 to 9,810. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Centrifugal chillers (new only).	Propylene (R-1270) and R-443A	Unacceptable as of [date 30 days after publication of final rule].	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Cold storage warehouses (new only).	HFC-227ea, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-438A, R-507A, and RS-44 (2003 composition).	Unacceptable as of January 1, 2023.	These refrigerants have GWPs ranging from approximately 2,090 to 3,990. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Cold storage warehouses (new only).	Propylene (R-1270) and R-443A	Unacceptable as of [date 30 days after publication of final rule].	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Household refrigerators and freezers (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-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.	Unacceptable as of January 1, 2021.	These refrigerants have GWPs ranging from approximately 900 to 3,985. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.

REFRIGERANTS—UNACCEPTABLE SUBSTITUTES—Continued

End-use	Substitutes	Decision	Further information
Positive displacement chillers (new only).	FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 composition), SP34E, and THR-03.	Unacceptable as of January 1, 2024 except where allowed under a narrowed use limit.	These refrigerants have GWPs ranging from approximately 900 to 3,985. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Positive displacement chillers (new only).	Propylene (R-1270) and R-443A	Unacceptable as of [date 30 days after publication of final rule].	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Residential and light commercial air conditioning and heat pumps (new only).	Propylene (R-1270) and R-443A	Unacceptable as of [date 30 days after publication of a final rule].	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Residential and light commercial air conditioning—unitary split AC systems and heat pumps (retrofit only).	All refrigerants identified as flammability Class 3 in ANSI/ASHRAE Standard 34-2013.[1 2 3] All refrigerants meeting the criteria for flammability Class 3 in ANSI/ASHRAE Standard 34-2013. This includes, but is not limited to, refrigerant products sold under the names R-22a, 22a, Blue Sky 22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeeze EF-22a, EF-22a, Envirosafe 22a, ES-22a, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, Oz-Chill 22a, Priority Cool, and RED TEK 22a.	Unacceptable as of [date 30 days after publication of final rule].	These refrigerants are highly flammable and present a flammability risk when used in equipment designed for nonflammable refrigerants. Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Retail food refrigeration (refrigerated food processing and dispensing equipment) (new only).	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, 2021.	These refrigerants have GWPs ranging from approximately 1,770 to 3,990. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.

[1] The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. You may inspect a copy at U.S. EPA's Air and Radiation Docket; EPA West Building, Room 3334, 1301 Constitution Ave. NW., Washington DC or at the National Archives and Records Administration (NARA). For questions regarding access to this standard, the telephone number of EPA's Air and Radiation Docket is 202–566–1742. For information on the availability of this material at NARA, call 202–741–6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.*

[2] American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 6300 Interfirst Drive, Ann Arbor, MI 48108; 1–800–527–4723 in the U.S. or Canada; *http://www.techstreet.com/ashrae/ashrae_standards.html?ashrae_auth_token=.*

[3] ANSI/ASHRAE Standard 34–2013: Designation and Safety Classification of Refrigerants, November 2013.

FOAM BLOWING AGENTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS

End-use	Substitutes	Decision	Narrowed use limits	Further information
Rigid PU: Spray foam—high-pressure two-component.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Acceptable subject to narrowed use limits.	Acceptable from January 1, 2020, until January 1, 2025, 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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2025, may be used after that date.	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.

FOAM BLOWING AGENTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS—Continued

End-use	Substitutes	Decision	Narrowed use limits	Further information
Rigid PU: Spray foam—low-pressure two-component.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Acceptable subject to narrowed use limits.	Acceptable from January 1, 2021, until January 1, 2025, 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. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2025, may be used after that date.	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.

FOAM BLOWING AGENTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitutes	Decision	Further information
Flexible PU	Methylene chloride	Unacceptable as of [date 30 days after publication of final rule].	Methylene chloride is a carcinogen and may present a toxicity risk. Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Integral Skin PU	Methylene chloride	Unacceptable as of January 1, 2017	Methylene chloride is a carcinogen and may present a toxicity risk. Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Polyolefin	Methylene chloride	Unacceptable as of January 1, 2020 Closed cell foam products and products containing closed cell foams manufactured with this substitute on or before January 1, 2020, may be used after that date.	Methylene chloride is a carcinogen and may present a toxicity risk. Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Rigid PU: Spray foam—one component foam sealants.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Unacceptable as of January 1, 2020. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date.	These foam blowing agents have GWPs ranging from higher than 730 to approximately 1,500. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid PU: Spray foam—high-pressure two-component.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Unacceptable as of January 1, 2020, except where allowed under a narrowed use limit. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date.	These foam blowing agents have GWPs ranging from higher than 730 to approximately 1,500. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid PU: Spray foam—low-pressure two-component.	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI.	Unacceptable as of January 1, 2021, except where allowed under a narrowed use limit. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date.	These foam blowing agents have GWPs ranging from higher than 730 to approximately 1,500. Other alternatives 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—ACCEPTABLE SUBJECT TO USE CONDITIONS

End-use	Substitute	Decision	Use conditions	Further information
Streaming	2-BTP	Acceptable, subject to use conditions.	As of [date 30 days after publication of final rule], acceptable only for use in handheld extinguishers in aircraft.	This fire suppressant has a relatively low GWP of 0.23–0.26 and a short atmospheric lifetime of approximately seven days. This agent is subject to requirements contained in a Toxic Substance Control Act (TSCA) section 5(e) Consent Order and any subsequent TSCA section 5(a)(2) Significant New Use Rule (SNUR).

FIRE SUPPRESSION AND EXPLOSION PROTECTION AGENTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

End-use	Substitute	Decision	Use conditions	Further information
				For establishments manufacturing, installing and maintaining handheld extinguishers using this agent: (1) Use of this agent should be used in accordance with the latest edition of NFPA Standard 10 for Portable Fire Extinguishers; (2) In the case that 2-BTP is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention; (3) Eye wash and quick drench facilities should be available. In case of ocular exposure, person(s) should immediately flush the eyes, including under the eyelids, with fresh water and move to a non-contaminated area. Exposed person(s) should remove all contaminated clothing and footwear to avoid irritation, and medical attention should be sought if irritation develops or persists; (4) Although unlikely, in case of ingestion of 2-BTP, the person(s) should consult a physician immediately; (5) Manufacturing space should be equipped with specialized engineering controls and well ventilated with a local exhaust system and low-lying source ventilation to effectively mitigate potential occupational exposure; regular testing and monitoring of the workplace atmosphere should be conducted; (6) Employees responsible for chemical processing should wear the appropriate PPE, such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation; (7) All spills should be cleaned up immediately in accordance with good industrial hygiene practices; and (8) Training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent. (9) 2-BTP use as a streaming fire extinguishing agent in handheld extinguishers in aircraft should be in accordance with UL 711, Rating and Testing of Fire Extinguishers and the Federal Aviation Administration (FAA) Minimum Performance Standard for Hand-Held Extinguishers (DOT/FAA/AR–01/37), with regard to the size and number of extinguishers depending on the size of aircraft. (10) 2-BTP handheld extinguishers should follow required minimum room volumes established by UL 2129, Halocarbon Clean Agent Fire Extinguishers, when discharged into a confined space.
Total flooding	2-BTP	Acceptable, subject to use conditions.	As of [date 30 days after publication of final rule], acceptable only for use in engine nacelles and auxiliary power units on aircraft.	This fire suppressant has a relatively low GWP of 0.23–0.26 and a short atmospheric lifetime of approximately seven days. This agent is subject to requirements contained in a TSCA section 5(e) Consent Order and any subsequent TSCA section 5(a)(2) SNUR. For establishments manufacturing, installing, and servicing engine nacelles and auxiliary power units on aircraft using this agent: (1) This agent should be used in accordance with the safety guidelines in the latest edition of the National Fire Protection Association (NFPA) 2001 Standard for Clean Agent Fire Extinguishing Systems; (2) In the case that 2-BTP is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention; (3) Eye wash and quick drench facilities should be available. In case of ocular exposure, person(s) should immediately flush the eyes, including under the eyelids, with fresh water and move to a non-contaminated area.

FIRE SUPPRESSION AND EXPLOSION PROTECTION AGENTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

End-use	Substitute	Decision	Use conditions	Further information
				Exposed person(s) should remove all contaminated clothing and footwear to avoid irritation, and medical attention should be sought if irritation develops or persists; (4) Although unlikely, in case of ingestion of 2-BTP, the person(s) should consult a physician immediately; (5) Manufacturing space should be equipped with specialized engineering controls and well ventilated with a local exhaust system and low-lying source ventilation to effectively mitigate potential occupational exposure; regular testing and monitoring of the workplace atmosphere should be conducted; (6) Employees responsible for chemical processing should wear the appropriate PPE, such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation; (7) All spills should be cleaned up immediately in accordance with good industrial hygiene practices; (8) Training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent; (9) Safety features that are typical of total flooding systems such as pre-discharge alarms, time delays, and system abort switches should be provided, as directed by applicable OSHA regulations and NFPA standards; use of this agent should also conform to relevant OSHA requirements, including 29 CFR 1910, subpart L, sections 1910.160 and 1910.162.

FIRE SUPPRESSION AND EXPLOSION PROTECTION AGENTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitute	Decision	Further information
Total flooding	PFCs (C_3F_8 and C_4F_{10}).	Unacceptable as of [date one year after publication of final rule]. Total flooding systems manufactured using these fire suppressants on or before [date one year after publication of final rule] may be used after that date.	These fire suppressants have GWPs ranging from 8,830 to 8,860. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.

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